

Molecules & Their Interaction Relevant to Biology

1.A Structure of Atoms, Molecules and Chemical Bonds

Q. 1 The hydrocarbon tail of the micelles would be _____, which is formed when the Sodium Dodecyl Sulphate (SDS) is added into the water and the spherical micelles are formed.

- a. cleaved on micelle formation
- b. in the interior of the micelle
- c. towards the surface of the micelle
- d. None of the above

Correct Answer: B

A micelle is formed when a variety of molecules including soaps and detergents are added to water. The molecule may be a fatty acid, a salt of a fatty acid (soap), phospholipids or other similar molecules. The molecule must have a strongly polar “head” and a non-polar hydrocarbon chain “tail”. When this type of molecule is added to water, the non-polar tails of the molecules clump into the center of a ball like structure called a micelle, because they are hydrophobic or “water hating”. The polar head of the molecule presents itself for interaction with the water molecules on the outside of the micelle.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 2 What does the statement mean that the glucose and mannose are epimers?

- a. One is an aldose, the other a ketose.
- b. They are mirror images of each other.
- c. They differ only in the configuration of one carbon atom.
- d. None of the above

Correct Answer: C

In stereochemistry, epimer refers to one of a pair of stereoisomers. They are very closely related structures. The two isomers differ in configuration at only one stereogenic center. All other stereo-centers in the Mannose differ the position of hydroxyl group at C-2 position.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 3 A strongest chemical linkage is formed between the molecules in which the atoms are held together by _____ bonds.

- a. ionic
- b. covalent
- c. Both a and b
- d. None of the above

Correct Answer: B

Covalent bonding is a form of chemical bonding characterized by the sharing of one or more pairs of electrons between two atoms, producing a mutual attraction that holds the resultant molecule or polyatomic ion together. Atoms tend to share electrons in such a way that their outer electron shells satisfy the octet rule. Such bonds are always stronger than the intermolecular hydrogen bond and similar in strength to or stronger than the ionic bond.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 4 What is the reason that the salt dissolves well in water?

- a. Water molecules form hydrogen bonds with the positively and negatively charged ions.
- b. Water molecules share electrons with the ions to make covalent bonds.
- c. Water molecules make non-polar bonds with the positively charged ions only.
- d. Water molecules surround the ions because of their charge but do not form hydrogen bonds.

Correct Answer: D

When ionic compounds are added to water, individual ions interact with the polar regions of the water molecules during the dissociation process, disrupting their ionic bonds. Dissociation occurs when atoms or groups of atoms break off from molecules and form ions. Consider table salt (NaCl or Sodium Chloride) when NaCl crystals are added to water, the molecules of NaCl dissociate into Na^+ and Cl^- ions, and spheres of hydration form around the ions. The positively charged sodium ion is surrounded by the partially negative charge of the water molecule's oxygen; the negatively charged chloride ion is surrounded by the partially positive charge of the hydrogen in the water molecule.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 5 In what type of chemical bonds, one or more pairs of electrons are shared by two atoms?

- a. Covalent bonds
- b. Ionic bonds
- c. Co-ordinate bonds
- d. All of the above

Correct Answer: A

Covalent bonds is the bond in which one or more than one pair of electrons are shared by two atoms. Covalent bonds are formed when two atoms have a very small difference in their electronegativity.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 6 _____ is the most abundant form of carbohydrate.

- a. Cellulose
- b. Starch
- c. Chitin
- d. All of the above

Correct Answer: A

Cellulose is the most abundant form of carbohydrate. It is the major component in the rigid cell walls in plants. It is linear, unbranched polysaccharide polymer with many glucose monosaccharide units.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 7 Which among the following is essential amino acid?

- a. Methionine
- b. Lysine
- c. Tryptophan
- d. All of the above

Correct Answer: D

An essential amino acid or indispensable amino acid is an amino acid that cannot be synthesized *de novo* (from scratch) by the organism being considered and therefore must be supplied in its diet. The nine amino acids humans cannot synthesize are phenylalanine, valine, threonine, tryptophan, methionine, leucine, isoleucine, lysine and histidine.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 8 What will be the atomic number if the K, L and M shells of an atom are full?

- a. 15
- b. 16
- c. 17
- d. 18

Correct Answer: D

Not all shells and sub-orbital hold the same number of electrons. For the first eighteen elements, there are some easy rules. The K shell only holds two electrons. The L shell only holds eight electrons. The M shell only holds eight electrons as we move to higher atomic numbers. The maximum number of electrons we will find in any shell is 32.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 9 What is the ratio of hydrogen and oxygen?

- a. 1:2
- b. 1:4
- c. 1:8
- d. 1:1

Correct Answer: C

Water is compound which always contains the same two elements, hydrogen and oxygen, in the same constant proportion of 1:8 by mass.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 10. What is the oxidation number of Cr in CrO_5 ?

- a. 2
- b. 4
- c. 6
- d. 8

Correct Answer: C

The oxidation state of Cr in CrO_5 is 6, because it involves two peroxy bonds, generally the valence electron number (6) is an oxidation number.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 11 _____ molecule do not have a zero-dipole moment.

- a. CO_2
- b. NO_2
- c. NH_3
- d. All of the above

Correct Answer: C

A polyatomic molecule has more than two atoms bonded by covalent bonds. The dipole moment of individual bond in a polyatomic molecule is referred to as bond dipole. The dipole moment of the molecule depends upon the orientation of various bond dipoles. The bond dipoles of three N-H bonds in NH_3 molecule, do not cancel out each other. Hence, the molecule has a net dipole moment 1.49D and is polar in nature. CO_2 has 2 oxygen atoms bonded with double bonds to the carbon. That makes the molecule a straight line with an O at each end. So, structure of CO_2 is linear. Since the ends are same, so electron pull is same for both oxygen atoms hence there is no dipole.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 12. Length of the hydrogen bond will not be

- a. independent on the nature of donor and acceptor atoms.
- b. dependent on the solvent in which the molecule is dissolved.
- c. Both A and B
- d. None of the above

Correct Answer: B

The length of hydrogen bonds depends on bond strength, temperature and pressure. The bond strength itself is dependent on temperature, pressure, bond angle and environment (usually characterized by local dielectric constant). The typical length of a hydrogen bond in water is 197pm. The ideal bond angle depends on the nature of the hydrogen bond donor. But the length of hydrogen bond is not dependent on solvent in which it is dissolved.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 13. Why ATP (adenosine triphosphate) is termed as the universal energy currency in life?

- a. It enables cells to disobey the first law of thermodynamics.
- b. It releases energy as heat when it undergoes hydrolysis.
- c. It traps energy released from the oxidation of different classes of food molecules.
- d. All of the above

Correct Answer: C

Living cells obey the laws of physics and chemistry, including the first and second law of thermodynamics. Cells must harness the useful energy from oxidation of food in a form of chemical energy. Virtually all processes releasing energy from all food molecules trap it in a single compound adenosine triphosphate (ATP). With trivial exceptions, all processes needing energy use the hydrolysis of ATP to supply it. For ATP to supply energy to a process rather than releasing energy as heat, its breakdown must, in some manner, be tightly coupled to the process.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 14 Formation of hydrogen bomb is based on which phenomenon?

- a. Nuclear fusion
- b. Nuclear fission
- c. Nuclear reaction
- d. All of the above

Correct Answer: A

The phenomenon of nuclear fusion gives rise to the formation of hydrogen bombs. Hydrogen bomb is based on the fusion of lighter nuclei to form heavy nuclei.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 15 What type of hydrogen bonds are formed in water?

- a. Weak electrostatic bonds between partially charged hydrogen and oxygen atoms.

- b. Strong electrostatic bonds between positive hydrogen ions and negative oxygen ions.
- c. Covalent bonds between hydrogen atoms.
- d. Covalent bonds between hydrogen and oxygen atoms.

Correct Answer: A

Hydrogen bonds belongs to the class of chemical bonds known as non-covalent or weak secondary bonds. Hydrogen bonds form between water molecules are due to weak electrostatic attractions between the partial positive charges on the hydrogen atoms and the partial negative charge on the oxygen of adjacent molecules. They can also form between appropriate hydrogen atoms and oxygen or nitrogen atoms of other molecules and play a vital role in biological structures.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 16. As described by the first law of thermodynamics, which of the following statements correctly describes the energy content of the universe?

- a. The total energy content of the universe is in a state of continual flux, increasing at some times and decreasing at others.
- b. The total energy content of the universe is gradually first increase and then decrease with time.
- c. The total energy content of the universe remains constant.
- d. The total energy content of the universe may gradually decrease or increase with time.

Correct Answer: C

The total energy of the universe remains constant. However, it is continually being transferred between different forms.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 17 Which element(s) represents the most common elements in biological systems?

- a. Carbon
- b. Nitrogen
- c. Oxygen
- d. All of the above

Correct Answer: D

Carbon, Nitrogen, Oxygen and hydrogen together comprise around 99% of the total number of atoms in the body.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 18 Which one the following non-covalent interaction between two non-bonded atoms A and B is the most sensitive to the distance between them?

- a. A and B are permanent dipoles and are involved in hydrogen bonding.
- b. A and B are fully ionized and are involved in salt bridge formation.
- c. A and B are uncharged and repel each other.
- d. A and B are attracts each other.

Correct Answer: C

Understand the nature of noncovalent interactions, we first must return to covalent bonds and delve into the subject of dipoles. Many of the covalent bonds that we saw in—between two carbons, for example, or between a carbon and a hydrogen involve the approximately equal sharing of electrons between the two atoms in the bond. This is because, in these examples, the two atoms have approximately the same electronegativity. Recall from general chemistry that electronegativity refers to “the power of an atom in a molecule to attract electrons to itself” (this is the definition offered by Linus Pauling, the eminent 20th - century American chemist who was primarily responsible for developing many of the bonding concepts that we have been learning).

Quite often, however, we deal in organic chemistry with covalent bonds between two atoms with very different negativities, and in these cases the sharing of electrons is not equal: the more electronegative atom pulls the two electrons closer to itself. In the carbon-oxygen bond of an alcohol, for example, the two electrons in the σ bond are closer to the oxygen than they are to the carbon, because oxygen is significantly more electronegative than carbon. The same is true for the oxygen-hydrogen bond, as hydrogen is slightly less electronegative than carbon, and much less electronegative than oxygen.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 19. Under which of the following conditions, the atoms are at their most stable forms?

- a. When their valence shells are completely full.
- B. The degree of filling of valence shells has no impact on the stability of an atom, so it doesn't matter how full (or empty) they are.
- c. When their valence shells are completely empty.
- d. Both A and B.

Correct Answer: A

Atoms tend to be most stable with a full outer shell (one which, after the first, contains 8 electrons), leading to what is commonly called the "octet rule". Atoms that do not have full outer shells will tend to gain or lose electrons, resulting in a full outer shell and therefore, stability. Chemical systems tend to achieve the lowest possible energy state, which happens when valence shells are full.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 20. The structure-activity relationships (SAR) can be best described as

- a. the study of the structural features of a drug that are important to its biological activity.
- b. the study of the physicochemical properties that are important to the absorption of a drug into the blood supply.
- c. Both A and B.
- d. None of the above.

Correct Answer: A

Structure-activity relationships involve the synthesis of a series of analogues of a lead compound to discover how changes in structure affect the biological activity. In this way, important binding groups and the drug's pharmacophore can be identified.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 21. What will be the effect on atomic number during a chemical reaction?

- a. It changes
- b. It remains same
- c. It changes after sometime

d. It changes and then restored

Correct Answer: B

In a chemical reaction the total mass of all the substances taking part in the reaction remains the same. Also, the number of atoms in a reaction remains the same. Mass cannot be created or destroyed in a chemical reaction.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 22. What type of intermolecular bonding interactions is possible for a primary amine?

- a. Ionic bonding only
- b. Hydrogen bonding only
- c. Both A and B
- d. None of the above

Correct Answer: C

The hydrogen of an un-ionised primary amine can act as hydrogen bond donors while the nitrogen can act as a hydrogen bond acceptor. If the amine is protonated and ionised, it can form ionic interactions. In an ionised situation, the hydrogens can still act as hydrogen bond donors, but the nitrogen can no longer act as a hydrogen bond acceptor.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 23. How many number of electrons are present in the outer most shell in case of inert gases?

- a. 4
- b. 6
- c. 8
- d. 10

Correct Answer: C

The atoms of the inert gases have either 2 or 8 electrons in their outermost orbit. These gases do not enter into chemical combinations and therefore, are assumed to have complete or stable

orbitals. The atoms of all other elements have incomplete outermost orbitals and tend to complete them by chemical combination with other atoms.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 24. Electrovalent linkage is formed by

- a. sharing of electrons
- b. transfer of electrons
- c. transfer of pair of electrons
- d. None of the above

Correct Answer: B

Chemical bond formed between two atoms due to transfer of electron(s) from one atom to the other atom is called "Ionic bond" or "electrovalent bond". In ionic bond formation one atom loses electron(s) and the other picks it up. The atom that loses the electron acquires positive charge and the other atom, which gains the electron, becomes a negatively charged particle. Due to opposite charge an electrostatic force of attraction is set up between them. This force holds these atoms together in a unit. This force of attraction is referred to as ionic or electrovalent bond.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 25. _____ is the weak acid.

- a. HCl
- b. HF
- c. HBr
- d. HI

Correct Answer: B

Fluorine atoms are very electronegative. That is the reason hydrofluoric acid is a weak acid. It does not dissociate 100% because the bond between hydrogen and fluorine atoms in the molecule is stronger than the other halogen atoms. H-F Bond Strength = 568.2 these are all KJ/mol

H-Cl = 431.9

H-Br = 366.1

H-I = 298.3

The stronger the bond, the weaker is the acid.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 26. The sequence that demonstrate a gradual decrease in the strength of Van der Waal forces is

- a. Kr, Xe, Ne, Ar
- b. Xe, Kr, Ar, Ne
- c. Kr, Xe, Ar, Ne
- d. Ne, Ar, Kr, Xe

Correct Answer: B

Van der Waal forces are weak forces of attraction between molecules. These forces decrease, as the molecule gets smaller and increase as the molecule increases. The elements are getting smaller. Therefore the Van der Waal forces would also be decreasing.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 27. The element that is present in all the organic compounds is

- a. phosphorous
- b. carbon
- c. nitrogen
- d. All of the above

Correct Answer: B

In general, organic molecules contain carbon and organic chemistry is the study of carbon compounds. In chemistry, organic means chemical compounds with carbon in them.

Core Concept :

Topic Name :
Complexity :
Difficulty Level : Medium

Q. 28. The element carbon forms so many compounds because

- a. it has very high electronegativity.
- b. it readily forms ionic bonds with other carbon atoms.
- c. it readily forms covalent bonds with other carbon atoms.
- d. it easily combine with oxygen.

Correct Answer: C

Carbon forms four covalent or shared bonds with other carbon atoms as well as many other kinds of atoms. It has an almost limitless ability to bond with other carbon atoms making possible a very large number of compounds.

Core Concept :
Topic Name :
Complexity :
Difficulty Level : Medium

Q. 29. The reaction $\text{CH}_2\text{CH}_2 + \text{H}_2 \rightarrow \text{CH}_3\text{CH}_3$ is an example of

- a. substitution
- b. addition
- c. esterification
- d. fermentation

Correct Answer: B

Addition usually involves adding one or more atoms at a double or triple bond. Here H_2 combines with CH_2CH_2 changing ethene (double bond) into ethane (single bond).

Core Concept :
Topic Name :
Complexity :
Difficulty Level : Difficult

Q. 30. _____ is a network solid.

- a. Nitrogen dioxide
- b. Silicon dioxide
- c. Carbon dioxide

d. Sulfur dioxide

Correct Answer: B

Only silicon dioxide forms a network solid, a network of covalent bonds extending throughout the crystal without forming a molecule.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 31. How the strontium atoms differ from a strontium ion?

- a. On the basis of number of protons
- b. On the basis of atomic number
- c. On the basis of mass number
- d. On the basis of number of electrons

Correct Answer: D

Strontium has 2 valence electrons in its outer shell. It is easier to lose these 2 electrons than to gain 6 more electrons. Losing 2 electrons will give the strontium ion a charge of +2. Ions are charged atoms. A neutral atom has no charge because it has the same number of protons and electrons. An ion can have more or less electrons than an atom of the same element does. A strontium atom would have 2 more electrons than a strontium ion.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 32. _____ are isomers.

- a. Methanol and methanal
- b. Ethane and ethanol
- c. 1-propanol and 2-propanol
- d. Methanoic acid and ethanoic acid

Correct Answer: C

Structural isomerism or constitutional isomerism (per IUPAC), is a form of isomerism in which molecules with the same molecular formula have bonded together in different orders, *i.e.* they each have a different structural formula, as opposed to stereoisomerism. There are multiple

synonyms for constitutional isomers. 1-propanol and 2-propanol are isomers of an alcohol with three carbons. They are colorless liquids with a sweet odor.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 33. In polymerization reactions, reactions take place between

- a. identical molecules only.
- b. different molecules only.
- c. Both a and b
- d. None of the above

Correct Answer: A

In polymer chemistry, polymerization is a process of reacting monomer molecules together in a chemical reaction to form polymer chains or three-dimensional networks. There are many forms of polymerization and different systems exist to categorize them.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 34. _____ is generally the characteristic of organic compounds.

- a. High melting point
- b. Low melting point
- c. Insoluble in non-polar solvents
- d. Soluble in polar solvents

Correct Answer: B

High melting points (450°C and higher) are characteristic of ionic compounds but organic compounds generally have low melting points. Wax and street tar melt in the summer heat, sugar melts and can burn on the kitchen stove. Wax, tar and sugar are examples of organic compounds.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 35. What is a polar molecule?

- a. It is slightly negative at one and slightly positive at the other end.
- b. It has an extra electron, giving it a negative charge.
- c. It has an extra neutron, making it weight more.
- d. It has covalent and non-covalent bonds.

Correct Answer: A

The electron density of a polar bond accumulates towards one end of the bond, causing that end to carry a slight negative charge and the other end a slight positive charge. Likewise molecules in which there is an accumulation of electron density at one end of the molecule, giving that end a partial negative charge and the other a partial positive charge, are called polar molecules.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 36. _____ atoms can form a polar covalent bond.

- a. N and N
- b. Na and Br
- c. H and Br
- d. H and H

Correct Answer: C

The electronegativity difference between H (2.1) and Br (3.0) is 0.9 . If the difference is less than 1.7 (but not zero, usually more than 0.4), a polar covalent bond is formed. A non-polar covalent bond is formed when the difference is close to zero (usually up to 0.4). If the difference is more than 1.7 , an ionic bond is formed.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 37. Which element is the least abundant in human body?

- a. Oxygen
- b. Carbon
- c. Phosphorous
- d. All of the above

Correct Answer: C

“Phosphorous is the least abundant element cosmically relative to its presence in biology”. About 1.2% to 1.5% of our body consists of phosphorous.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 38. What is the phenomenon called that involve the simultaneous existence of two molecular forms in equilibrium?

- a. Resonance
- b. Tautomerism
- c. Polarity
- d. None of the above

Correct Answer: B

Tautomerism, the existence of two or more chemical compounds that are capable of facile interconversion, in many cases merely exchanging a hydrogen atom between two other atoms, to either of which it forms a covalent bond. Unlike other classes of isomers, tautomeric compounds exist in mobile equilibrium with each other, so that attempts to prepare the separate substances usually result in the formation of a mixture that shows all the chemical and physical properties to be expected on the basis of the structures of the components.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 39. What kind of hybridization is seen in methane molecule (CH_4)?

- a. sp^2 hybridization
- b. sp^3 hybridization
- c. sp^1 hybridization
- d. None of the above

Correct Answer: B

The electrons rearrange themselves again in process called hybridization and this reorganized the electrons into four identical hybrid orbitals called sp^3 hybridization because bonds in methane (CH_4) molecules are formed by four separate but equivalent orbitals; a single $2s$ and three $2p$ orbitals of the carbon hybridize into four sp^3 orbitals.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 40. At what angle the sp^3 hybrid orbits are inclined?

- a. 109.5°
- b. 120°
- c. 90°
- d. None of the above

Correct Answer: A

The four new orbitals formed by mixing of one s and $3p$ -orbitals of an atom are known as sp^3 hybrid orbitals and are directed along the corners of a tetrahedron and are inclined to each other at an angle of 109.5° .

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 41. The energy needed to break the compound is called

- a. bond energy
- b. bond enthalpy
- c. bond dissociation energy
- d. None of the above

Correct Answer: A

The bond energy is a measure of the amount of energy needed to break apart one mole of covalently bonded gases. The SI units used to describe bond energy are kilo Joules per mole of bonds (kJ/mol).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 42. What is the shape of p-orbital ?

- a. Spherical shape
- b. Dumb-bell shape
- c. Conical shape
- d. Cylindrical shape

Correct Answer: B

The three p-orbital have the form of two ellipsoids with a point of tangency at the nucleus (sometimes referred to as a dumb bell).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

1 B. Composition, Structure and Junction of Biomolecules

Q. 43. If the molecular mass of an amino acid is 150D, what will be the molecular mass of a tripeptide?

- a. 350D
- b. 480D
- c. 400D
- d. 414D

Correct Answer: D

The molecular mass will be $3 \times 150 - 2 \times 18 = 414 \text{g/mol}$. Because one water molecule is lost by the formation of a peptide bond and there are 2 peptide bonds between the three amino acids.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 44. Which among the following force is required to maintain the three-dimensional structure of a protein?

- a. Non-covalent

- b. Covalent
- c. Van der Waal
- d. Covalent and non-covalent

Correct Answer: A

A non-covalent interaction differs from a covalent bond in that it does not involve the sharing of electrons, but rather involves more dispersed variations of electromagnetic interactions between molecules or within a molecule. Non-covalent interactions are the dominant type of interaction between super molecules in super-molecular chemistry and are critical in maintaining the three-dimensional structure of large molecules, such as proteins and nucleic acids. In addition, they are also involved in many biological processes in which large molecules bind specifically but transiently to one another.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 45. Which statement is false about histamine?

- a. It is produced on decarboxylation of histidine.
- b. It lowers blood pressure.
- c. Diphenyl hydramine hydrochloride activates histamine.
- d. Both A and B

Correct Answer: C

Diphenyl hydramine (abbreviated DPH, sometimes DHM) is a first-generation antihistamine possessing antitussive, anticholinergic, antiemetic and sedative properties that is mainly used to treat allergies.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 46. What is the chemical name of thymine?

- a. 2-oxy-4amino pyrimidine
- b. 2,4-dioxy-5methyl pyrimidine
- c. 2,4dioxypurine
- d. None of the above

Correct Answer: B

Thymine (5-methyl uracil), chemically it is 2,4-dioxy-5methyl pyrimidine. It occurs only in DNA, which contains deoxyribose as sugar. Minor amounts have recently been found in t-RNA.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 47. What will be the base composition of a double-stranded molecule, if one of the strands of a double-stranded, 10Kbp DNA duplex has the following numbers of base residues:

adenine (A) – 3800, thymine (T) – 2600 ?

- a. A – 3300, T – 5100, G – 4800, C – 4800
- b. A – 7600, T – 7600, G – 2400, C – 3400
- c. A – 3200, T – 6000, G – 6400, C – 3600
- d. A – 6400, T – 6400, G – 3600, C – 3600

Correct Answer: D

If one strand has 3800A and 2600T, the other strand has 3800T and 2600A, so the duplex has 6400A and 6400T, with the remainder being G and C (3600 each).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 48. Why do the growing DNA chains are terminated in the Sanger's method of DNA sequencing?

- a. Because the DNA polymerase is not very progressive.
- b. Because a radioactive nucleotide is incorporated.
- c. As the substrates become limiting.
- d. Because the phosphodiester bond cannot be formed.

Correct Answer: D

The Sanger's method is the primary sequencing method and involves the use of chain terminators composed of 2'3'-dideoxynucleoside triphosphates (ddNTPs). These terminators can be incorporated normally into the growing DNA chain through their 5' triphosphate groups. However, ddNTPs cannot form triphosphate bonds with the next incoming deoxynucleotide

triphosphates because ddNTPs lack 3' hydroxyl group in the ribose, which is essential to the formation of phosphodiester bond. And hence the growing chain will be terminated.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 49. The amino acid(s) that can be phosphorylated is/are

- a. Serine
- b. Threonine
- c. Tyrosine
- d. All of the above

Correct Answer: D

Protein phosphorylation is one of the most common forms of reversible protein post-translational modification (PTM), with up to 30% of all proteins being phosphorylated at any given time. Protein kinases (PKs) are the effectors of phosphorylation and catalyse the transfer of a γ -phosphate from ATP to specific amino acids on proteins. Proteins are phosphorylated predominantly on Ser, Thr and Tyr residues, which account for 86, 12 and 2% respectively of the phosphoproteome, at least in mammals.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 50. Who was the first person to discover the vitamins?

- a. Jenner
- b. Funk
- c. Pasteur
- d. Mellanby

Correct Answer: B

Kazimierz Funk (February 23,1884 – November19,1967), commonly anglicized as Casimir Funk, was a Polish biochemist, generally credited with being among the first to formulate (in1912) the concept of vitamins, which he called “vital amines” or “vitamins”.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 51. What will be the molecular weight of a protein that is composed of 100 amino acids, if the average molecular weight of 20 amino acids is 136?

- a. 12,000 g/mol
- b. 12,368 g/mol
- c. 12,638 g/mol
- d. None of the above

Correct Answer: C

In the formation of a peptide bond, a water molecule is “lost” (18Da), so if there are 100 amino acids (of average weight = 128), 99 peptide bonds were created, kicking out $99 \times 18 = 162 \text{ Da}$.

$$100 \text{ AA} \times 128 \text{ Da} = 12,800 \text{ Dalton}$$

Removing the “water” upon condensation gives

$$12,800 \text{ Da} - 162 \text{ Da} = 12,638 \text{ Da} = 12,638 \text{ g/mol}.$$

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 52. _____ have the lowest melting point.

- a. Fatty acids with sites of unsaturation with *cis* double bonds
- b. Fatty acids with sites of unsaturation with *trans* double bonds
- c. Fatty acids with shorter hydrophilic tails
- d. None of the above

Correct Answer: A

When double bonds are present, fatty acids are said to be unsaturated, mono-unsaturated if only one double bond is present and polyenoic if they have two or more double bonds generally separated by a single methylene group in the carbon backbone. The configuration for double bond is almost always *cis*. Therefore, the bent structure is common for unsaturated fatty acids. Unsaturated fatty acids tend to be liquid at room temperature; their melting point increases with increasing chain length but decreases with high degree of unsaturation. When a fatty acid is unsaturated and has a short chain length, it increases the fluidity. Most commonly, unsaturated fatty acids are from vegetable origin.

Core Concept :
Topic Name :
Complexity :
Difficulty Level : Medium

Q. 53. _____ is the alkaline hydrolysis of a triglyceride.

- a. Saponification
- b. Trans-esterification
- c. Hydration
- d. Dehydration

Correct Answer: A

The term “Saponification” is an indication of chemical reaction originally was used for making soap. By boiling animal fat or lard with either potassium hydroxide or sodium hydroxide, the reaction, hydrolysis, produced glycerol and soap.

Core Concept :
Topic Name :
Complexity :
Difficulty Level : Medium

Q. 54. Which among the following is an example of imino acid?

- a. Lysine
- b. Glycine
- c. Proline
- d. Histidine

Correct Answer: C

In chemistry, an imino acid is any molecule having both imino ($>C=NH$) and carboxyl ($-C(=O)-OH$) functional groups. Amino acids containing a secondary amine group (the only proteinogenic amino acid of this type is proline) are sometimes named imino acids, though this usage is obsolescent.

Core Concept :
Topic Name :
Complexity :
Difficulty Level : Medium

Q. 55. Where does the non-polar amino acid residues are found mostly?

- a. In the core of proteins
- b. On the surface of proteins
- c. On beta sheets
- d. In a specific region

Correct Answer: A

The ionic, polar or non-polar character of amino acid side chains is very important in protein structure and function. Most stable proteins are constructed so that the polar residues are situated at the surface of the molecule where they can associate with the surrounding water and contribute to the protein's solubility in aqueous solution. In contrast, the non-polar residues are situated predominantly in the core of the molecule. The hydrophobic residues of the protein interior are often tightly packed together, creating a type of three-dimensional jigsaw puzzle in which water molecules are generally excluded. Hydrophobic interactions among the non-polar side chains of these residues are a driving force during protein folding.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 56. What is an average molecular weight of an amino acid in a globular structure of protein?

- a. 70
- b. 90
- c. 110
- d. 130

Correct Answer: C

The average molecular weight of an amino acid residue is 110.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 57. The fatty acid synthase complex is best described as

- a. a complex of S different proteins.
- b. a dimer of simpler units.
- c. a composite of covalently linked enzymes.
- d. Both A and B

Correct Answer: C

Fatty acid synthase is a multi-enzyme protein that catalyzes fatty acid synthesis. It is not a single enzyme but a whole enzymatic system composed of two identical 272 kDa multifunctional polypeptides, in which substrates are handed from one functional domain to the next. Its main function is to catalyze the synthesis of palmitate from acetyl-CoA and malonyl-CoA, in the presence of NADPH, into long-chain saturated fatty acids.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 58. Which among the following amino acid can exist as diastereomer?

- a. Isoleucine
- b. Valine
- c. Threonine
- d. Serine

Correct Answer: A

Isoleucine is an α - amino acid that is found in most proteins and is essential in the human diet. Isoleucine is one of two common amino acids (along with threonine) that have a chiral side chain. Four stereoisomers of isoleucine are possible, including two possible diastereomers (non-mirror image chemical reaction) of L- isoleucine. However, isoleucine present in nature exists in one specific form, (2S,3S)-2- amino - 3- methylpentanoic acid.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 59. Ala, lie, Leu, Phe and Val are the examples of _____ amino acids.

- a. polar
- b. non polar
- c. hydrophilic
- d. hydrophobic

Correct Answer: D

Hydrophobic amino acids are those with side-chains that do not like to reside in an aqueous (*i.e.* water) environment. For this reason, one generally finds these amino acids buried within the hydrophobic core of the protein, or within the lipid portion of the membrane. The nine amino acids that have hydrophobic side chains are glycine (Gly), alanine (Ala), valine (Val), leucine (Leu), isoleucine (Ile), proline (Pro), phenylalanine (Phe), methionine (Met) and tryptophan (Trp).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 60. What are the total numbers of conformations a peptide can adopt if in a five-residue long peptide each amino acid can adopt three conformations?

- a. 33
- b. 27
- c. 125
- d. 243

Correct Answer: D

$$3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243.$$

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 61. Which of the following substance would get impaired in the case of cystic fibrosis in which the pancreatic ducts are obstructed by viscous mucus?

- a. Lipids
- b. Proteins
- c. Fatty acids
- d. Starch

Correct Answer: A

Cystic fibrosis affects the body's ability to move salt and water in and out of cells. This defect causes the lungs and pancreas to secrete abnormally thick mucus that blocks passageways and prevents proper function. In the pancreas, clogged passageways prevent secretion of digestive enzymes into the intestine, causing serious impairment of digestion (especially the digestion of fat, which can lead to malnutrition).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 62. _____ bonds have a partial double bond character in proteins.

- a. Ca – C
- b. Ca – N
- c. C – N
- d. C – O

Correct Answer: C

The peptide bond is planar, because resonance between the carbonyl group and the amino nitrogen lends the C – N bond a partial double-bond character. It is possible to draw a resonance structure with a double bond between the carbon atom and the nitrogen atom, with a formal negative charge on the oxygen atom and a formal positive charge on the nitrogen. The peptide bond C' — N, has a partial double bond character due to the presence of a neighboring double bond C' = O.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 63. Name the process of electron acceptance which is the common way for the cells to capture the energy that is released during the breakdown of the large molecules to add electrons to smaller, specialized molecules that can accept them.

- a. Oxidation
- b. Reduction
- c. Kinetics
- d. Catalysis

Correct Answer: B

The original view of oxidation and reduction is that of adding or removing oxygen. An alternative view is to describe oxidation as the losing of electrons and reduction as the gaining of electrons. The definition of redox reactions is extended to include other reactions with nonmetals such as chlorine and bromine. For example, the reaction $\text{Mg} + \text{Cl}_2 \rightarrow \text{Mg}^{2+} + 2\text{Cl}^-$

Magnesium loses electrons and is therefore said to be “oxidized”, whereas the chlorines gain electrons and are said to be reduced. Another way to judge that the chlorine has been reduced is the fact that the charge on the atoms is made more negative or reduced.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 64. What is the active form of Vitamin D called?

- a. Calcidiole
- b. Cholesterol
- c. Calcitriol
- d. None of the above

Correct Answer: C

Calcitriol, also called 1,25–dihydroxycholecalciferol or 1,25–dihydroxyvitamin D₃, is the hormonally active metabolite of vitamin D with three hydroxyl groups. Calcitriol increases the level of calcium (Ca²⁺) in the blood by increasing the uptake of calcium from the gut into the blood and possibly increasing the release of calcium into the blood from bone.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 65. Vitamins often act as _____.

- a. cofactors
- b. coenzymes
- c. apoenzymes
- d. All of the above

Correct Answer: B

Vitamins work together in impressive ways as coenzymes or precursors to coenzymes. Coenzymes are organic molecules that are required by certain enzymes to carry out catalyses. They are often precursors to coenzymes. Precursors are substances that can be converted into active vitamins and coenzymes.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 66. What is the shape of the backbone of α -helix, in proteins?

- a. Like the English letter “ α ”
- b. Right handed spiral
- c. Left handed spiral
- d. Like the Greek letter “ α ”

Correct Answer: B

In α -helix, the polypeptide backbone is twisted into the right handed helix which, for the L-amino acids, is more stable than a left-handed one. The direction of twist of the right handed helix, the axis either way the helix turns clockwise.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 67. _____ is a steroid vitamin.

- a. Vitamin A
- b. Vitamin D
- c. Vitamin B
- d. Vitamin E

Correct Answer: B

The term vitamin D is, unfortunately, an imprecise term referring to one or more members of a group of steroid molecules. Vitamin D is a fat-soluble steroid hormone precursor that contributes to the maintenance of normal levels of calcium and phosphorus in the bloodstream.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 68. What kind of molecules are glucose and galactose?

- a. Anomers
- b. Epimers
- c. Conformers
- d. Enantiomers

Correct Answer: B

In stereochemistry, epimer refers to one of a pair of stereoisomers. They are very closely related structures. The two isomers differ in configuration at only one stereogenic center. All other stereocenters in the molecules, if any, are the same in each. The sugars glucose and galactose are epimers. In glucose, the $-OH$ group on the first carbon is in the axial position, the direction opposite the $-OH$ group on carbon C-4. In galactose, the $-OH$ group is oriented in the same direction, the equatorial position. In cyclical compounds like these, the $-OH$ group on C-1 may lie in opposite directions as well. This structural difference distinguishes two anomers. The two molecules are both epimers and anomers (as indicated by the α -glucose and β -designation).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 69. How many double bonds are present in Arachidonic acid?

- a. 2
- b. 3
- c. 4
- d. 5

Correct Answer: C

Arachidonic acid is a polyunsaturated omega-6 fatty acid $20:4(\omega-6)$. It is the counterpart to the saturated arachidic acid found in peanut oil. In chemical structure, arachidonic acid is a carboxylic acid with a 20-carbon chain and four cis-double bonds; the first double bond is located at the sixth carbon from the omega end.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 70. _____ form of vitamin A is required for vision.

- a. All trans

- b. All *cis*
- c. 11-*cis*-retinal
- d. 11-*cis*-retinol

Correct Answer: C

Vitamin A has several functions in the body. The most well known is its role in vision - hence carrots “make able to see in the dark”. The retinol is oxidised to its aldehyde, retinal, which complexes with a molecule in the eye called opsin. When a photon of light hits the complex the retinal changes from the 11-*cis*-form to the all-trans form, initiating a chain of events, which results in the transmission of an impulse up the optic nerve.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 71. What conditions must be most appropriate to elute target proteins from an affinity chromatography matrix?

- a. Continuous washing with the buffer.
- b. Adding a soluble ligand which competes with the affinity tagged protein for binding to the column.
- c. Both A and B
- d. None of the above

Correct Answer: B

Affinity chromatography exploits the specificity of a protein for binding only certain other molecules. Immobilizing one molecule on a chromatography matrix allows you to capture a binding partner. A soluble ligand passed through the column can bind the target protein, displacing it from the column so it can be washed out. However, some interactions are very strong and require more aggressive conditions; very low pH is often used to disrupt antibody-antigen interactions and for Protein A purification of antibodies. High salt concentrations are used to elute proteins from IEX columns, while low salt concentrations are used to elute proteins from HIC columns. Isocratic elution is used for SEC - washing an affinity column without changing binding conditions with not elute protein.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 72. Ascorbic acid act as

- a. oxidizing agent
- b. reducing agent
- c. Both A and B
- d. None of the above

Correct Answer: B

Ascorbic acid is a naturally occurring organic compound with antioxidant properties. It is a mild reducing agent and antioxidant. It is oxidized with loss of one electron to form a radical cation and then with loss of a second electron to form dehydroascorbic acid. It typically reacts with oxidants of the reactive oxygen species, such as the hydroxyl radical.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 73. What is the difference between the R and T states of hemoglobin?

- a. Folded and unfolded state
- b. Oxy and deoxy states
- c. Both A and B
- d. None of the above

Correct Answer: B

There are two states in the hemoglobin, the T state (the tense state) and the R state (the relaxed state). The T state has a less affinity for oxygen than the R state. T (tense) and R (relaxed) are two states of hemoglobin at which deciding factors allow oxygen to either bind easier or release.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 74. Which among the following is an example of trimeric protein?

- a. Keratin
- b. Collagen

- c. Hemoglobin
- d. All of the above

Correct Answer: B

In biochemistry, a trimer is a macromolecular complex formed by three, usually non-covalently bound, macromolecules like proteins or nucleic acids. Three identical molecules would form a homo-trimer. A heterotrimer would be formed by three different macromolecules. Collagen is an example of homo-trimeric protein. Rickets is caused by vitamin D deficiency; scurvy is caused due to deficiency of vitamin C and cheilosis due to vitamin B₂.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 75. Which among the following is not a vitamin deficiency disease?

- a. Rickets and Scurvy
- b. Marasmus and Cheilosis
- c. Only Marasmus
- d. Only Cheilosis

Correct Answer: C

Marasmus is a form of severe malnutrition, characterized by energy deficiency, a child with marasmus looks emaciated. Body weight is reduced to less than 60% of the normal (expected) body weight for the age.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 76. What will be the closest molecular weight of mRNA that codes for protein with 75,000 molecular weight?

- a. 600
- b. 6,000
- c. 60,000
- d. 6,00,000

Correct Answer: D

Protein weights 75,000 , thus $75,000/110 = 681$ amino acids in protein molecule. 1 amino acid is coded by 3 bases in mRNA , thus we need $681 \times 3 = 2045$ bases. 1base = 330amu . So 2045 bases weigh = close to 6,00,000 .

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 77. In case of size exclusion chromatography, on what factors do the elution of proteins depends upon?

- a. Surface charge distribution of the protein
- b. The shape of the protein
- c. The size of the protein
- d. Both B and C

Correct Answer: D

Size-exclusion chromatography (SEC) is a chromatographic method in which molecules in solution are separated by their size and in some cases molecular weight. It is usually applied to large molecules or macromolecular complexes such as proteins and industrial polymers.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 78. _____are the major dietary constituents.

- a. Glucose stored in the body
- b. All non-essential amino acids found in meat
- c. All essential amino acids found in meat
- d. All of the above

Correct Answer: C

Glucose is stored in the liver, skeletal muscle and some other tissues as glycogen. Animal protein is complete protein and contains all 20 of the amino acids used by the body to synthesize new proteins. Plant oils are rich in unsaturated fats. Ketones are by-products of fat metabolism and appear in the urine of individuals who are eating little or no carbohydrate.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 79. Which among the following amino acids is regarded as both ketogenic and glucogenic?

- a. Valine
- b. Tryptophan
- c. Both A and B
- d. None of the above

Correct Answer: B

A ketogenic amino acid is an amino acid that can be degraded directly into acetyl CoA through ketogenesis. This is in contrast to the glucogenic amino acids, which are converted into glucose. Tryptophan is considered partially ketogenic and partially glucogenic. Tryptophan yields acetyl CoA as well as pyruvate upon catabolism.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 80. If the peptide, Ala-Arg-Gln-Met-Thr-Trp-Lys-Val is treated with cyanogens bromide, which among the following sequence will be produced?

- a. Ala – Arg – Gln – Met + Thr – Trp – Lys – Val
- b. Ala – Arg – Gln – Met – Thr – Trp + Lys – Val
- c. Ala – Arg + Gln – Met – Thr – Trp – Lys – Val
- d. Ala – Arg – Gln + Met + Thr – Trp – Lys – Val

Correct Answer: A

Cyanogen bromide hydrolyzes peptide bonds at the C- terminus of methionine residues.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 81. Alanine becomes _____ , when the amino acid alanine (R-group is CH₃) is added to a solution with a pH of 7.3 .

- a. polar

- b. non-polar
- c. zwitter ion
- d. None of the above

Correct Answer: C

The alanine becomes zwitter ions because at a pH of 7.3 , the carboxyl group COOH of alanine becomes fully deprotonated (a proton is removed) forming COO⁻ while the amino group becomes fully protonated forming an NH₃⁺ .

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 82. Which among the following Is largest amino acid?

- a. Leucine
- b. Tryptophan
- c. Lysine
- d. Alanine

Correct Answer: B

Tryptophan, an essential amino acid, is the largest of the amino acids. It is the protein with highest molecular mass (186g/mol) , the largest volume and largest surface area.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 83. What is the main function of the insulin hormone?

- a. To increase the blood glucose levels
- b. To decrease the blood glucose levels
- c. To decrease glycogen in the liver
- d. All of the above

Correct Answer: B

Insulin is a hormone, which plays a key role in the regulation of blood glucose levels. A lack of insulin or an inability to adequately respond to insulin, can each lead to the development of the symptoms of diabetes. Insulin regulates how the body uses and stores glucose and fat. Many of the body's cells rely on insulin to take glucose from the blood for energy.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 84. What can be inferred regarding dietary requirements of the major foodstuffs?

- a. Children who have a protein deficient diet may develop Kwashiorkor.
- b. Children who do have a protein deficient diet may develop Marasmus.
- c. Children who have a protein deficient diet may develop Oedema.
- d. None of the above

Correct Answer: A

Adults cannot synthesize the 8 essential amino acids, which must be supplied by the diet. Children whose diet is protein deficient are at risk of developing Kwashiorkor. Such children have oedema; those suffering from marasmus do not. Fatty acid deficiency is rare, even in those whose diet is low in fats.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 85. What are essential amino acids?

- a. They are easy to synthesize
- b. They cannot be synthesized by body
- c. The body can synthesize under essential conditions
- d. None of the above

Correct Answer: B

An essential amino acid or indispensable amino acid is an amino acid that cannot be synthesized *de novo* (from scratch) by the organism being considered and therefore must be supplied in its diet. The nine amino acids humans cannot synthesize are phenylalanine, valine, threonine, tryptophan, methionine, leucine, isoleucine, lysine and histidine.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 86. Excess intake of _____ can cause severe toxic reactions.

- a. vitamin D
- b. vitamin A
- c. vitamin B
- d. vitamin C

Correct Answer: B

Excess vitamin A is highly toxic and can cause a variety of neurological problems. Vitamin B₂ deficiency is comparatively rare. Symptoms include cracking at the edges of the lips and skin lesions. Neurological disorders are seen in deficiency of Vitamins B₁, B₃ and B₆. Vitamin B₁₂ deficiency results in macrocytic (or pernicious) anaemia. Rickets can be prevented by administration of vitamin D .

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 87. The sequence Lys-Ser-Gly-Ala-Ala-Glu-Tyr-Pro-Thr-Val-Phe can be represented as:

- a. KSAGAEYPTFV
- b. KSGAAEYPTVF
- c. KSGPTAAGCFF
- d. FTGYHPTYFVS

Correct Answer: B

KSGAAEYPTVF is represented as Lys-Ser-Gly-Ala-Ala-Glu-Tyr-Pro-Thr-Val-Phe . This small protein can be defined as a peptide but a decapeptide would contain 10 amino acids. It is very helpful to learn the three-letter and single letter abbreviation for the amino acids and to know the side chain properties of each.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 88. Which among the following statement is correct regarding the carbohydrates?

- a. Hexoses are more likely to exist in their open-chain forms.
- b. Monosaccharides always contain six carbon atoms.
- c. Hexose sugars can form six-membered rings.
- d. All of the above

Correct Answer: C

Carbohydrates have important roles in nutrition (they are energy rich) and biochemistry, as well as some pharmaceutical applications. The chemistry of carbohydrates is complex and more varied than other classes of macromolecules. Monosaccharides have a preference for the cyclic form and typically prefer 5 and 6 membered rings (comprising 4 or 5 carbons plus an oxygen). Remaining carbons are outside the ring. Hexose sugars can also form six-membered rings.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 89. Active site of chymotrypsin consists of

- a. serine
- b. histidine
- c. aspartate
- d. All of the above

Correct Answer: D

The active site of chymotrypsin consists of a catalytic triad of serine, histidine and aspartate amino acid residues. The 'histidine acts as a general base by accepting a proton from the serine. The serine oxygen then makes a nucleophilic attack on the carbonyl carbon of the susceptible peptide bond forming a tetrahedral intermediate. The histidine proton is then transferred to the tetrahedral intermediate produced causing it to break down. An acylated enzyme is formed and the first product is liberated. The histidine side chain again acts as a base accepting a proton from a water molecule, activating it and forming a second tetrahedral intermediate. As before, the protonated histidine (now an acid), donates its acquired proton back to the tetrahedral intermediate, completing the reaction. The aspartate holds the histidine side chain in the correct orientation to accept the proton from the serine.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 90. How many numbers of hydrogen bonds are present in between the bases if 1,000 bases are considered in a strand and the DNA molecule has 40% GC content?

- a. 1,000
- b. 1200

- c. 2200
- d. 2400

Correct Answer: D

Total hydrogen bonds = 2400.

40% GC, thus in 1,000 bp, 400GC, between them 3H bonds, thus total bonds = 1200. Rest 60% AT, in 1,000 bp, 600ATbps hence bond between them = $600 \times 2 = 1200$.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 91. Cobalmine is only synthesized by

- a. plants
- b. animals
- c. microorganisms
- d. All of the above

Correct Answer: C

Vitamin B₁₂ (Cobalmine) is unique among vitamins in that it is synthesized in nature only by microorganisms.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 92. Naturally occurring unsaturated fatty acids generally form less effective non-polar interactions with each other.

- a. True
- b. False
- c. Cannot say
- d. Wrong

Correct Answer: A

Fatty acids and their derivatives are highly important in biochemistry, not least the contribution that phospholipids make to the structure of cell membranes. Lipids have a strong degree of non-

polar character, a property relatively unusual in biochemistry, but often also contain polar functional groups - resulting in mixed properties. Despite phospholipids containing a charged (polar) group they also have very non-polar region. Dietary fat (triesters) contain ester linkages and acetic acid is a very short chain fatty acid. Naturally occurring unsaturated fatty acids contain *cis*-double bonds, resulting in poor non-polar interactions between molecules. Therefore these molecules are usually liquids (*i.e.* they have low melting points).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 93. Which is an instant source of energy?

- a. Fructose
- b. Sucrose
- c. Glucose
- d. All of the above

Correct Answer: C

The red blood cells use glucose as an instant energy source. Glucose is absorbed into the bloodstream from the intestines, where the carbohydrates are broken down into simple sugars like glucose, fructose and beta-galactose. One part of glucose is converted into the needed energy, while the rest of glucose is stored as glycogen in muscles and in the liver.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 94. From the following given statements, regarding some common carbohydrates, which is correct?

- a. Ribose is a pentose sugar.
- b. Sucrose is a disaccharide of galactose and glucose.
- c. Glucose can be classified as an oligosaccharide.
- d. All of the above

Correct Answer: A

Ribose, an important component of nucleic acids, contains five carbons and can be classified as a pentose, Sucrose is formed from fructose and glucose. D-Sugars are dextrorotatory and rotate

polarised light in the clockwise direction. Oligosaccharides contain 2–10 monosaccharides ; glucose is a single monosaccharide.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 95. What is an inverted sugar?

- a. Hydrolytic product of dextrin
- b. Hydrolytic product of sucrose
- c. Hydrolytic product of glucose
- d. None of the above

Correct Answer: B

Inverted or invert sugar is a mixture of glucose and fructose; it is obtained by splitting sucrose into these two components. The mixture is sold as a viscous liquid and is often referred to as trimoline or invert syrup. Compared to sucrose, inverted sugar is sweeter and its products (glucose and fructose) tend to retain moisture and are less prone to crystallization.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 96. Disulfide bonds are formed between _____ residues.

- a. cysteine
- b. proline
- c. histidine
- d. All of the above

Correct Answer: A

A disulfide bond is a covalent bond, usually derived by the coupling of two thiol groups. The linkage is also called an S-S-bond or disulfide bridge. The overall connectivity is therefore C-S-S-C . Disulfide bonds in proteins are formed between the thiol groups of cysteine residues.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 97. Deficiency of ____ leads to the disease called Megaloblastic anaemia.

- a. Vitamin B₄
- b. Vitamin B₉
- c. Vitamin B₇
- d. Vitamin B₂

Correct Answer: B

Megaloblastic anaemia is a condition in which the bone marrow produces unusually large, structurally abnormal, immature red blood cells (megaloblasts). Bone marrow, the soft spongy material found inside certain bones, produces the main blood cells of the body red cells, white cells, and platelets. Megaloblastic anemia has several different causes deficiencies of either cobalamin (vitamin B₁₂) or folate (Vitamin B₉) are the two most common causes. These vitamins play an essential role in the production of red blood cells.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 98. What is true regarding body weight and the diet?

- a. An individual with a BMI of 20 kg m^{-2} is overweight.
- b. An individual with a BMI of 25 kg m^{-2} is underweight.
- c. A growing child may have a BMI significantly below 18 kg m^{-2} and yet be perfectly healthy.
- d. None of the above

Correct Answer: C

BMI is a measurement that relates weight to height. As a measure of bodily health it is of most value in adults. Normal values range from 18.5 to 25 kg m^{-2} Values in excess of 30 represent increasing levels of obesity. During periods of accelerated growth in childhood, the body is in positive nitrogen balance, which means that synthesis of new protein exceeds protein breakdown or fat deposition.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 99. Which among the following do not show an antioxidant property?

- a. Vitamin D
- b. Vitamin C
- c. Vitamin A
- d. Vitamin K

Correct Answer: A

Activated vitamin D is both a natural antioxidant and helps repair damaged DNA. Humans live by burning (oxidizing) food and the byproducts of that oxidation damage DNA. That's why so many people take antioxidants like vitamin C and E.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 100. Which among the following are stop codons?

- a. UGA
- b. UAG
- c. UAA
- d. All of the above

Correct Answer: D

In the genetic code, a stop codon (or termination codon) is a nucleotide triplet within messenger RNA that signals a termination of translation. In the standard genetic code, there are three stop codons UAG (in RNA) / TAG (in DNA) ("amber"), UAA / TAA ("ochre") and UGA / TGA ("opal" or "umber"); several variations to this most common set are known.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 101. What is the role of protein disulphide isomerase enzyme?

- a. Protein unfolding
- b. Protein folding
- c. Protein bending
- d. Protein breakdown

Correct Answer: B

PDI is an enzyme involved in shuffling of disulphide bonds in protein folding. Protein disulfide isomerase (PDI) catalyzes the formation of native disulfides of peptide chains from either the reduced form or randomly joined disulfides. So that thiols situated at distant parts of the polypeptide chain can be joined together to form the native disulfides, the polypeptide chain has to be folded, at least to some extent, into the native conformation.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 102. Casal Necklace Pattern is visible in _____ deficiency,

- a. riboflavin
- b. niacin
- c. thiamine
- d. bilirubin

Correct Answer: B

Vitamin B₃ or niacin deficiency causes pellagra. Populations dependent on maize and with low dietary diversity are at the risk of the disease. Casal's necklace is the term used to describe pellagra visible on the neck.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 103. What are EF-Tu and EF-1a ?

- a. Homologs
- b. Analogs
- c. Paralogs
- d. Both A and C

Correct Answer: A

EF-Tu elongation factor is involved in protein synthesis of bacteria. The protein counterpart in eukaryote is EF-1a . Both are members of the same family with a common ancestry.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 104. Which among the following is used to distinguish between ketoses and aldoses?

- a. Benedict's solution
- b. Faling's solution
- c. Tollen's reagent
- d. Bromine water

Correct Answer: D

Bromine water oxidizes aldehyde functional group, but it cannot oxidize ketones or alcohols. Therefore, aldose can be distinguished from ketose by observing reddish-brown colour of bromine. The oxidized product is an aldonic acid.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 105. What are the two constituents of maltose?

- a. Glucose and Glucose
- b. Glucose and Fructose
- c. Glucose and Galactose
- d. Sucrose and Glucose

Correct Answer: A

Maltose, also known as maltobiose or maltsugar, is a disaccharide formed from two units of glucose joined with an $\alpha(1 \rightarrow 4)$ bond, formed from a condensation reaction. The isomer isomaltose has two glucose molecules linked through an $\alpha(1 \rightarrow 6)$ bond. Maltose is the second member of an important biochemical series of glucose chains.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 106. Which of the following statements about amino acids is correct?

- a. Amino acids are classified according to the structures and properties of their side chains.

- b. Amino acids are uncharged at neutral pH .
- c. Amino acids in proteins are mainly in the D- configuration.
- d. None of the above

Correct Answer: A

More than 20 different amino acids are found in nature, but only 20 are used for protein synthesis. The same 20 are used for all life forms on earth. An α - amino acid exists in aqueous neutral solution as the zwitterionic form. Every amino acid, with the exception of proline which is actually an imino acid, has the same $H_2N - CH - COOH$ part only the R group or side chain attached to the α - carbon atom varies. With the exception of glycine, which has no asymmetric carbon atom, amino acids in proteins are of the L- configuration. It is not necessary to specify that an amino acid in any biological context is of the L- configuration since D- amino acids are only rarely encountered (mainly in certain microbial structures) and where they occur these are always specified.

Amino acids are classified according to the structures and properties of their side chains. Although the criteria used and hence the groupings may vary somewhat depending on the hydrophobic or hydrophilic ('water hating' or 'water loving') nature of the side chain usually emphasized, as it is a key determinant of how the amino acid interacts with other chemical groups.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 107. Lipids are

- a. generally insoluble in water.
- b. generally soluble in oils.
- c. generally soluble in fats.
- d. All of the above

Correct Answer: A

The lipids are a large and diverse group of naturally occurring organic compounds that are related by their solubility in nonpolar organic solvents (*e.g.* ether, chloroform, acetone and benzene) and general insolubility in water.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 108. What are sorbitol and mannitol?

- a. Anomers
- b. Epimers
- c. Enantiomers
- d. None of the above

Correct Answer: B

Reducing the aldehyde group of glucose derives sorbitol. While mannitol is the same reaction done to mannose. The structure of mannose and glucose are the same except for the stereochemistry at C2 . The reduction of the aldehyde does not affect the other stereocenters in the molecule; therefore sorbitol and mannitol are epimers.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 109. Collagen

- a. contains a high proportion of hydroxylated proline residues.
- b. is a globular, intracellular protein.
- c. consists of a superhelix of three α helices twisted together.
- d. None of the above

Correct Answer: A

Collagen is the most plentiful protein in the mammalian body. It is a secreted protein and therefore occurs outside cells. Glycine occurs at every third residue in the collagen polypeptide chain. Collagen also contains a high proportion of proline, hydroxyproline and hydroxylysine.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 110. If the protein has 5 lysine residues, how many small peptides will be formed after trypsin cleavage?

- a. 2
- b. 4

- c. 6
- d. 8

Correct Answer: C

Different enzymes have different specificity for their substrate; trypsin, for example, cleaves the peptide bond after a positively charged residue (arginine and lysine). After the signal peptide is cleaved, and a further processing to remove the N-terminal 6-residue propeptide yields the mature form of the protein.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 111. The amino acid that is mostly likely to disrupt an alpha helix is

- a. Proline
- b. Cysteine
- c. Lysine
- d. All of the above

Correct Answer: A

While some amino acids (including leucine) are very good at forming alpha helices, proline is known as a helix disrupter because of its inhibitory effect on helix formation.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 112. Which of the following pairs of amino acids might contribute to protein conformation by forming electrostatic interactions?

- a. Glutamate and Lysine
- b. Phenylalanine and Tyrosine
- c. Lysine and Tyrosine
- d. Cysteine and Lysine

Correct Answer: A

Electrostatic interactions operate most strongly between amino acid side chains carrying full and opposite charges. Glutamate and lysine have oppositely charged side chains at physiological pH, so will experience attractive electrostatic interactions.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 113. Cellulose, the structural polysaccharide of plant is a polymer of

- a. β -D-Glucose
- b. α -D-Glucose
- c. β -D-Galactose
- d. α -D-Galacturonic acid

Correct Answer: A

Beta glucose is the monomer unit in cellulose. As a result of the bond angles in the beta acetol linkage, cellulose is mostly a linear chain.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 114. An unusual amino acid named as desmosine is present in _____.

- a. Tropomyosin
- b. Troponin
- c. Elastin
- d. Myosin

Correct Answer: C

Desmosine (DES) and isodesmosine (IDES) are two unusual, tetrafunctional, pyridinium ring-containing amino acids involved in elastin cross-linking. Being amino acids unique to mature cross-linked elastin, they are useful for discriminating peptides derived from elastin breakdown from precursor elastin peptides. Desmosine is responsible for the rubber like properties of elastine.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 115. The important role of carotenoids in the human diet is their ability to serve as precursors of

- a. vitamin C
- b. vitamin D
- c. vitamin A
- d. vitamin K

Correct Answer: C

Carotenoids are not only essential to the organisms that produce them (namely plants, and certain bacteria, algae and fungi) but are also required in animals as a source of pro-vitamin A (or retinol), even though they cannot produce the carotenoids themselves but must obtain them through their diet.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 116. _____ has pK , value near to neutrality.

- a. Histidine
- b. Proline
- c. Arginine
- d. Serine

Correct Answer: A

Histidine has a pKa of 6.0 and has buffering capacity. The R group of histidine has 10% probability to become positively charged at pH = 7 , but the probability increases to 50% at pH = 6 . Thus, histidine is very sensitive to pH change in the physiological range.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 117. Vitamin D is derived from which of the following precursor by the action of UV light?

- a. 7 – dehydrocholesterol

- b. Lanosterol
- c. Cholecalciferol
- d. Squalene epoxide

Correct Answer: A

Vitamin D₃ (cholecalciferol) is produced through the action of ultraviolet irradiation (UV) on its precursor 7-dehydrocholesterol. Human skin makes vitamin D₃ and supplies about 90% of Vitamin D. This molecule occurs naturally in the skin of animals and in milk. Vitamin D₃ can be made by exposure of the skin to UV/B, or by exposing milk directly to UV (one commercial method). Vitamin D₃ is also found in oily fish and cod liver oil.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 118. What is the cause that the peptide bond is planar?

- a. The formation of hydrogen bonds between amide protons and carbonyl oxygen.
- b. The restriction in the rotation around C α -N bond.
- c. The restriction in the rotation around C α -C bond.
- d. None of the above

Correct Answer: B

A peptide bond is a covalent bond that is formed between two molecules when the carboxyl group of one molecule reacts with the amino group of another molecule, releasing a molecule of water. X-ray diffraction studies of crystals of small peptides by Linus Pauling and R. B. Corey indicated that the peptide bond is rigid and planar. Pauling pointed out that this is largely a consequence of the resonance interaction of the amide, or the ability of the amide nitrogen to delocalize its lone pair of electrons onto the carbonyl oxygen. Because of this resonance, the C=O bond is actually longer than normal carbonyl bonds, and the N-C bond of the peptide bond is shorter than the N-C α bond. Notice that the carbonyl oxygen and amide hydrogen are in a trans configuration, as opposed to a cis configuration. This configuration is energetically more favorable because of possible steric interactions in the other.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 119. On which among the following factors, the fluidity of the membrane depends?

- a. Nature of head groups.
- b. Length of fatty acids irrespective of the extent of unsaturation.
- c. Length and degree of unsaturation of fatty acid chains.

None of the above

Correct Answer: C

The fluidity of the membrane depends on primarily on the kinds of lipids present. Three most important aspects of lipid composition that affects the membrane fluidity are the length of the fatty acids present, the degree of unsaturation of their side chains (that is the number of double bonds present) and for the animal membranes the amount of cholesterol in the membrane. If the length of the fatty acid chains is increased, the fluidity of the bilayer will decrease due to the larger propensity for non-covalent interactions between the hydrocarbon chains. In contrast, if the degree of unsaturation in the fatty acid chains is increased, the fluidity of the bilayer will increase.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 120. What will be the primary sequence of the polypeptide, if a polypeptide 10 amino acid long is split into various smaller fragments and the amino acid sequences of some of the fragments are determined and the identical fragments include: ala-gly-ser-gln , lys-trp-arg-pro , gln, his-lys , asp-ala-gly ?

- a. asp-ala-gly-ser-gln-his-lys-trp-arg-pro
- b. lys-arg-lys-pro-arg-ala-ser-pro-trp-asp
- c. lys-lys-arg-trp-arg-ala-ser-pro-trp-asp
- d. lys-arg-lys-pro-his-lys-trp -trp-asp

Correct Answer: A

As we combine all the sequences of the fragments so formed, we can easily get this sequence.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 121. The group that is most hydrophobic is

- a. histidine
- b. phenylalanine
- c. Both A and B
- d. None of the above

Correct Answer: B

Hydrophobic amino acids are those with side-chains that do not like to reside in an aqueous (i.e. water) environment. Most hydrophobic amino acids are valine, isoleucine, leucine, methionine, phenylalanine, tryptophan and cysteine.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

- Q. 122. Which metabolite build up in serum is a specific indicator of vitamin B₁₂ deficiency?
- a. Methylmalonic acid
 - b. Methionine
 - c. Succinyl CoA
 - d. N⁵ – methylTHF

Correct Answer: A

Methylmalonic acid is the form that show up in the serum. Methylmalonyl CoA is the reactant of methylmalonyl CoA mutase, a B₁₂ –requiring enzyme , but its CoA is probably removed because it is used for other metabolic reactions and anyway, CoA derivatives probably cannot even get out of the mitochondria, let alone the cell. Methylmalonic aciduria therefore is the result. The reason this is a good specific indicator of a B₁₂ problem is that B₁₂ is the only cofactor of this enzyme, while methionine synthase requires both folate and B₁₂, confusing the issue. Turning to another matter, methylmalonic aciduria whether due to B₁₂ deficiency or even a specific defect of this enzyme creates a secondary backup of propionyl CoA inside the cell (the immediate precursor to methylmalonate). Propionyl CoA , when at high concentration, may substitute for acetyl CoA in the citrate synthase reaction to form methyl citrate, a TCA cycle poison. Presumably, the severe consequence of this for neural tissue are due to its high oxidative demands.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

- Q. 123. Name the amino acid(s) that has strong absorbance at 280nm .
- a. Tryptophan
 - b. Tyrosine
 - c. Phenylalanine

d. All of the above

Correct Answer: D

Tryptophan, tyrosine and phenylalanine can absorb at 280nm. These are aromatic amino acids. Tryptophan and tyrosine absorb strongly at 280nm whereas phenylalanine has comparatively low absorbance.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 124. How many amino acids and peptide bonds are present in tri-peptide?

a. 2,3

b. 3,3

c. 2,2

d. 3,2

Correct Answer: D

A tripeptide composed of three different amino acids joined together by peptide bonds. When all twenty of the natural amino acids are possible components of a peptide, the possible combinations are enormous.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 125. The chromatin is

a. the total genetic content of a cell.

b. the protein that give structural support to a chromosome.

c. the complex of DNA and protein from which chromosomes are composed.

d. All of the above

Correct Answer: C

DNA and specific proteins called histones form a complex called chromatin.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 126. _____ is/are polysaccharide(s).

a. Starch

b. Glycogen

c. Cellulose

d. All of the above

Correct Answer: D

Polysaccharides are polymeric carbohydrate molecules composed of long chains of monosaccharide units bound together by glycosidic linkages and on hydrolysis give the constituent monosaccharides or oligosaccharides. They range in structure from linear to highly

branched. Examples include storage polysaccharides such as starch, glycogen and structural polysaccharides such as cellulose and chitin.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 127. Insufficient Vitamin B₁₂ often creates an apparent folate deficiency by trapping which folate intermediate?

- a. Folic acid
- b. Dihydrofolate (DHF)
- c. N⁵ – methyl THF
- d. None of the above

Correct Answer: C

Several forms of folate are there, all of which must pass through tetrahydrofolate (THF), the central intermediate. The form trapped by a B₁₂ deficiency is N⁵ – methyl THF, for the following two reasons.

- i) Without B₁₂, N⁵ – methyl THF cannot donate its methyl group to make methyl-B₁₂;
- ii) This is the only way N⁵ – methyl THF can be converted back to THF for recycling. So, sooner or later, a significant portion of the body's folate winds up in this dead end and becomes useless.

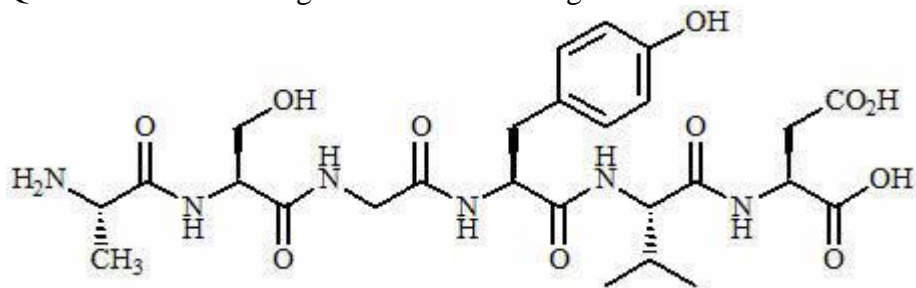
Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 128. Choose the single letter to code the given structure.



- a. AGYVDS
- b. AVGYDS
- c. ASVYSD
- d. ASGYVD

Correct Answer: D

The order of the amino acids from the N-terminal end of the peptide is alanine (A), serine (S), glycine (G), tyrosine (Y), valine (V) and aspartic acid (D).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 129. _____ was the first protein sequenced by Frederick Sanger,

- a. Globin
- b. Insulin
- c. Keratin
- d. Collagen

Correct Answer: B

Sanger solved what had been seemingly intractable problems posed by the sheer size and complexity of the two principal molecules of life that govern our health and destiny – proteins and the nucleic acids (DNA and RNA). He was the first to reveal the structure of a protein, which happened to be insulin. The discovery was an essential step for the laboratory synthesis of insulin and a major advance in the treatment of diabetes.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 130. Which among the following statement(s) is/are true regarding the tertiary structure of proteins?

- a. It is simply the sequence of amino acids.
- b. It represents the unique three-dimensional folding of the molecule.
- c. it involves the interactions of a protein with other subunits of enzymes.
- d. All of the above

Correct Answer: B

Tertiary structure refers to the overall folding of the entire polypeptide chain into a specific 3D shape. The tertiary structure of enzymes is often a compact, globular shape.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 131. Cholesterol is a

- a. fatty acid
- b. steroid
- c. glycolipid
- d. All of the above

Correct Answer: B

Cholesterol is an organic molecule. It is a sterol (or modified steroid), a lipid molecule and is biosynthesized by many animal cells because it is an essential structural component of animal cell membranes that is required to maintain both membrane structural integrity and fluidity.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 132. Which of the following statements about glycogen storage is/are false?

P. Glycogen is stored in muscles and liver.

Q. Glycogen is a major source of stored energy in the brain.

R. Glycogen reserves are more rapidly depleted than fat reserves during starvation.

S. Glycogen storage occurs in the form of dense granules in the cytoplasm of cells.

a. P and Q

b. P and R

c. Q only

d. R only

Correct Answer: C

Glycogen is a complex of glucose polymer found in a variety of tissues, including brain, where it is localized primarily in astrocytes. The small quantity found in brain compared to e.g. liver has led to the understanding that brain glycogen is merely used during hypoglycemia or ischemia.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 133. What is the process called, that is used to describe the process by which DNA is copied to produce two daughter DNA molecules?

a. Translation

b. Replication

c. Transduction

d. Reproduction

Correct Answer: B

Reproduction is the term used for the overall physiological process by which new progeny are produced in a particular species. The other terms refer to molecular processes. Replication is the copying of DNA into two daughter DNA molecules. Translation is the process by which the genetic code for a specific protein (carried in messenger RNA) is used for the synthesis of a new protein. Transcription is the term used to describe how the genetic code relevant for the synthesis of one protein (a gene) is copied from DNA to form messenger RNA.

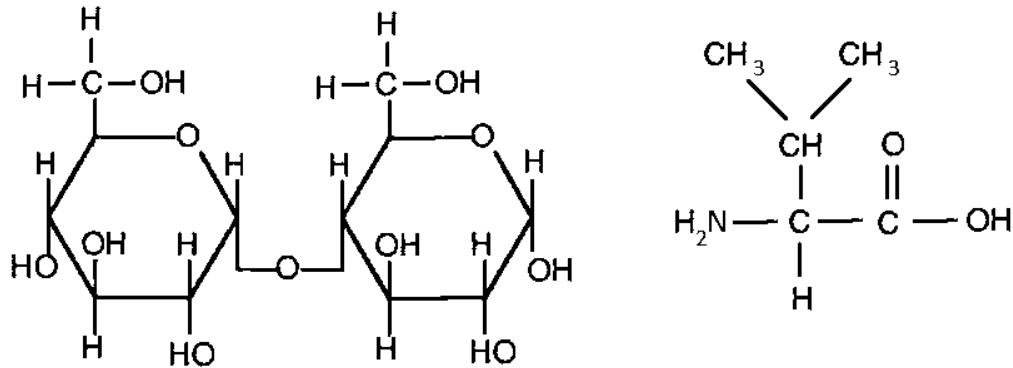
Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 134. The structure on the left is a _____ and the structure on the right is a(n) _____.



- a. lipid, fats
- b. lipid, amino acid
- c. carbohydrate, amino acid
- d. carbohydrate, lipid

Correct Answer: C

There are four major classes of small biological molecules found in cells. These are carbohydrates, lipids, amino acids, and nucleotides. Their characteristic structural features can identify the different classes of compounds. Carbohydrates have the general formula of $C(H_2O)_n$, with abundant hydroxyl groups ($-OH$); amino acids have conserved amino and carboxyl groups and variable R- groups all attached to the alpha carbon. Valine is the amino acid illustrated.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 135. The amino acid that is coded by the triplet of bases UAU is

- a. Lysine
- b. Tryptophan
- c. Alanine
- d. Tyrosine

Correct Answer: D

The triplet code for phenylalanine can be UUU or UUC. For serine it can be UCU, UCC, AGU or AGC. For tyrosine, it is UAU or UAC. For cysteine it can be UCU or UGC.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 136. _____ are the molecules that can act as small messenger molecules.

- a. Lipids
- b. Eicosanoids
- c. Fatty acids
- d. None of the above

Correct Answer: B

Eicosanoids are signaling molecules made by oxidation of 20-carbon fatty acids . They exert complex control over many bodily systems; mainly in growth during and after physical activity, inflammation or immunity after the intake of toxic compounds and pathogens, and as messengers in the central nervous system. They are found in most living things. In humans, eicosanoids are local hormones that are released by most cells, act on that same cell or nearby cells (*i.e.*, they are autocrine and paracrine mediators) and then are rapidly inactivated.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 137. Lipoic acid can exist as

- a. oxidised form
- b. reduced form
- c. both reduced and oxidised form
- d. None of the above

Correct Answer: C

Lipoic acid (LA), also known as α - lipoic acid and alpha lipoic acid (ALA) and thioctic acid is an organosulfur compound derived from octanoic acid. It can exist as both an oxidised and reduced form, with both showing antioxidant properties. It can occur in both the forms due to the ability of the disulfide linkage to undergo reduction.

Core Concept :

Topic Name :

Complexity :

Difficulty Level: Medium

Q. 138. Pernicious anemia can be cured with the intake of

- a. Vitamin A
- b. Vitamin B₆
- c. Vitamin B₁₂
- d. Vitamin C

Correct Answer: C

Pernicious anemia is a condition caused by too little Vitamin B₁₂ in the body. It is a form of Vitamin B₁₂ deficiency anemia.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 139. Which among the following is/are the simple lipid/s?

- a. Fatty acids
- b. Waxes
- c. Triglycerides
- d. All of the above

Correct Answer: D

Simple lipids can be segregated into structural types, which are fatty acids (FA), waxes, triglycerides (TG) and sterols. A fatty acid is a long-chain monocarboxylic acid and a wax is the ester of a long-chain alcohol and a fatty acid. A triglyceride is the ester of a glycerol that contains three FA molecules. Sterols are a special class of alcohols, containing a fused four-ring structure or steroid nucleus. Sterols may combine with a fatty acid to form sterol esters.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 140. A compound must be ____ to attain optical activity.

a. symmetric

b. hexameric

c. trimeric

d. asymmetric

Correct Answer: D

A molecule which has no plane of symmetry is described as chiral. The carbon atom with the four different groups attached which causes this lack of symmetry is described as a chiral centre or as an asymmetric carbon atom.

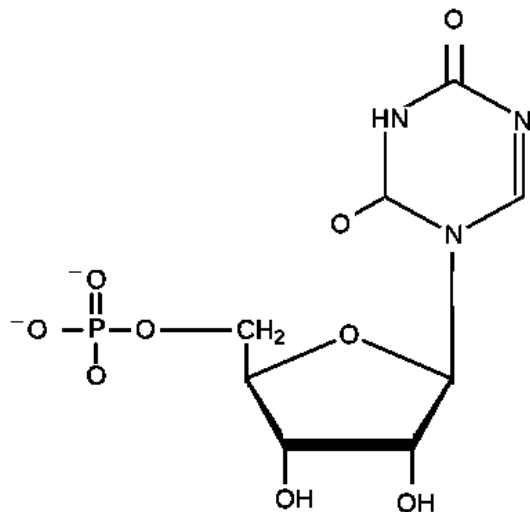
Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 141. A monomer unit of _____ is represented in the structure shown in the diagram.



a. DNA

b. RNA

c. Protein

d. Lipid

Correct Answer: B

The compound, UMP or uridine monophosphate is found internal to RNA chains. The 2'-OH group on the sugar ring is the best indicator that it is from RNA and not DNA.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 142. Which among the following are included in the physiological roles of bile salts?

P. Aid in the digestion of lipid

Q. Facilitate the absorption of sugars

R. Facilitate the absorption of lipid

S. Provide a mean for excreting cholesterol

a. P and Q

b. P and R

c. Q and S

d. Q and S

Correct Answer: B

Bile salts aid fat digestion through their detergent action (emulsification) and facilitate fat absorption by participating in the formation of micelles.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 143. The lipid that is exclusively present in mitochondrial membrane is

a. lecithin

b. cardiolipin

c. ceramide

d. cephalin

Correct Answer: B

Cardiolipin (IUPAC name “1,3-bis (sn-3'-phosphatidyl)-sn-glycerol”) is an important component of the innermitochondrial membrane, where it constitutes about 20% of the total lipid composition. The only other place that cardiolipin can be found is in the membranes of most bacteria. The name ‘cardiolipin’ is derived from the fact that it was first found in animal hearts. It was first isolated from beef heart in the early 1940s .

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 144. Which among the following release maximum energy per gram on oxidation?

a. Starch

b. Carbohydrates

c. Fats

d. None of the above

Correct Answer: C

Fats provide more kilocalories of energy yield per gram than carbohydrates. At the rest conditions 70% of the ATP is produced from fat and 30% from carbohydrates.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 145. Where the defect lies in case of Familial hypercholesterolemia, which is a genetic disorder of lipid metabolism?

- a. Transport of cholesterol from extra hepatic tissue to the liver.
- b. Impairment of cholesterol degradative pathway.
- c. Impairment of uptake of cholesterol by tissues.
- d. Impairment of HDL metabolism due to deficiency of Apo-A .

Correct Answer: C

Familial hypercholesterolemia is the lipid disorder caused by mutation of LDL receptor. LDL receptor is responsible for uptake of LDL in both hepatic and extrahepatic tissues. Decreased uptake of LDL leads to increased LDL cholesterol in the blood.

Core Concept :

Topic Name :

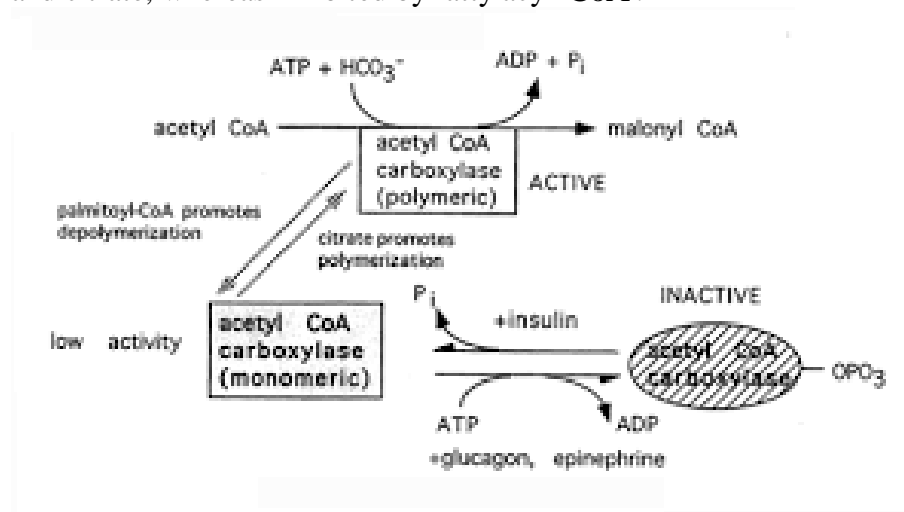
Complexity :

Difficulty Level : Medium

Q. 146. _____ inhibit the acetyl CoA carboxylase enzyme, which act as a rate limiting enzyme of carbohydrate metabolism.

- a. Malonyl CoA
- b. Acetyl CoA
- c. ATP
- d. Citrate

Correct Answer: Acetyl CoA carboxylase is enzyme that is allosterically activated by ATP and citrate, whereas inhibited by fatty acyl CoA .



Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 147. The mineral element that facilitates insulin binding to its cell surface receptor is

- a. Copper
- b. Chromium
- c. Zinc
- d. None of the above

Correct Answer: C

Chromium is an ultra-trace element, it facilitates the biological action of insulin in carbohydrates, protein and lipid metabolism. Chromium, which binds to an intracellular, low molecular weight chromium binding protein, potentiates the auto-amplification of insulin signaling by stimulating the insulin receptor kinase activity in insulin sensitive cells.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 148. What will be the approximate mass of polypeptide if it consists of 400 amino acid residues?

- a. 11,000 daltons
- b. 44,000 daltons
- c. 22,000 daltons
- d. 88,000 daltons

Correct Answer: B

Average molecular weight of amino acid is 110 Da . And if the polypeptide has 400 amino acid residues, the approximate mass will be $400 \times 110 = 44,000$ Da .

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 149. Which among the following given vitamin is water soluble?

- a. Vitamin K
- b. Vitamin C
- c. Vitamin D
- d. Vitamin A

Correct Answer: B

Vitamins are classified as either fat soluble (vitamins A, D, E and K) or water soluble (vitamins B and C). Vitamin C is a water-soluble vitamin that is necessary for normal growth and development. Water-soluble vitamins dissolve in water. Leftover amounts of the vitamin leave the body through the urine. That means you need a continuous supply of such vitamins in your diet.

Core Concept :

Topic Name :
Complexity :
Difficulty Level : Medium

Q. 150. Name the protein that help in storage of iron?

- a. Transferin
- b. Ferredoxin
- c. Ferritin
- d. All of the above

Correct Answer: C

Ferritin is a globular protein complex consisting of 24 protein subunits and is the primary intracellular iron-storage protein in both prokaryotes and eukaryotes that keeps iron in a soluble and non-toxic form. Ferritin serves to store iron in a non-toxic form, to deposit it in a safe form and to transport it to areas where it is required.

Core Concept :
Topic Name :
Complexity :
Difficulty Level : Medium

Q. 151. Vitamin A deficiency leads to

- a. Osteoporosis
- b. Night blindness
- c. Colour blindness
- d. Both A and B

Correct Answer: B

Vitamin A plays an important role in your vision. To see the full spectrum of light, eye needs to produce certain pigments for the photoreceptor cells in your retina to work properly. Vitamin A deficiency stops the production of these pigments, leading to night blindness.

Core Concept :
Topic Name :
Complexity :
Difficulty Level : Medium

Q. 152. How many acetyl-CoA are produced from the oxidation of palmitic acid?

- a. 6
- b. 8
- c. 10
- d. 12

Correct Answer: B

Oxidation of palmitic acid yields $7\text{NADH} + 7\text{FADH}_2 + 8\text{acetyl-CoA}$ in 7 cycles of mitochondrial beta oxidation. Every acetyl-CoA yields $3\text{NADH} + 1\text{FADH}_2 + 1\text{GTP}(=\text{ATP})$ during Krebs Cycle.

Core Concept :
Topic Name :
Complexity :

Difficulty Level : Difficult

Q. 153. Vitamin riboflavin is part of which molecule?

- a. Ferredoxin
- b. Pyrophosphate
- c. FAD
- d. NADPH

Correct Answer: C

Riboflavin (vitamin B₂) is part of the vitamin B group. It is the central component of the cofactors FAD and FMN and as such required for a variety of flavoprotein enzyme reactions including activation of other vitamins. It was formerly known as vitamin G.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 154. Rickets is caused by the deficiency of vitamin

- a. A
- b. B
- c. C
- d. D

Correct Answer: D

Rickets is defective mineralization of bones before epiphyseal closure in immature mammals due to deficiency or impaired metabolism of vitamin D, phosphorus or calcium, potentially leading to fractures and deformity.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 155. _____ is a polysaccharide.

- a. Glucose
- b. Glycogen
- c. Lactose
- d. Amylose

Correct Answer: Glycogen is a multi-branched polysaccharide that serves as a form of energy storage in animals and fungi.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 156. The two carbohydrates are called epimers when

- a. they differ in length in one carbon.
- b. they differ in configuration about one carbon atom.
- c. Both A and B

d. None of the above

Correct Answer: B

In stereochemistry, epimer refers to one of a pair of stereoisomers. They are very closely related structures. The two isomers differ in configuration at only one stereogenic center. All other stereocenters in the molecules, if any, are the same in each.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 157. In the process of mutarotation, which two pairs will be interconverted?

- a. D-glucose and D-fructose
- b. α -D-Glucose and β -D-glucose
- c. D-glucose and L-glucose
- d. All of the above

Correct Answer: B

Mutarotation is the change in the optical rotation because of the change in the equilibrium between two anomers, when the corresponding stereocenters interconvert. Cyclic sugars show mutarotation as α and β anomeric forms interconvert. The optical rotation of the solution depends on the optical rotation of each anomer and their ratio in the solution.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 158. Which amino acid has a non-polar and aliphatic R group ?

- a. Leucine
- b. Tryptophan
- c. Glutamate
- d. All of the above

Correct Answer: A

Polarity is relatively (with respect to other molecules) due to the side chains (the R groups). Side chains which have pure hydrocarbon alkyl groups (alkane branches) are non-polar, this includes leucine, isoleucine, etc. Aliphatic R groups are nonpolar and hydrophobic.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 159. _____ is an unsaturated fatty acid.

- a. Choline
- b. Oleate
- c. Palmitate
- d. None of the above

Correct Answer: B

Oleic acid is a fatty acid that occurs naturally in various animal and vegetable fats and oils. It is odourless, colourless oil, although commercial samples may be yellowish. In chemical terms, oleic acid is classified as a monounsaturated omega-9 fatty acid, abbreviated with a lipid number of 181 *cis*-9. It has the formula $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 160. The combination of amino alcohol, fatty acid and sialic acid called

- a. Aminolipids
- b. Sulpholipids
- c. Glycolipids
- d. All of the above

Correct Answer: C

Glycolipids are lipids with a carbohydrate attached. Their role is to provide energy and also serve as markers for cellular recognition. For example, cerebrosides, gangliosides etc. Cerebrosides consist of cereboric acid as fatty acid, sphingosine as alcohol and sugar sulfate. Cerebrosites are most commonly seen in brain tissues. Gangliosides contain sialic acid as fatty acid.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 161. Bile salts are

- a. esterified cholesterols
- b. hydrolysed triacylglycerols
- c. amphiphatic cholesterol analogs with detergent properties.
- d. Both B and C

Correct Answer: C

Bile acids (bile salts) are polar derivatives of cholesterol. Bileacids (bile salts) are polar derivatives of cholesterol. They are formed in the liver from cholesterol and secreted into the gallbladder. The bile acids eventually pass via the bile duct into the intestine, where they aid digestion of fats and fat-soluble vitamins.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 162. In double helix of DNA, the two DNA strands are

- a. coiled around a common axis
- b. coiled around each other
- c. coiled differently
- d. coiled over protein sheath

Correct Answer: A

According to Watson-Crick model, the DNA molecule consists of two long, parallel chains which are joined together by short crossbars at regular intervals. The two chains are Spirally coiled around a common axis in a regular manner to form a right-handed double helix.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 163. What do the gangliosides contain?

- a. Glucose and Galactose
- b. Sialic acid
- c. A ceramide structure
- d. All of the above

Correct Answer: D

A ganglioside is a molecule composed of a glycosphingolipid (ceramide and oligosaccharide) with one or more sialic acids (*e.g.* n- acetylneuraminic acid, NANA) linked on the sugar chain. Gangliosides are present and concentrated on cell surfaces, with the two hydrocarbon chains of the ceramide moiety embedded in the plasma membrane and the oligosaccharides located on the extracellular surface, where they present points of recognition for extracellular molecules or surfaces of neighboring cells.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 164. Which is the most abundant protein in human body?

- a. Keratin
- b. Collagen
- c. Both A and B
- d. None of the above

Correct Answer: B

Collagen is the main structural protein of the various connective tissues in animals. As the main component of connective tissue, it is the most abundant protein in mammals, making up from 25% to 35% of the whole-body protein content.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 165. Which among the following statements correctly explain the structure of α - helix?

- a. It is stabilized by H bonds between backbone N-H and C=O groups of polypeptide bonds.
- b. It is maintained by H bonding between amino acid side chains.
- c. Both A and B
- d. None of the above

Correct Answer: A

The alpha helix (α -helix) is a common secondary structure of proteins and is a right hand-coiled or spiral conformation (helix) in which every backbone N-H group donates a hydrogen bond to the backbone C=O group of the amino acid four residues earlier (hydrogen bonding).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 166. What among the following is not possessed by RNA?

- a. Uracil
- b. Thymine
- c. Adenine
- d. Cytosine

Correct Answer: B

DNA and RNA both consist of nitrogenous bases-purines and pyrimidines. The purines (adenine and guanine) in DNA and RNA are the same. The pyrimidine, cytosine is same in both while the other pyrimidine thymine of DNA is replaced by uracil in RNA.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 167. What is the total number of nucleotides present in a segment, if a segment of DNA has 120 adenine and 120 cytosine bases?

- a. 120
- b. 240
- c. 480
- d. 440

Correct Answer: C

According to Chargaff's rules, the amount of adenine is always equal to that of thymine, and the amount of guanine is always equal to that of cytosine i.e. $A = T$ (120) and $G = C$ (120),

therefore, the total no. of nucleotides would be $120 \times 4 = 480$.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 168. What is a basic unit of nucleic acid?

- a. Pentose sugar
- b. Nucleoid
- c. Nucleoside
- d. Nucleotide

Correct Answer: D

The nucleic acids (DNA and RNA) are the molecules having complex structure and very high molecular weights. The nucleic acid is composed of a large number of nucleotide molecules joined into a linear, unbranched chain. Nucleotide is an organic compound consisting of a

nitrogen-containing purine or pyrimidine base linked to a sugar (ribose or deoxyribose) and a phosphate group.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 169. ____ help in emulsification of fat.

- a. Bile pigments
- b. Bile salts
- c. HCl
- d. Pancreatic juice

Correct Answer: B

Bile contains no enzyme and has no chemical action on food. However, it has salts, namely, sodium glycocholate and sodium taurocholate. These salts reduce; the surface tension of large fat droplets and break them into many small ones. This process is called emulsification. They also form thin coating around tiny fat droplets to keep them from coalescing. This increases lipase action on fats.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 170. Which among the following is not a consistent with double helical structure of DNA?

- a. $A = T, C = G$
- b. Density of DNA decreases on heating
- c. $A + \frac{T}{C} + G$ is not constant
- d. Both A and B

Correct Answer: C

The density of DNA decreases on heating as hydrogen bonds breakdown. According to Chargaff's rules, the amount of adenine is always equal to that of thymine and the amount of guanine is always equal to that of cytosine i.e., $A = T$ and $C = G$. The base ratio $A + T/G + C$ may vary from species to species, but is constant for a given species.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 171. Deficiency of calcium is related to

- a. Vitamin A
- b. Vitamin B
- c. Vitamin C
- d. Vitamin D

Correct Answer: D

Calcium is an important constituent of bones and teeth, It is present in the blood at a concentration of about 10 mg/100 ml , being maintained at this level by hormones – calcitonin and parathyroid hormone. Ca absorption is enhanced by Vitamin D. Thus, deficiency of Vitamin D hampers Ca absorption resulting in conditions such as rickets, osteoporosis and osteomalacia. A deficiency of calcium in the blood may lead to tetany.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 172. All are aldoses except_____.

- a. sucrose
- b. ribose
- c. deoxyribose
- d. fructose

Correct Answer: D

Fructose, along with glucose is the monosaccharides found in disaccharide, sucrose. Fructose is classified as a monosaccharide, the most important ketose sugar, a hexose and is a reducing sugar.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 173. Which among the following is included in the function of Vitamin K ?

- a. Change of prothrombin into thrombin.
- b. Synthesis of prothrombin.
- c. Change of fibrin to fibrinogen.
- d. All of the above

Correct Answer: B

Thromboplastin, a lipoprotein, helps in clot formation. Thromboplastin helps in the formation of an enzyme prothrombinase. This enzyme inactivates heparin and it also converts the inactive plasma protein prothrombin into its active form, thrombin. Both the changes require calcium ions. Thrombin converts fibrinogen molecule to insoluble fibrin. The fibrin monomers polymerize to form long, sticky fibres. The fibrin threads form a fine network over the wound and trap blood corpuscles (RBCs, WBCs, platelets) to form a crust, the clot.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 174. What kind of interactions play the major role in stabilizing B-DNA ?

- a. Hydrogen bond
- b. Hydrophobic interactions
- c. Van der Waal's interactions
- d. Ionic interaction

Correct Answer: A

The stability of the DNA double helix depends on a fine balance of interactions including hydrogen bonds between bases and surrounding water molecules and base-stacking interactions between adjacent bases.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 175. Which among the following amino acid is aromatic in nature?

- a. Leucine
- b. Valine
- c. Phenylalanine
- d. All of the above

Correct Answer: C

Phenylalanine is an aromatic, hydrophobic, amino acid. Among 20 standard amino acids, the aromatic amino acids are

- i. Tryptophan
- ii. Phenylalanine
- iii. Histidine
- iv. Tyrosine

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 176. What is the overall ratio of DNA to protein in chromosomes?

- a. 1:2
- b. 1:1
- c. 1:3
- d. 2:1

Correct Answer: B

The first level of packaging involves the binding of the chromosomal DNA to histones. Overall, in chromosomes, the ratio of DNA to histones on a weight basis is approximately 1:1.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 177. Which among the following amino acid contains sulfur?

- a. Cysteine
- b. Methionine
- c. Both A and B
- d. None of the above

Correct Answer: C

Methionine, cysteine, homocysteine and taurine are the 4 common sulfur-containing amino acids, but only the first 2 are incorporated into proteins. Sulfur belongs to the same group in the periodic table as oxygen but is much less electronegative. Methionine and cysteine may be considered to be the principal sulfur-containing amino acids because they are 2 of the canonical 20 amino acids that are incorporated into proteins. Methionine is one of the most hydrophobic amino acids and is almost always found on the interior of proteins. Cysteine on the other hand does ionize to yield the thiolate anion.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 178. _____ are found in high quantity in oranges.

- a. Carbohydrates
- b. Fats
- c. Proteins
- d. Vitamins

Correct Answer: D

Oranges make a nutritional snack that is refreshing and easy to pack in a lunch or backpack without worrying about melting or leaking. They are loaded with vitamin C, are relatively low in calories, and can satisfy a craving for sweets. Oranges are also good source of Vitamin B₁, which is also known as thiamine. B₁ helps your body convert blood sugar into energy. An average orange contains 269IU of vitamin A.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 179. _____ is a calcium binding protein.

- a. Myosin
- b. Actin
- c. Troponin
- d. Tropomyosin

Correct Answer: C

Troponin is a complex of three regulatory proteins (troponin C, troponin I and troponin T) that is integral to muscle contraction in skeletal muscle and cardiac muscle, but not smooth muscle. Troponin is found in both skeletal muscle and cardiac muscle, but the specific versions of troponin differ between types of muscle. The main difference is that the TnC subunit of troponin in skeletal muscle has four calcium ion-binding sites, whereas in cardiac muscle there are only three. Views on the actual amount of calcium that binds to troponin vary from expert to expert and source to source.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 180. _____ has a good buffering capacity against added acid at physiological pH .

- a. Alanine
- b. Lysine
- C. Arginine
- d. Histidine

Correct Answer: D

A buffer is most effective when its pKa is within the pH range, of the surrounding medium. Histidine is the only amino acid with good buffering capacity at physiological pH . The imidazole side chain of histidine has a pKa around 6.0 and can reversibly donate and accept protons at physiological pH .

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 181. In case of RNA

- a. hydrogen bonding within the same strand of RNA is necessary to maintain its three-dimensional structure.
- b. mRNA translates the base sequence of DNA for use in protein synthesis.
- c. a double helix is the predominant three-dimensional structure of most forms of RNA.
- D. All of the above

Correct Answer: A

Despite its close chemical similarity to DNA, RNA forms a variety of three-dimensional structures, which doesn't include the familiar double helix of DNA. tRNA transfers single to the ribosome and mRNA is responsible for transcribing DNA sequences. In contrast to DNA, RNA structures are formed by base pairing (stabilised by hydrogen bonds) within the same nucleic acid strand.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 182. Which of the following statements correctly defines the structure of DNA?

- a. Each DNA sequence folds into a unique and complex three-dimensional structure.
- b. The double helix of DNA is stabilized by interactions between adjacent ribose sugar.
- c. All base pairs interact by forming three hydrogen bonds.
- d. DNA is comprised of nucleotide subunits each containing a base, a ribose sugar and a phosphate group.

Correct Answer: D

The three-dimensional structure of DNA is rather simple compared to other biological macromolecules but it is perfectly suited to its biological purpose storage of information (as base pairs) and the ability to copy itself (unwinding of the double helix). All DNA sequences form a similar, regular, three-dimensional structure stabilized by a network of hydrogen bonds between the base pairs. The A-T base pair forms two hydrogen bonds, the G-C base pair forms three. The DNA monomer unit is known as a nucleotide.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 183. What is the product formed when the linear form of glucose cyclizes?

- a. Hemiketal
- b. Hemiacetal
- c. Acetal
- d. Ketal

Correct Answer: B

The predominant forms of ribose, glucose, fructose and many other sugars in solution are not open chains. Rather, the open-chain forms of these sugars cyclize into rings. In general, an aldehyde can react with an alcohol to form a hemiacetal.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 184. The statement that correctly describes the structure and chemistry of carbohydrates is

- a. Glycosidic bonds between two monosaccharides always join two anomeric carbons.
- b. Hexose sugars can form six-membered rings.
- c. Monosaccharides always contain six carbon atoms.
- d. None of the above

Correct Answer: B

Carbohydrates have important roles in nutrition (they are energy rich) and biochemistry, as well as some pharmaceutical applications. The chemistry of carbohydrates is complex and more varied than other classes of macromolecules. Monosaccharides have a preference for the cyclic form and typically prefer 5 and 6 membered rings (comprising 4 or 5 carbons plus an oxygen). Remaining carbons are outside the ring. Hexose sugars can also form six-membered rings.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 185. Deficiency of _____ causes pellagra disease.

- a. niacin
- b. riboflavin
- c. folic acid
- d. None of the above

Correct Answer: A

Niacin is a vitamin that acts as a part of coenzymes (NAD^+ NADP^+) which serve as hydrogen acceptors and donors for many enzymes. Its deficiency in the body causes pellagra which is characterized by dermatitis (skin inflammation), diarrhea and dementia (nervous disorder)

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 186. Which is the common structural feature of all the steroids?

- a. A hydrocarbon functional group at position 17 .
- b. Methyl groups at position 8 and 9 .
- c. A nitrogen containing functional group at position 3 .
- d. Four fused six-member rings.

Correct Answer: A

Steroids, a class of lipids, have a wide variety of biochemical roles and pharmaceutical uses. Despite the large number of different steroids, the core structure of this class of molecules is largely constant, with variation of functional groups occurring at key positions in the structure. Unlike other biological molecules, it doesn't take long to commit the basic structure of steroids to memory - all contain the characteristic pattern of four fused rings 3 six- membered and one five membered. Steroids often contain oxygen, especially at position 3 , but very rarely nitrogen. Methyl group are often found at 10 and 13 but not at 8 and 9 which are ring functions. There is often (but not always) a hydrocarbon group at position 17 ; cholesterol is a good example of this.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 187. Which polysaccharide is synthesized and stored in liver cells?

- a. Arabinose
- b. Glycogen
- c. Lactose
- d. Galactose

Correct Answer: B

The polysaccharide which is synthesized and stored in the liver is glycogen. When there is a need of energy in the body, the glycogen is converted into glucose which is released into the blood to be reached to the target cell.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 188. Which of the following statements, regarding some common carbohydrates, is correct?

- a. D- glyceraldehyde rotates plane polarised light in the anticlockwise direction.
- b. Ribose is a pentose sugar.
- c. Glucose can be classified as an oligosaccharide.
- d. All of the above

Correct Answer: B

Ribose, an important component of nucleic acids, contains five carbons and can be classified as a pentose. Sucrose is formed from fructose and glucose. D- Sugars are dextrorotatory and rotate

polarised light in the clockwise direction. Oligosaccharides contain 2–10 monosaccharides; glucose is a single monosaccharide.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 189. Which vitamin deficiency causes the haemorrhagic disease in new born?

- a. Vitamin A
- b. Vitamin K
- c. Vitamin B₁₂
- d. Vitamin B

Correct Answer: B

Haemorrhagic disease is characterized by profuse bleeding in the newborn. Deficiency of vitamin K, an anti-haemorrhagic factor causes delayed blood clotting in case of injuries.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 190. Regarding the structure and properties of lipids which statement is correct?

- a. Naturally occurring unsaturated fatty acids generally form less effective non-polar interactions with each other.
- b. Acetic acid is a typical medium chain fatty acid.
- c. Phospholipids are highly polar molecules.
- d. Dietary fats are comprised of three fatty acids bonded to a molecule of glycerol by ether linkages.

Correct Answer: A

Fatty acids and their derivatives are highly important in biochemistry, not least the contribution that phospholipids make to the structure of cell membranes. Lipids have a strong degree of non-polar character, a property relatively unusual in biochemistry, but often also contain polar functional groups - resulting in mixed properties. Despite phospholipids containing a charged (polar) group they also have very non-polar region. Dietary fat (triesters) contain ester linkages and acetic acid is a very short chain fatty acid. Naturally occurring unsaturated fatty acids contain *cis*- double bonds, resulting in poor non-polar interactions between molecules. Therefore these molecules are usually liquids (*i.e.* they have low melting points).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 191. What is the accurate description of the phospholipid bilayer in cell membranes?

- A. It is made up of two layers of phospholipid molecules with the tails interacting with each other.
- B. It is made up of two layers of phospholipid molecules with the tails lying parallel to each other.

- C. It is made up of two layers of phospholipid polymers.
- D. None of the above.

Correct Answer: A

The cell membrane is made up of a bilayer of phospholipid molecules where the hydrophobic tails interact with each other in the center of the membrane by Van der Waal interactions. The polar head groups interact with water at the outer and inner surfaces of the membrane.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 192. can be synthesized by bacteria inside the gut.

- A. Vitamin K
- B. Vitamin B
- C. Vitamin A
- D. Vitamin D

Correct Answer: B

Vitamin B, is synthesized by symbiotic bacteria living inside the gut. This is evidenced by the fact that Vitamin B deficiency occurs on taking antibiotics which in addition to killing harmful bacteria also kill useful bacteria forming Vitamin B.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 193. Which of the following statements correctly defines the phospholipid bilayer in cell membranes?

- a. Water and ions are encouraged to cross the bilayer by interacting with the charges present in the head groups.
- B. Water and ions are unable to cross the bilayer due to the hydrophobic tails of the phospholipid molecules.
- C. The molecules in the bilayer are fluid and so the cell membrane is porous allowing the passage of ions and water across the cell membrane.
- D. Water and ions are unable to cross the bilayer due to the charges present in the head groups.

Correct Answer: B

The tails of the phospholipid molecules are hydrophobic (water hating) and repel water and ions. The polar head groups do not have any role in preventing water or ions from crossing the cell membrane. The phospholipid molecules are certainly fluid, but no pores are formed as a result of that.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 194. Who gave the term nucleic acids?

- a. Lipmann

- b. Altmann
- c. Robert brown
- d. None of the above

Correct Answer: B

Richard Altmann (12 March 1852 – 8 December 1900) was a German pathologist and histologist from Deutsch Eylau in the Province of Prussia. He is credited with coining the term “nucleic acid”, replacing Friedrich Miescher’s term “nuclein” when it was demonstrated that nuclein was acidic.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 195. The pair that is not correctly matched is

- a. Vitamin B₁₂ - Pernicious anaemia
- b. Vitamin B₆ - Convulsions
- c. Vitamin B - Beri-beri
- d. Vitamin B₂ – Pellagra

Correct Answer: C

Deficiency of Vitamin B₆, leads to inflammation of eyes, sores on the lips and skin diseases. Pellagra is caused due to deficiency of nicotinic acid or Vitamin B₃. It is characterized by dermatitis (skin inflammation), diarrhea and dementia (nervous disorder).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 196. What is the richest source of Vitamin B₂?

- a. Goat’s liver and Spirulina
- b. Chocolate and green gram
- c. Rice and ben’s egg
- d. Carrot and chicken’s breast

Correct Answer: A

Goat’s liver and Spirulina (a bacterium) are the richest sources of vitamin B₂. Other sources are eggs, meat, fish etc.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 197. Choose the mismatch

- a. Vitamin A — Xerophthalmia
- b. Vitamin D —Rickets
- c. Vitamin K — Beri-beri
- d. Vitamin C – Scurvy

Correct Answer: C

Deficiency of vitamin K causes haemorrhage, which is characterized by profuse bleeding. Beri-beri is caused due to deficiency of vitamin B.

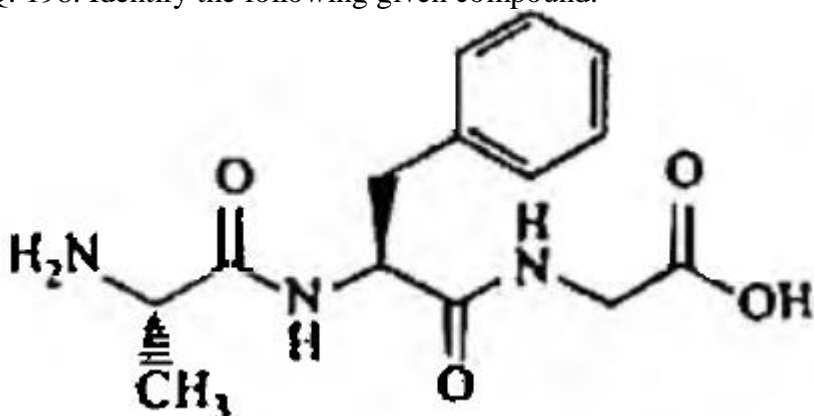
Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 198. Identify the following given compound.



- Glycyl-L-phenylalanyl-L-alanine
- L-alanyl-L-phenylalanyl-glycine
- L-alanyl-glycyl-L-phenylalanine
- None of the above

Correct Answer: B

Peptides are named, starting from the amino end. Option A) is wrong since it is named from the carboxyl end and option C) is wrong since the amino acid is labelled in the wrong order.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 199. Which among the following is an essential amino acid?

- Phenylalanine
- Glycine
- Aspartic acid
- Serine

Correct Answer: A

Essential amino acids are those amino acids that must be ingested in food for survival as they are not synthesized in the body. There are 7 essential amino acids. Glycine, aspartic acid and serine are non-essential amino acids as they can be synthesized in the body.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 200. _____ helps in absorption of L amino acid.

- a. Pinocytosis
- b. Faciliated diffusion
- c. Active transport
- d. Passive diffusion

Correct Answer: C

Digested food is able to pass into the blood vessels in the wall of the intestine through either diffusion or active transport. The small intestine is the site where most of the nutrients from ingested food are absorbed.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q.201. Triglycerides, that are liquid at room temperature are called

- a. Fats
- b. Fatty acids
- c. Oils
- d. All of the above

Correct Answer: C

The triesters of fatty acids with glycerol (1, 2, 3– trihydroxypropane) compose the class of lipids known as fats and oils. These triglycerides (or triacylglycerols) are found in both plants and animals and compose one of the major food groups of our diet. Triglycerides that are solid or semisolid at room temperature are classified as fats, and occur predominantly in animals. Those triglycerides that are liquid are called oils and originate chiefly in plants, although triglycerides from fish are also largely oils.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 202. Which among the following is a phospholipid?

- a. Cholesterol
- b. Steroid
- c. Lecithin
- d. All of the above

Correct Answer: C

Lecithin is a generic term to designate any group of yellow brownish fatty substances occurring in animal and plant tissues composed of phosphoric acid, choline, fatty acids, glycerol, glycolipids, triglycerides and phospholipids. Lecithin is a phospholipid mixture of phosphatides consisting mainly of phosphatidylcholine, phosphatidyl ethanolamine, phosphatidyl serine, phosphatidyl inositol combined with various other substances, including fatty acids and carbohydrates. Lecithins also contain phosphorous and nitrogenous (*e.g.* choline) compounds.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 203. Naturally, all the carbohydrates occur in _____ form.

- a. D
- b. L
- c. Both A and B
- d. None of the above

Correct Answer: D

D and L designations are based on the configuration about the single asymmetric carbon in glyceraldehyde. For sugars with more than one chiral center, the D or L designation refers to the asymmetric carbon farthest from the aldehyde or keto group. Most naturally occurring sugars are D isomers. D and L sugars are mirror images of one another. They have the same name.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 204. In the structure of nucleotides,

- a. bases are attached to the pentose sugar moieties by a glycosidic bonds.
- b. sugar component is in L configuration.
- c. sugars are always ribose.
- d. sugars are always deoxyribose.

Correct Answer: A

A nucleotide has the general structure phosphate-pentose sugar-base where the sugar component is always either ribose or 2'-deoxyribose, always in the D-configuration. The purine bases adenine and guanine can be found in nucleotides that make up DNA and RNA, whereas the pyrimidine bases cytosine and thymine are found in DNA, while uracil and not thymine is found in RNA. The bases are attached to the pentose sugar moieties of nucleotides at the N-9 position for purines and the N-t position for pyrimidines via a glycosidic bond in the configuration (above the plane of the ring).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 205. All the statements about the nomenclature of nucleosides are correct, except

- a. Thymine is a nucleoside made up of the base thymidine attached to ribose.
- b. Adenosine is a nucleoside made up of the base adenine attached to ribose.
- c. Cytosine is a nucleoside made up of the base cytidine attached to ribose.
- d. Inosine is a nucleoside made up of the base hypoxanthine attached to L-ribose.

Correct Answer: B

A nucleotide has the structure phosphate -sugar- base. The sugar is always a pentose, D-ribose in ribonucleotides (in RNA) or D-deoxyribose (in DNA), The bases in ribonucleotides of RNA are the purines, adenine (A), guanine (G), and the pyrimidines cytosine (C) and uracil (U). The nucleotides or monophosphate nucleosides are called AMP, GMP, CMP and UMP respectively. The bases in DNA are A, G, C and thymine (T).

The deoxynucleotides or monophosphate deoxynucleosides are dAMP, dGMP, dCMP and TMP. Nucleosides lack the phosphate group and are called adenosine, guanosine, cytidine and uridine respectively or deoxy- adenosine, guanosine, cytidine and thymidine. The bases are attached to the pentose sugar by a -glycosidic bond at the N-9 position for purines or the N-1 position for pyrimidines via (above the plane of the ring). Hypoxanthine is an unusual 'minor' purine base. Its ribonucleoside is called inosine and its nucleotide is IMP.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 206. Where the HDLs are synthesized?

- a. Blood
- b. Serum
- c. Pancreas
- d. Liver

Correct Answer: D

High-density lipoprotein (HDL) is one of the five major groups of lipoproteins. Lipoproteins are complex particles composed of multiple proteins which transport all fat molecules (lipids) around the body within the water outside cells. HDL (or really, the HDL precursor) is synthesized and secreted by the liver and small intestine. It travels in the circulation where it gathers cholesterol to form mature HDL, which then returns the cholesterol to the liver via various pathways.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 207. The haematological manifestation of vitamin B₁₂ deficiency is similar to that produced by tetrahydrofolate deficiency because

- a. deficiency of B₁₂ prevents the removal of the methyl group of methyl tetrahydrofolate.
- b. both vitamin deficiencies lead to polycythaemia by increasing the production of erythrocytes.
- c. deficiency of B₁₂ leads to increased levels of methionine in the blood.
- d. None of the above

Correct Answer: A

Deficiency of B₁₂ prevents the removal of the methyl group of methyl tetrahydrofolate. This means that the tetrahydrofolate cannot return to the one-carbon pool of THF as the only way of removing the methyl group is via B₁₂ to homocysteine to produce methionine. In this way the THF cannot be reused.

The situation is known as 'the methyl trap'. The methyl group cannot be oxidized, it can only be transferred. B₁₂ deficiency will cause a functional folate deficiency as eventually all the THF from the one-carbon pool will be irreversibly reduced to the methyl group. The anaemia produced is megaloblastic not microcytic and there is definitely no increase in the number of blood cells *i.e.* no polycythemia in B₁₂ or Folate deficiency.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 208. How many glucose units are present in amylose?

- a. 100–200
- b. 200–300
- c. 300–400
- d. 500–600

Correct Answer: C

Amylose consists of long unbranched chains of about 300–400 alpha glucose units. It is a helical polymer made of α -D-glucose units, bound to each other through $\alpha(1 \rightarrow 4)$ glycosidic bonds.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 209. What are the molecules called that have a same molecular formula, but differ only in the three-dimensional orientations of their atoms in space?

- a. Isomers
- b. Stereoisomers
- c. Epimers
- d. None of the above

Correct Answer: B

Stereoisomers are isomeric molecules that have the same molecular formula and sequence of bonded atoms (constitution), but that differ only in the three-dimensional orientations of their atoms in space. This contrasts with structural isomers, which share the same molecular formula, but the bond connections or their order differs. By definition, molecules that are stereoisomers of each other represent the same structural isomer.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 210. From which amino acid nitrous oxide is generated?

- a. Glycine
- b. Arginine
- c. Thymine
- d. Histidine

Correct Answer: B

Arginine contains a guanidine functional group that provides the nitrous oxide. The enzyme NO synthase converts arginine to citrulline with release of nitrous oxide.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 211. What is Cellulose made up of?

- a. Branched chain of glucose molecules linked by $\beta-1, 4$ glycosidic bond in straight chain and $\alpha-1, 6$ glycosidic bond at the site of branching.
- b. Unbranched chain of glucose molecules linked by $\beta-1, 4$ glycosidic bond having $3P-1, 4$ linkages.
- c. Branched chain of glucose molecules linked by $\alpha-1, 6$ glycosidic bond at the site of branching.
- d. Unbranched chain of glucose molecules linked by $\alpha-1, 4$ glycosidic bond.

Correct Answer: B

Cellulose is the most abundant carbohydrate. Cellulose molecule is composed of 1600 to 6000 glucose molecules joined together. Those polymers form long twisting macromolecules of cellulose. The chains are unbranched and linear. The successive glucose residues are joined together by $3P-1-4$, linkages.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 212. _____ is a reducing sugar.

- a. Galactose
- b. Gluconic acid
- c. Sucrose
- d. Both A and B

Correct Answer: A

All those sugars which have free aldehyde or ketone group are called reducing sugars. These are able to reduce cupric ions (Cu^{2+}) into cuprous ions (Cu^+). The two common tests are Benedict's

test and Fehling's test. Both tests employ alkaline solution of copper sulphate which is blue in colour with reducing sugar it gives orange to brick red precipitation. Galactose is a reducing sugar. It gives brownish red precipitate with Fehling reagent and with Benedict's reagent it gives yellow, red or green precipitate confirming the presence of sugar. Sucrose, starch are non-reducing sugars.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 213. A nucleotide is formed of 95% water. Water is present in

- a. Purine, pyrimidine and phosphate
- b. Purine, sugar and phosphate
- c. Nitrogen base, sugar and phosphate
- d. Pyrimidine, sugar and phosphate

Correct Answer: C

Nucleotide is an organic compound consisting of a nitrogen containing purine or pyrimidine base linked to a sugar (ribose or deoxyribose) and a phosphate group.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 214. The molecule that is most widely distributes in the cell is

- a. DNA
- b. RNA
- c. Chloroplast
- d. All of the above

Correct Answer: B

RNA occurs in the nucleus as well as in the cytoplasm of the eukaryotic cells and in prokaryotic cell, it is found in the cytoplasm. DNA is found in the nucleus, mitochondria and chloroplast. Chloroplast and spherosomes are found only in cytoplasm.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 215. Which test is used for the detection of carbohydrates?

- a. Iodine test
- b. Molisch test
- c. Barfoed test
- d. Osazone test

Correct Answer: B

Molisch's test (named after Austrian botanist Hans Molisch) is a sensitive chemical test for the presence of carbohydrates, based on the dehydration of the carbohydrate by sulfuric acid or hydrochloric acid to produce an aldehyde, which condenses with two molecules of phenol (usually α -naphthol, though other phenols (e.g. resorcinol, thymol) also give colored products), resulting in a red- or purple-colored compound.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 216. The enzyme that help in the digestion of fats is

- a. Sucrose
- b. Protease
- c. Ligase
- d. Lipase

Correct Answer: D

A lipase is an enzyme that catalyzes the hydrolysis of fats (lipids). Lipases are a subclass of the esterases. Lipases perform essential roles in the digestion, transport and processing of dietary lipids (e.g. triglycerides, fats, oils) in most, if not all, living organisms. For example, human pancreatic lipase (HPL), which is the main enzyme that breaks down dietary fats in the human digestive system, converts triglyceride substrates found in ingested oils to monoglycerides and two fatty acids.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 217. Four pyrimidine bases are present in

- a. GATCAATGC
- b. GCUAGACAA
- c. UAGCGGUAA
- d. Both B and C

Correct Answer: A

The bases are of two types-purines and pyrimidines. The purine derivatives adenine (A) and guanine (G) are double ring structures whereas pyrimidine derivatives thymine, cytosine and uracil are single ring structures. Thymine (T) and cytosine (C) are found in DNA and cytosine (C) and uracil (U) is found in RNA. In the given question there are 4 pyrimidines as 2 cytosine and 2 thymine in optional.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

- Q. 218. Megaloblastic anaemia occurs in
- Vitamin B₁₂ but not folic acid deficiency
 - Folic acid but not Vitamin B₁₂ deficiency
 - Either Vitamin B₁₂ or folic acid deficiency
 - Only combined Vitamin B₁₂ + folic acid deficiency

Correct Answer: C

Megaloblastic anemia is an anemia (of macrocytic classification) that results from inhibition of DNA synthesis during red blood cell production. The defect in red cell DNA synthesis is most often due to hypovitaminosis, specifically a deficiency of vitamin B₁₂ and/or folic acid. Vitamin B₁₂ deficiency alone will not cause the syndrome in the presence of sufficient folate, as the mechanism is loss of B₁₂ dependent folate recycling, followed by folate deficiency loss of nucleic acid synthesis (specifically thymine), leading to defects in DNA synthesis.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 219. How many different classes of steroid hormones are there?

- 2
- 3
- 4
- 5

Correct Answer: D

There are 5 different classes of steroid hormones. A steroid hormone (abbreviated as sterone) is a steroid that acts as a hormone. Steroid hormones can be grouped into five groups by the receptors to which they bind glucocorticoids, mineral ocorticoids, androgens, estrogens and progestrogens.

Vitamin D derivatives are a sixth closely related hormone system with homologous receptors. They have some of the characteristics of true steroids as receptor ligands, but lack the planar fused four ring system of true steroids.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 220. Globular proteins are included under

- primary structures
- secondary structures
- tertiary structures
- quaternary structures

Correct Answer: C

Tertiary structure refers to the three-dimensional structure of a single, double or triple bonded protein molecule. The alpha-helices and beta pleated-sheets are folded into a compact globular structure. The folding is driven by the non-specific hydrophobic interactions, the burial of hydrophobic residues from water, but the structure is stable only when the parts of a protein domain are locked into place by specific tertiary interactions, such as salt bridges, hydrogen bonds and the tight packing of side chains and disulfide bonds.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 221. Chylomicrons are synthesized in

- a. intestine
- b. liver
- c. stomach
- d. pancreas

Correct Answer: B

Chylomicrons are lipoprotein particles that consist of triglycerides (85–92%), phospholipids (6–12%), cholesterol (1–3%) and proteins (1–2%). They transport dietary lipids from the intestines to other locations in the body. Chylomicrons are one of the five major groups of lipoproteins (chylomicrons, VLDL, IDL, LDL and HDL) that enable fats and cholesterol to move within the water based solution of the bloodstream.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 222. The vitamin that helps in regulating blood clotting is

- a. vitamin A
- b. vitamin C
- c. vitamin K
- d. vitamin E

Correct Answer: C

Vitamin K is a group of structurally similar, fat-soluble vitamins the human body needs for complete synthesis of certain proteins that are required for blood coagulation and also certain proteins that the body uses to manipulate binding of calcium in bone and other tissues.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 223. The group that contain the polysaccharides is

- a. maltose, lactose and fructose
- b. glycogen, sucrose and maltose
- c. glycogen, cellulose and starch
- d. None of the above

Correct Answer: C

Polysaccharides are complex long chain carbohydrates which are formed by dehydrate synthesis or polymerisation of more than 10 but generally very large number of units called monosaccharides. Starch, glycogen and cellulose are all polysaccharides. Starch is a glucosan homopolysaccharide which is the main reserve food of plants. Glycogen is also a glucosan homopolysaccharide which is the major reserve food of fungi, animals and some bacteria. It is also called animal starch. Cellulose is the structural polysaccharide of plant cell walls, some fungi, protists. It is a fibrous glucosan homopolysaccharide of high tensile strength.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 224. Lactose hydrolysis yields

- a. glucose and glucose
- b. glucose and galactose
- c. galactose and fructose
- d. glucose and sucrose

Correct Answer: B

The hydrolysis of lactose to glucose and galactose is catalyzed by the enzyme's lactase and β - galactosidase.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 225. The most diverse molecule in the cell is

- a. DNA
- b. RNA
- c. proteins
- d. carbohydrates

Correct Answer: C

Proteins show enormous diversity because of different proportions and sequences of twenty amino acids within the protein molecule. A large number of permutations and combinations of this amino acid are responsible for the unlimited variety of proteins. Proteins are the most abundant and most varied of the macromolecules having one or more polypeptides (chains of amino acids). The proteins constitute almost 50% of the total dry weight of the cell. Proteins may be simple or conjugated. Among conjugated, proteins may be phosphoprotein, glycoprotein, nucleoprotein, chromoprotein, lipoprotein, flavoprotein, metalloprotein etc. Functionally proteins may be structural protein, enzymes, hormones, respiratory pigment etc.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

1.C Stabilizing Interactions

Q. 226. Which among the following is an example of a non-covalent interaction in proteins?

- a. Salt bridge
- b. Disulphide bridge
- c. Peptide bond
- d. All of the above

Correct Answer: A

Salt bridges fall into the broader category of noncovalent interactions. A salt bridge is actually a combination of two noncovalent interactions hydrogen bonding and electrostatic interactions. This is most commonly observed to contribute stability to the entropically unfavorable folded conformation of proteins.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 227. Water, which constitutes about 70% of a typical cell, is able to form what kind of hydrogen bonds?

- a. Strong electrostatic bonds between positive hydrogen ions and negative oxygen ions.
- b. Weak electrostatic bonds between partially charged hydrogen and oxygen atoms.
- c. Covalent bonds between hydrogen atoms.
- d. None of the above

Correct Answer: B

Hydrogen bonds belong to the class of chemical bonds known as non-covalent or weak secondary bonds. Hydrogen bonds form between water molecules due to weak electrostatic attractions between the partial positive charges on the hydrogen atoms and the partial negative charge on the oxygen of adjacent molecules. They can also form between appropriate hydrogen atoms and oxygen or nitrogen atoms of other molecules and play a vital role in biological structures.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 228. What is the nature of DNA backbone?

- a. Hydrophobic

- b. Hydrophilic
- c. Neutral
- d. None of the above

Correct Answer: B

The sugar-phosphate backbone is responsible for the polyanionic characteristic of DNA. In the double helix structure bases exist in a highly hydrophobic environment inside the helix, while the outer, negatively charged backbone allows the dsDNA molecule to interact freely with the hydrophilic environment. The dsDNA is considered a highly hydrophilic molecule.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 229. What properties of proteins are exploited by the hydrophobic interaction chromatograph?

- a. Enzymatic and catalytic activity
- b. Hydrophobic amino acids on the protein surface
- c. Hydrophilic amino acids on the protein surface
- d. All of the above

Correct Answer: B

Hydrophobic interaction chromatography (HIC) uses hydrophobic amino acids on the surface of the protein to interact with a matrix carrying other hydrophobic groups, such as butyl or phenyl. IEX uses interactions between opposite charges on protein and column matrix. SEC separates molecules based on molecular weight and shape. Substrate specificity may be exploited by affinity chromatography. Use different types of matrix exploiting different properties - impurities are unlikely to share the same properties as your target protein.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 230. _____ are the weakest forces.

- a. H bonds
- b. Ionic bonds
- c. Van der Waal forces
- d. Salt bridges

Correct Answer: C

Molecules can attract each other at moderate distances and repel each other at close range. The attractive forces are collectively called "Van der Waal forces". Van der Waal forces are much weaker than chemical bonds and random thermal motion around room temperature can usually overcome or disrupt them.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 231. _____ is used to check the vibrational activity of a molecule.

- a. Electron microscope
- b. Compound microscope
- c. Infrared spectroscopy
- d. All of the above

Correct Answer: C

Infrared spectroscopy (IR spectroscopy) is the spectroscopy that deals with the infrared region of the electromagnetic spectrum, which is light with a longer wavelength and lower frequency than visible light.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 232. The Van der Waal forces between the molecules is

- a. directly proportional to the number of electrons.
- b. inversely proportional to the number of electrons.
- c. constant
- d. None of these

Correct Answer: A

Van der Waal forces are driven by induced electrical interactions between two or more atoms or molecules that are very close to each other. Van der Waal interaction is the weakest of all intermolecular attractions between molecules. The Van der Waal forces of attraction mainly depend on the number of electrons present in the molecules and increase with increase in the number of electrons in the molecules. Larger the molecular size, the stronger the Van der Waal forces.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 233. What types of molecular intermolecular bonding interactions are possible for an alkene?

- a. ionic bonding
- b. Van der Waal interactions
- c. Hydrogen bonding
- d. All of the above

Correct Answer: B

The alkene group has no heteroatoms and can form neither hydrogen bonds nor ionic bonds. Van der Waal interactions are possible.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 234. Secondary amides show

- a. ionic bonding only
- b. hydrogen bonding only
- c. Both A and B
- d. None of the above

Correct Answer: B

The carbonyl oxygen of a secondary amide group can act as a hydrogen bond acceptor while the NH proton can act as a hydrogen bond donor. The nitrogen cannot act as a hydrogen bond acceptor since its lone pair of electrons interacts with the carbonyl group.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 235. How can weak forces such as electrostatic attraction, Van der Waal bonds, hydrogen bonds and hydrophobic forces lead to such strong adherence, as the two molecules such as proteins can adhere tightly and specifically to each other?

- a. Adherence can be quite strong by having many weak forces involved in molecular adhesion.
- b. The weak forces can become very strong once non-polar groups are excluded from the inside of the molecules.
- c. The weak forces are readily converted to covalent bonds, thus leading to strong adherence between molecules.
- d. Adhesion is strong because the weak forces can be involved in condensation reactions.

Correct Answer: A

The additive effect of many weak forces, including hydrogen bonds, hydrophobic interactions, Van der Waal forces and ionic bonds provide significant energy for biological structure.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 236. What types of Interactions are most likely to be important initial interactions when a drug enters a binding site?

- a. Ionic
- b. Van der Waal
- c. Dipole dipole
- d. All of the above

Correct Answer: A

Ionic interactions fall off in strength more slowly with distance than the other interactions and so they are likely to be the most important initial interaction. Van der Waal interactions are the least likely to be important as a molecule approaches its binding site.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 237. What is the phenomenon called in which the actual electronic structure of a molecule is an average of two or more electronic structures assigned to same molecule?

- a. Isomerism
- b. Tautomerism
- c. Mesomerism
- d. None of the above

Correct Answer: C

Mesomerism is a method of describing the delocalized electrons in some molecules where the bonding cannot be explicitly expressed by a single Lewis structure. Each individual Lewis structure is called a contributing structure of the target molecule or ion. Contributing structures are not isomers of the target molecule or ion, since they only differ by the position of delocalized electrons.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 238. The electrovalent compounds are mostly

- a. soluble
- b. volatile and soluble
- c. insoluble in water
- d. having low melting points

Correct Answer: A

Electrovalent compounds are generally crystalline in nature. The constituent ions are arranged in a regular way in their lattice. Electrovalent compounds are made up of ions. They are usually soluble in water. These compounds generally have high melting and boiling points.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 239. What types of forces that are most favorable for protein folding?

- a. Van der Waal interactions
- b. Hydrogen bonds

- c. Hydrophobic interactions
- d. All of the above

Correct Answer: C

In the case of protein folding, the hydrophobic effect is important to understand the structure of proteins that have hydrophobic amino acids, such as alanine, valine, leucine, isoleucine, phenylalanine, tryptophan and methionine clustered together within the protein. Structures of water-soluble proteins have a hydrophobic core in which side chains are buried from water, which stabilizes the folded state, and charged and polar side chains are situated on the solvent-exposed surface where they interact with surrounding water molecules.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 240. The proton is likely to be the strongest hydrogen bond donor in

- a. amine ($R-NH_2$)
- b. alcohol ($R-OH$)
- c. ammonium ion ($R-NH_3^+$)
- d. All of the above

Correct Answer: C

The best hydrogen bond donor will be the one where the hydrogen is the most electrons deficient. In the ammonium ion, the nitrogen has a positive charge and this in turn will make the attached hydrogens electron deficient. The phenol is likely to be the next best hydrogen bond donor since the oxygen's lone pair of electrons will interact with the aromatic ring giving it a slightly positive charge.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 241. The functional group most likely to participate in a dipole-dipole interaction is

- a. Alcohol
- b. Ketone
- c. Aldehyde
- d. All of the above

Correct Answer: B

The ketone will have the strongest dipole moment due to the electronegative oxygen polarising the carbonyl bond. The alcohol will also have a significant dipole moment, but less than that of the ketone.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 242. What are Van der Waal forces?

- a. They are the kind of electrostatic attraction between nuclei of one molecule and electrons of other.
- b. They are the kind of electrostatic repulsion between the electrons of one molecule and electrons of other.
- c. They are the kind of electrostatic repulsion between the nuclei of one and of the other.
- d. All of the above

Correct Answer: D

The Van der Waal force is the sum of the attractive or repulsive forces between molecules (or between parts of the same molecule) other than those due to covalent bonds or the electrostatic interaction of ions with one another, with neutral molecules or with charged molecules. It is also sometimes used loosely as a synonym for the totality of intermolecular forces.

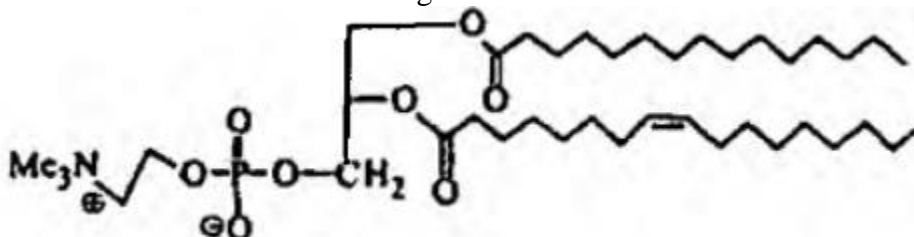
Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 243. The structure shown in the figure is



- a. Protein
- b. Phospholipid
- c. Nucleic acid
- d. Carbohydrate

Correct Answer: B

The 'phospho' of phospholipid indicates the presence of a phosphate group. The lipid part of the name refers to the two long hydrocarbon chains. The structure is also known as a phosphoglyceride. Proteins consist of amino acids linked by peptide bonds. Carbohydrates contain several hydroxyl groups. Nucleic acids consist of nucleic acid bases linked to a sugar phosphate backbone.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 244. How the pH of a solution is determined?

- a. By determining the concentration of only the bases.
- b. By determining the concentration of only the acids.
- c. By measuring the dielectric constant of the medium.
- d. By determining the concentration of acids and bases in the solution.

Correct Answer: D

The pH of a solution is a measure of the molar concentration of hydrogen ions in the solution and as such is a measure of the acidity or basicity of the solution. The letters pH stand for "power of hydrogen" and the numerical value is defined as the negative base 10 logarithm of the molar concentration of hydrogen ions.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 245. The pH of blood of a healthy person is maintained at 7.40 ± 0.05 , Assuming that this pH is maintained entirely by the bicarbonate buffer (pKa1, and pKa2 of carbonic acid are 6.1 and 10.3, respectively), the molar ratio of (bicarbonate) / (carbonic acid) in the blood is

- a. 0.05
- b. 1
- c. 10
- d. 20

Correct Answer: D

The pH is a method of expressing extremely small concentrations of acid in solution. The scale is exponential — a change of one unit is actually a ten-fold change. A solution with pH of 1 has ten times as much acid as a solution with pH of 2. The pH scale allows the description of concentrations from 1 to $1/100,000,000,000,000$ (10 to the minus 14) moles*/liter. pH is defined as the negative logarithm of the hydrogen ion (H^+) concentration or activity.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 246. What will be the pI of an amino acid, if an amino acid has three ionizable groups with pKa's of 2.0, 10.5 and 3.8?

- a. 9.6
- b. 2.9
- c. 6.5
- d. 2

Correct Answer: B

The pI is that point on the pH scale, where the two acidic groups are together 1 charge. Then there is 1 net acidic group and 1 basic group, and the net charge = 0. The pH at which each of the acidic groups is half ionized is $(pK_{a1} + pK_{a2})/2 = (2 + 3.8)/2 = 2.9$. Therefore, the isoelectric point = 2.9.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 247. An amino acid in a medium with a pH value above its isoelectric point would have

- a neutral charge.
- a net positive charge.
- A net negative charge.
- either a net positive or net negative charge depending on the pK_a value

Correct Answer: C

A pH above the isoelectric point means that the amino acid is in relatively basic conditions. A base will accept a proton (H^+) from the amino acid, leaving the amino acid negatively charged.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 248. What is the sum of exponents of molar concentration called?

- Rate of reaction
- Molarity
- Order of reaction
- Concentration

Correct Answer: C

The order of the reaction is defined as the total number of reactants whose concentration changes during the course of a reaction. It is the sum of exponents of the molar concentration of the reactants in the rate equation of the reaction $mA + nB \rightarrow \text{Products}$. Order of reaction = $m + n$.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 249. On increasing the temperature, the rate of reaction increases. Why?

- Because collision frequency increases.
- Because concentration of the reacting molecules increases.
- Because the activation energy of the reaction increases.

d. All of the above

Correct Answer: A

Particles can only react when they collide. The particles moves faster on heating and so collide more frequently. That will speed up the rate of reaction. Moreover, temperature (in Kelvin degrees) is proportional to the kinetic energy of the particles in a substance. At higher temperatures, particles collide more frequently and with greater intensity. Increasing the temperature by say 10°C causes some of the intermediate speed molecules to move faster. The result is more molecules with sufficient kinetic energy to form an activated complex upon collision.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Difficult

Q. 250. What is the rate of reaction called when the concentration of reactants is taken as unity?

- a. Molecularity
- b. Ideal rate constant
- c. Specific rate constant
- d. None of the above

Correct Answer: C

The constant of proportionality, 'K' is called, the rate constant or specific rate constant, as it is the rate constant when concentration of reactants is unity. The rate of reaction when the concentration of all the reactants is taken as unity is called the specific rate or rate constant or velocity constant. The rate constant is a constant which is independent of initial concentrations of the reactants and depends on temperature.

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 251. ____ molecule has a dipole moment greater than zero.

- a. HCl
- b. SiCl₂
- c. NH₃
- d. CO₂

Correct Answer: D

A good example of a non-polar molecule that contains polar bonds is carbon dioxide. This is a linear molecule and the C = O bonds are, in fact, polar. The central carbon will have a net positive charge, and the two outer oxygen a net negative charge. However, since the molecule is linear, these two bond dipoles cancel each other out (i.e. vector addition of the dipoles equals zero). And the overall molecule has no dipole ($\mu = 0$).

Core Concept :

Topic Name :

Complexity :

Difficulty Level : Medium

Q. 252. The absolute pressure of a given mass is directly proportional to _____, according to Gay Lussac law of a perfect gas.

- a. pressure of a gas
- b. volume of a gas
- c. absolute temperature, if volume is kept constant
- d. pressure and volume of a gas

Correct Answer: C

The law of combining volumes states that, when gases react together to form other gases, all volumes are measured at the same temperature and pressure. For example, Gay-Lussac found that 2 volumes of hydrogen and 1 volume of oxygen would react to form 2 volumes of gaseous water.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 253. What are the molecules called that bear charged groups of opposite polarity?

- a. Ambions
- b. Ion conversion
- c. Zwitter ions
- d. All of the above

Correct Answer: C

Molecules that bear charged groups of opposite polarity are known as zwitter ions or dipolar ions. At neutral pH (pH 7), all amino acids carry both positive and negative charges and therefore, zwitter ionic.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 254. What will be the resultant pH, if the equal volumes of 2 buffers of pH 2 and pH 6 of same strength are mixed?

- a. Near to 3
- b. Near to 4
- c. Near to 5
- d. Near to 6

Correct Answer: B

The H^+ ion concentration in the solution of pH is 0.0001. Similarly the H^+ ion concentration in pH 6 is 0.000001. When both the solutions of identical strengths are added the sum is equal to the (0.000001+0.000101) is close to 0.0001 and hence, the pH is closer to 4.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 255. Enzyme catalysis of a chemical reaction

- increases the forward and reverse reaction rates.
- decrease ΔG° so that the reaction can proceed spontaneously.
- increases the energy of transition state.
- decreases the entropy of reaction.

Correct Answer: A

A catalyst is a chemical that drives a reaction forward. Catalysts lower the activation energy, which is the amount of energy required for reactants to form products. Catalysts also lower the kinetic barrier, which is needed to drive a reaction forward and backward. A certain amount of energy contained in the molecules is required when the two molecules react together to form a product. If the two molecules do not have enough energy to react, then no product is produced. By lowering the activation energy, a catalyst allows the molecules to gain sufficient energy to overcome the barrier and form products.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 256. What will be the pH of 1M HCl solution?

- 0
- 1
- 2
- 3

Correct Answer: A

pH is defined as the negative log of H^+ or OH^- ion concentration for acids or bases. It is written as

$$pH = -\log[H^+]$$

Similarly for bases

$$pH = -\log[OH^-]$$

pH and pOH are related by the following expression, $pH +$

$$pOH = 14.$$

The pH of 1M HCl would therefore, will be

$$= -\log[H^+]$$

$$= -\log[1] = 0$$

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 257. Which of the following situation can be best described, if equal volumes of 0.05M NaH_2PO_4 and 0.05M H_3PO_4 are mixed? (pK_a for phosphoric acid are 2.0, 6.8 and 12.0)

- a. pH 2 and poorly buffered
- b. pH 2 and well buffered
- c. pH 6.8 and poorly buffered
- d. pH 12 and well buffered

Correct Answer: B

Equal amounts of phosphoric acid (H_3PO_4) and monosodium phosphate (NaH_2PO_4) will be present at a pH of 2.0, which is the pK_a for phosphoric acid. Because both components of the mixture have 50mM phosphate and the solution is poised at the pK_a of the first ionization, the solution will be able to absorb as much as 25mM of either acid or base before its buffering capacity is exhausted. The solution is thus judged to be "well buffered."

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 258. How many ml of a 0.2M NaOH solution are required to bring the pH of 20 ml of a 0.4M HCl solution to 7.0 ?

- a. 10
- b. 2
- c. 30
- d. 4

Correct Answer: A

To begin with, NaOH and HCl both completely dissociate in water, therefore no pK_a calculation is necessary. The implications of this are that a given amount of acid solution has the same number of free protons as the same amount of the same concentration of a base solution. In this case, the concentration of the acid solution (at 0.4M) is twice that of the base solution (at 0.2M). Thus, a neutral pH can be achieved by adding twice the amount of base solution to the acid.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 259. What is the correct relationship between pK_a and pH ?

- a. Both are log functions
- b. When $\text{pH} = \text{pK}_a$, the ionizable compound in question (whether acid or base) will be half protonated and half deprotonated
- c. Both A and B
- d. None of the above

Correct Answer: B

The "operational" relationship between pK_a and pH is mathematically represented by Henderson-Hasselbalch equation

$$pH = pK_a + \log \frac{[A^-]}{[HA]}$$

Where $[A^-]$ represents the deprotonated form and $[HA]$ represents the protonated form.

One of-cited solution to this equation is obtained by arbitrarily setting $pH = pK_a$.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 260. _____ ml of a 0.4M HCl solution is required to bring the pH of 10 ml of a 0.4M NaOH solution to 7.0 .

- a. 10
- b. 20
- c. 30
- d. 40

Correct Answer: A

Because both the acid and the base are at the same concentration and both completely dissociate in water, a neutral pH can be achieved by adding an equal amount of the acid solution to the base solution.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 261. 'Raising of viscosity' is not a colligative property, then why do the viscosity of the resultant solution is found to be greater than that of the original solvent, when some solutes are added to some solvents?

- a. The viscosity of the resultant solution depends on the nature of the solute added.
- b. The viscosity of the resultant solution depends on the amount of solute added.
- c. The viscosity of the resultant solution depends on the amount of pure liquid.
- d. None of the above

Correct Answer: A

All four answers here are true, but only one of them explains why 'raising of viscosity' is not a colligative property. Colligative properties are distinguished by the fact that they are independent of the nature of the solute. There are dependent only on the relative amounts of solute and solvent, and the nature of the solvent.

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 262. Which one of the following is the most likely vapour pressure for a 1.5M solution of sucrose (aq) at $75^\circ C$, if the vapour pressure of pure water is 39 kPa at the same temperature?

- a. 37 kPa
- b. 39 kPa
- c. 0 kPa
- d. 41 kPa

Correct Answer: A

The addition of a solute is expected to lower the vapour pressure. 1.5M sucrose solution is mainly composed of water and will still exert a vapour pressure.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 263. What will the concentration of OH^- , if the concentration of H^+ in a solution is 10^{-3}M , at 25°C ?

- a. 10^{-3}M
- b. 10^{11}M
- c. $2 \times 10^{-11}\text{M}$
- d. 10^{-11}M

Correct Answer: D

In aqueous solutions at 25°C , the product of the H^+ and OH^- concentrations is always 10^{-14} , as expressed in this equation

$$[\text{H}^+][\text{OH}^-] = 10^{-14}$$

This allows calculation of the OH^- concentration if the H^+ concentration is known.

$$[\text{OH}^-] = 10^{-14} / [\text{H}^+]$$

$$[\text{OH}^-] 10^{-14} / 10^{-3} \approx 10^{-11}$$

This calculation is used when the solution in question is not pure water, but contains some mixture of acids and bases.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 264. What is not an essential component of an osmotic pump drug delivery tablet?

- a. A single chamber.
- b. Tablet coated with a semi permeable membrane.
- c. A orifice in the tablet coating.
- d. An active pharmaceutical ingredient (API).

Correct Answer: A

Osmotic pump systems consist of a tablet sealed by a semi-permeable membrane with the orifice. The elementary osmotic pump generally has a single layer core containing the API (typically water soluble) enclosed in a semi-permeable membrane with one or more laser drilled orifices. This is the one chamber elementary osmotic pump system. Osmotic pump drug

delivery tablets require an API, semi-permeable membrane and orifice, but may be single or two-chamber devices.

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 265. What is the pH of the solution?

- a. The hydrogen ion concentration, $[H^+]$
- b. $-\log[H^+]$
- c. $-\ln[H^+]$
- d. All of the above

Correct Answer: B

pH of a solution is the negative log of its H^+ concentration,
or

$$pH = -\log[H^+]$$

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 266. What will be the hydrogen Ion concentration of a solution at physiological pH, which is 7.4?

- a. 0.6M
- b. $4 \times 10^{-5} M$
- c. $1 \times 10^{-5} M$
- d. -7.4M

Correct Answer: B

pH is the negative log of the hydrogen concentration, i.e.

$$\text{if } pH = -\log[H^+],$$

$$\text{Then } [H^+] = \text{antilog}(-pH) = 10^{-7.4} M$$

Thus, the hydrogen ion concentration of a solution at physiological pH(7.4) is $10^{-7.4}$, which is equal to $3.98 \times 10^{-8} M$. We can round off to $4 \times 10^{-5} M$.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 267. When there is equilibrium between a liquid solution phase and a second liquid phase, which colligative property will arise in system?

- a. Osmotic pressure

- b. Lowering of vapour pressure
- c. Lowering of melting point
- d. All of the above

Correct Answer: A

Lowering of vapour pressure and raising of boiling point arise in systems where there is an equilibrium between a liquid solution phase and a gaseous phase. Lowering of melting point arises in systems where there is equilibrium between a liquid solution phase and a solid phase.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 268. The typical osmolarity of physiological fluids is

- a. 0.3 mOsmol L⁻¹
- b. 300 mOsmol L⁻¹
- c. 0.3 mOsmol L⁻¹
- d. None of the above

Correct Answer: A

The typical osmolarity of physiological fluids is 0.3 osmol L⁻¹.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 269. Semi-permeable membrane in the context of osmosis is

- a. the membrane that allows solvent particles, but not solute particles, to pass through it.
- b. the membrane that allows solute particles, but not solvent particles, to pass through it
- c. the membrane that allows both solute and solvent particles to pass through it.
- d. None of the above

Correct Answer: B

Osmosis can arise in systems where there is a semi-permeable membrane that allows solute particles, but not solvent particles, to pass through it.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 270. The pH of a 10⁻³M solution of HCl will be

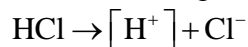
- a. 1
- b. 2
- c. 3
- d. 4

Correct Answer: C

pH is the negative log of the hydrogen ion concentration,
i.e.

$$\text{pH} = -\log[\text{H}^+]$$

HCl is a strong acid. It completely dissociates in water, i.e.



A 0.3 M HCl solution has a $[\text{H}^+]$ of 10^{-3}M . Therefore, the pH of a 10^{-3}M solution of HCl is

$$-\log[10^{-3}] = 3$$

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 271. What will be the van't Hoff factor (i) for a dilute aqueous solution of the strong electrolyte barium hydroxide, $\text{Ba}(\text{OH})_2$?

- a. 1
- b. 2
- c. 3
- d. 4

Correct Answer: C

Each mole of $\text{Ba}(\text{OH})_2$ in aqueous solution will fully dissociate to yield 1 mole of Ba^{2+} and 2 moles of OH^- . As each mole of $\text{Ba}(\text{OH})_2$ yields 3 moles of ions, the van't Hoff factor (i) is 3.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 272. On which of the following conditions, there is the reduction in the chemical potential of solvent molecules upon the addition of solute for an ideal system?

- a. The melting point of the solute
- b. The number of solute particles
- c. The boiling point of the solute
- d. All of the above

Correct Answer: B

The addition of solute simply reduces the number of solvent molecules at the surface of the liquid, and so the solvent molecules in the liquid escape into the vapor less frequently.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 273. Calculate the osmotic pressure of a 0.2M solution of NaCl at 25°C given

$R = 8.314\text{J K}^{-1}\text{mol}^{-1}$ using the van't Hoff equation that is written as: $P = 1000i [\text{S}]RT$, where

all terms have their usual meanings.

- a. 900 kPa

- b. 890 kPa
- c. 780 kPa
- d. 990 kPa

Correct Answer: D

This is obtained by recognising that $T = 298 \text{ K}$ and the van't Hoff factor, i , is equal to 2 given that one mole of NaCl will dissociate in solution to yield 2 moles of ions.

$$P = 1000 \times 2 \times 0.2 \times 8.314 \times 298 = 9.9 \times 10^5 \text{ Pa} = 990 \text{ kPa}.$$

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 274. When a cell is placed in _____ solution, it will have greater osmolarity than cytosol.

- a. hypertonic
- b. hypotonic
- c. isotonic
- d. None of the above

Correct Answer: A

A solution that contains more dissolved particles (such as salt and other electrolytes) than is found in normal cells and blood. For example, hypertonic solutions are used for soaking wounds.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 275. Trematol is a metabolic poison derived from the white snake root. Cows eating this plant concentrate the poison in their milk. The poison inhibits liver enzymes that convert lactic acid to other compounds for metabolism. Why does physical exertion increase symptoms of poisoning by trematol? Why does the pH of the blood decrease in a person who has digested trematol?

- a. Physical exertion would increase the production of lactic acid by fermentation and the build up of lactic acid decreases blood pH when liver enzymes are blocked.
- b. Physical exertion increases metabolism and the electron transport chain, pumping H^+ out of mitochondria increases blood pH.
- c. Both A and B
- d. None of the above

Correct Answer: A

During exertion, our muscles produce lactic acid from pyruvate by fermentation, allowing the regeneration of NAD^+ for continued ATP production by glycolysis. Because lactic acid metabolism is blocked by tremetol, the acid would build up in our blood, decreasing the pH.

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 276. _____ can be classified as an Arrhenius acid.

- a. HCl
- b. NaCl
- c. LiOH
- d. KOH

Correct Answer: A

The Arrhenius definition of acids and bases is one of the oldest. Arrhenius acid is a substance that when added to water increases the concentration of H^+ ions present. The chemical formulas of Arrhenius acids are written with the acidic hydrogens first. HCl is an example of an Arrhenius acid. The H^+ ion produced by an Arrhenius acid is always associated with a water molecule to form the hydronium ion. Arrhenius acids are frequently referred to as proton donors, hydrogen ion donors or hydronium ion donors, depending on whether we are trying to emphasize the species liberated by the acid (proton or hydrogen ion) or the species present in solution (hydronium ion).

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 277. What is the reason that the isolated mitochondria, when placed in a buffer with low pH begin to produce ATP?

- a. The high external acid concentration causes an increase in H^+ in the inter membrane space leading to increased ATP production by ATP synthetase.
- b. Low pH increases the OH^- concentration in the matrix resulting in the activation of ATP synthetase that help in ATP production.
- c. Low pH increases the concentration of base causing mitochondria to pump out H^+ to the inter membrane space leading to ATP production.
- d. Low pH increases the acid concentration in the mitochondrial matrix, a condition that normally causes ATP production.

Correct Answer: A

Mitochondrial production of ATP requires a concentration gradient of H^+ with a high concentration at the inter membrane space and a low concentration in the matrix. The inner membrane is impermeable to H^+ , but the outer membrane of the mitochondria will allow H^+ to pass through. Thus, placing mitochondria in a low pH buffer produces a H^+ gradient that can generate ATP through ATP synthetase.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 278. Which type of reaction does the equation, $H^+ + OH^- \leftrightarrow H_2O$, represent?

- a. Esterification
- b. Decomposition
- c. Hydrolysis

d. Neutralization

Correct Answer: D

By definition neutralization occurs when equal quantities of an acid (H^+) react with equal quantities of a base (OH^-) to form water.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 279. Which among the following equation indicate ΔG , if equilibrium constant is, K and change in free energy is ΔG ?

a. $\Delta G = RT \ln k$

b. $\Delta G = RT \log 10k$

c. $\Delta G = RT \ln k$

d. $\Delta G = r \ln kT$

Correct Answer: C

The formula, $\Delta G = RT \ln k$ is the standard Gibbs free energy change ΔG° equals the negative of the product of the gas constant R times the absolute temperature of the system T times the natural logarithm in of the equilibrium constant K .

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 280. If the associated enthalpy change (ΔH) is positive, then the chemical reaction

a. cannot occur spontaneously

b. may occur spontaneously

c. will inevitably occur spontaneously

d. raises the temperature of the surroundings

Correct Answer: B

The enthalpy change (ΔH) of a chemical reaction may be negative (heat is lost from molecules and released, so raising the temperature of the surroundings) or positive (heat is taken up from the surroundings, which, correspondingly, cool down). At first sight it may seem surprising that reactions with a positive ΔH can occur at all since it might seem to represent an energy uptake analogous to a weight simply raising itself from the floor and cooling the surrounding air as it does so. This is the point at which physical analogies such as weights falling become inadequate as models for chemical reactions. In chemical reactions, a negative ΔH favours the reaction and a positive ΔH has the opposite effect, but ΔH is not the final arbiter as is gravitational energy with a weight system. Entropy change (the drive to randomness), known as ΔS .

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 281. What will be the pH of a 0.00001 Molar HCl solution?

- a. 1
- b. 9
- c. 5
- d. 4

Correct Answer: C

pH is the negative log (logarithm) of the hydronium ion concentration. A 0.00001 Molar solution has a H^+ concentration of 10^{-5}M (move the decimal point 5 places to the right). The value of the negative exponent (10^{-5}) gives a pH of 5.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 282. Which among the following solution will change red litmus to blue?

- a. $\text{HCl}(\text{aq})$
- b. $\text{NaCl}(\text{aq})$
- c. $\text{CH}_3\text{OH}(\text{aq})$
- d. $\text{NaOH}(\text{aq})$

Correct Answer: D

Red litmus turns blue when a base is present. HCl is an acid; NaCl is a salt and salts neutralize acids and bases. The litmus does not change colour with salts. CH_3OH is an alcohol not a base.

NaOH is a strong base and will change red litmus to blue.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 283. What will be the pH of a solution that have a hydronium ion concentration of 0.01 mole per liter?

- a. 5
- b. 2
- c. 10
- d. 7

Correct Answer: B

By definition pH is the negative log (logarithm) of the hydronium ion concentration. A 0.01 molar solution has a H^+ concentration of 10^{-2} (move the decimal point 2 places to the right). The value of the negative exponent (10^{-2}) gives a pH of 2

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 284. If the solution is of concentration $0.069 \text{ mol dm}^{-3}$, and the path length of the cell is 12.5 mm, calculate the molar absorption coefficient of the solution and in a spectrophotometric experiment, 84.9% of the incident light is absorbed by the solution under investigation.

- a. $0.824 \text{ mol}^{-1} \text{ dm}^{-3} \text{ cm}^{-1}$
- b. $0.0824 \text{ mol}^{-1} \text{ dm}^{-3} \text{ cm}^{-1}$
- c. $0.0724 \text{ mol}^{-1} \text{ dm}^{-3} \text{ cm}^{-1}$
- d. $0.0824 \text{ mol}^{-1} \text{ dm}^{-1} \text{ cm}^{-1}$

Correct Answer: A

We may rearrange the Beer-Lambert law

$$\text{Log } \frac{I_0}{I} = \varepsilon [J] I$$

To determine the molar absorption coefficient of a substance J

$$\varepsilon = \frac{\log\left(\frac{I_0}{I}\right)}{[J]I}$$

In this problem,

$$I = 0.849 I_0$$

So that, the molar absorption coefficient in the conventional units of $\text{mol}^{-1} \text{ dm}^{-3} \text{ cm}^{-1}$, then

$$\begin{aligned} \varepsilon &= \frac{\log(0.849^{-1})}{(0.069 \text{ mol dm}^{-3}) \times (12.5 \times 10^{-1}) \text{ cm}} \\ &= 0.824 \text{ mol}^{-1} \text{ dm}^{-3} \text{ cm}^{-1} \end{aligned}$$

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 285. If the associated free energy change (ΔG) is large and negative,

- a. chemical reaction will inevitably occur spontaneously.
- b. chemical reaction is likely to be irreversible in the cell.
- c. chemical reaction will occur very rapidly.
- d. None of the above

Correct Answer: B

A negative ΔG is a necessary but not sufficient condition for a reaction to occur. Enzyme catalysis is also needed for biochemical reactions to take place. There is an energy barrier to chemical reactions occurring; molecules must be raised to a transition state before they can react. The value of ΔG does not give any information about the rate of a reaction. If the ΔG of a biochemical reaction $A \leftrightarrow B$ is small, significant reversibility may be possible in the cell because changes in reactant concentrations may be sufficient to reverse the sign of the ΔG . If the ΔG is large, for all practical purposes the reaction is irreversible. In cellular reactions there is relatively little scope for concentration change in the metabolites (as reactants and products are

called). The net result is that most reactions with large negative ΔG values are irreversible because concentration changes are insufficient to reverse the sign of those values.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 286. 0.1M solution of _____ phenolphthalein pink.

- a. $\text{HBr}(\text{aq})$
- b. $\text{CO}_2(\text{aq})$
- c. $\text{LiOH}(\text{aq})$
- d. $\text{CH}_3\text{OH}(\text{aq})$

Correct Answer: C

Different indicators change color at differing concentrations of hydrogen ions. Phenolphthalein turns pink in basic solutions that range from about 8.2 to 10 and colourless in acid solutions.

LiOH is an alcohol it is neutral in water. Group I elements of the Periodic Table

(Li, Na and K) form strong bases when combined with hydroxide $(\text{OH})^-$. When dissolved in water, LiOH makes a strongly basic solution. It will turn phenolphthalein pink.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 287. The units for the rate constant of a reaction that is second order is

- a. $\text{mol}^{-1}\text{dm}^3\text{s}^{-1}$
- b. $\text{mol}^{-1}\text{s}^{-1}$
- c. $\text{mol}^{-2}\text{dm}^6\text{s}^{-1}$
- d. None of the above

Correct Answer: A

The differential rate equation of a reaction that is second order has the form

$$u = k_r [\text{A}]^a [\text{B}]^b [\text{C}]^c \dots$$

Where, $a + b + c + \dots = 2$

It follows that, because rate has dimensions of concentration per unit time,

$$\text{Concentration/time} = k_r \times \text{concentration}^2$$

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 288. On what factor does the specific rate constant of a first order reaction depends?

- a. Time
- b. Temperature

- c. Concentration of reactants
- d. Concentration of products

Correct Answer: B

In chemical kinetics a reaction rate constant, k or k_1 , quantifies the rate of a chemical reaction. For a reaction between reactants A and B to form product C;



the rate is often found to have the form,

$$r = k(T)[A]^m[B]^n$$

Here, $k(T)$ is the reaction rate constant that depends on temperature.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 289. The value of activation energy is primarily determined by

- a. temperature
- b. chemical nature of reactants and products
- c. concentration of reactants
- d. effective collision

Correct Answer: D

For a collision to be effective, the sum of energy of colliding molecules must equal or exceed some minimum value called the activation energy of the reaction. It is the minimum energy needed to convert reactants into products. It is denoted by E_a . The activation depends upon the nature of the chemical bonds undergoing rupture. Another definition of activation energy is that "the minimum energy which the reacting species must possess in order to be able to form an activated complex or transition state before proceeding to the products". Reactions having higher activation energy are slow while those having high energy of activation proceed with slow speed.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 290. When HCl (aq) is exactly neutralized by NaOH (aq), the hydrogen ion concentration in the resulting mixture is

- a. always less than the concentration of the hydroxide ions.
- b. always greater than the concentration of the hydroxide ions.
- c. always equal to the concentration of the hydroxide ions.
- d. sometimes greater and sometimes less than the concentration of the hydroxide ions.

Correct Answer: C

Neutralization means equivalent amounts of hydronium and hydroxide ions react in solution to produce water. Water has a pH of 7.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 291. In the case of acids and bases,

- a. at pH values above its pK_a , more than 50% of a weak acid will be present in the dissociated state (as the conjugate base).
- b. acetic (ethanoic) acid (pK_a 4.76) is a good physiological buffer in blood
- c. Both A and B
- d. None of the above

Correct Answer: A

pH is the negative logarithm to base 10 of the H^+ concentration expressed in moles per litre. Special situations occur, such as in the stomach where HCl is secreted, and in lysosomes into which protons are pumped to maintain an acid pH, but, otherwise, the pH of cells and of circulating fluids is maintained within narrow limits. This pH stability is largely due to the buffering effect of weak acids. The pK_a value represents the pH at which a weak acid is 50% dissociated. As the pH increases (*i.e.* as H^+ concentration decreases), the acid becomes more dissociated; as the pH decreases (H^+ concentration increases), the reverse occurs. This is because the $HA \rightarrow H^+ + A^-$ equilibrium is affected by the H^+ concentration as would be expected. Buffering is maximal at the pK_a . According to thumb rule, in biochemistry, a useful buffer covers a range of about 1 pH unit on either side of the pK_a .

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 292. What do the sum of exponents of molar concentration called?

- a. Rate of reaction
- b. Average of reaction
- c. Order of reaction
- d. None of the above

Correct Answer: C

The order of reaction with respect to a given substance (such as reactant, catalyst or product) is defined as the index or exponent, to which its concentration term in the rate-equation is raised. Order of reaction is the sum of the exponents (powers) to which the molar concentration terms are raised in the rate law.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 293. Which of the following statements about the kinetics of the reaction;

$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$ is definitely true?

- a. The reaction is first order with respect to bromine, Br_2 .
- b. The reaction is second order overall.

c. It is not possible to determine anything about the kinetics of the reaction from the stoichiometry.

d. None of the above

Correct Answer: C

The reaction between hydrogen, H_2 and bromine, Br_2 , has been found to proceed by a complicated multistep radical reaction. The differential rate law does not therefore have a simple form. In general, it is not possible to make any deductions about the kinetics of a reaction simply from the stoichiometry. Instead, it is necessary to consider the mechanism by which the reaction occurs.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 294. The following data were collected at the endpoint of a titration performed to find the molarity of an HCl solution.

Volume of acid (HCl) used = 14.4 mL

Volume of base (NaOH) used = 22.4 mL.

Molarity of standard base (NaOH) = 0.20M. What is the molarity of the acid solution?

a. 1.6 M

b. 0.64 M

c. 0.31 M

d. 0.13 M

Correct Answer: C

Using the titration method, the volume of acid x the molarity of the acid neutralizes an equal volume of base x the molarity of the base.

Or

$$V_{\text{Acid}} \times M_{\text{Acid}} = V_{\text{Base}} \times M_{\text{Base}}$$

where V = volume

and M = molarity of HCl and NaOH

The molarity of HCl or

$$(14.4 \text{ mL})(M \text{ of HCl}) = (22.4 \text{ mL})(0.20 \text{ M}).$$

$$\text{Rearranging terms, } M \text{ of NaOH} = \frac{(22.4 \text{ mL})(0.20 \text{ M})}{14.4 \text{ mL}}$$

$$= 0.31 \text{ M.}$$

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 295. As the hydrogen ion concentration of an aqueous solution increases, the hydroxide ion concentration of this solution will

- a. decrease
- b. increase
- c. not change
- d. be in equilibrium

Correct Answer: A

(OH^-) multiplied by (H_3O^4) is a constant number equal to 1×10^{-14} for aqueous solutions. In other words, $(A)(B) = -14$. Substituting numbers, $(-7)(2) = -14$.

But if 7 is increased to 14, 2 must decrease to -1 to keep the answer -14 . $(14)(-1) = -14$. If (H_3O^4) increases, (OH^-) must decrease.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 296. What is the energy called that is available to do useful work?

- a. Kinetic energy
- b. Free energy
- c. Enthalpy
- d. All of the above

Correct Answer: B

The free energy (or Gibbs free energy) is the energy change associated with a chemical reaction that can be harnessed to do useful work - that is, to drive another process or reaction.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 297. Which among the following statement represents the equilibrium constant, K_{eq} for a reaction



- a. $\frac{[\text{A}] + [\text{B}]}{[\text{C}] + [\text{D}]}$
- b. $\frac{[\text{A}][\text{B}]}{[\text{C}][\text{D}]}$
- c. $\frac{[\text{C}] + [\text{D}]}{[\text{A}] + [\text{B}]}$
- d. $\frac{[\text{C}][\text{D}]}{[\text{A}][\text{B}]}$

Correct Answer: B

The expression for the equilibrium constant features the products as the numerator (top line) and reactants as the denominator (bottom line), with the terms on each line being multiplied together, rather than being added.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 298. What will happen, when a small amount of acid is added to carbonic acid and sodium bicarbonate (sodium hydrogen carbonate) that act as buffers in the blood and buffer and the H^+ ions are used up as they combine with the bicarbonate ions?

- The pH of the blood does not change.
- The pH of the blood increases.
- The pH of the blood decreases.
- The reaction is irreversible.

Correct Answer: A

The phenomenon of buffering can be illustrated by a very simple observation. A test-tube containing distilled water and (as dissolved CO_2 normally makes it slightly acidic) adjust the pH to 7.0 with NaOH, and then add a few drops of 0.1 HCl, there will be a precipitous drop in pH. A test-tube containing 0.1 sodium phosphate, also adjusted to pH 7.0, and add the same amount of HCl; the pH will hardly change, due to the buffering action of the phosphate ion. The buffering action of compounds with pK_a values near 7, such as carbonic acid, thus protects the cell and body fluids against large pH changes.

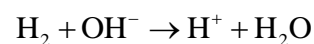
Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 299. What is the equivalent value expressed in units of $\text{Molecule}^{-1} \text{cm}^3 \text{s}^{-1}$, if the rate constant for the reaction?



Which is an important step in the hydrogen-oxygen reaction mechanism, has the value

$$k_r = 3.52 \times 10^6 \text{ mol}^{-1} \text{dm}^3 \text{s}^{-1}$$

- $5.75 \times 10^{-15} \text{ molecule}^{-1} \text{cm}^3 \text{s}^{-1}$
- $5.85 \times 10^{-20} \text{ molecule}^{-1} \text{cm}^3 \text{s}^{-2}$
- $5.85 \times 10^{-15} \text{ molecule}^{-1} \text{cm}^3 \text{s}^{-1}$
- None of the above

Correct Answer: C

$$K_r = 3.52 \times 10^6 \times \left(\frac{1}{6.022 \times 10^{23} \text{ molecule}} \right)$$

$$= 5.85 \times 10^{-15} \text{ molecule}^{-1} \text{cm}^3 \text{s}^{-1}$$

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 300. If the initial concentration is 100 mg mL^{-1} , what is the shelf life ($t_{10\%}$), when a drug suspension decomposes by zero-order kinetics with a rate constant of $2 \text{ mg mL}^{-1}\text{month}^{-1}$?

- a. 6 months
- b. 5 months
- c. 3 months
- d. 12 months

Correct Answer: B

The shelf life will be valid until the concentration of drug falls to 90% of the original amount i.e. to 90 mg mL^{-1} . Since $[A] = -kt + [A]_0$ for a zero-order reaction, we can determine t as we know that $[A] = 90 \text{ mg mL}^{-1}$, $[A]_0 = 100 \text{ mg mL}^{-1}$ and $k = 2 \text{ mg mL}^{-1} \text{ month}^{-1}$.

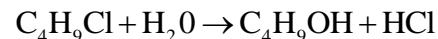
Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 301. What will be the activation energy of the reaction, if the rate constant for the substitution reaction



Increases by a factor of 10.6 when the temperature is increased from 298K to 308K

- a. 180 kJ mol^{-1}
- b. 190 kJ mol^{-1}
- c. 120 kJ mol^{-1}
- d. None of the Above

Correct Answer: A

$$\ln \frac{K_{T(T')}}{K_{T(T)}} = \frac{E_a}{R} \left(\frac{1}{T} - \frac{1}{T'} \right) = \frac{E_a}{R} \left(\frac{T' - T}{T \times T'} \right)$$

$$E_a = R \ln \left\{ \frac{K_T(T')}{K_T(T)} \right\} \times \left(\frac{T' - T}{T \times T'} \right)$$

Thus since

$$\left\{ \frac{K_T(T)}{K_T(T)} \right\} = 10.6$$

Then

$$E_a = 8.3145 \text{ JK}^{-1} \text{ mol}^{-1} \times \ln \times \left\{ \frac{298 \times 308}{308 - 298} \right\} \text{ K}$$
$$= 180 \times 10^2 \text{ J mol}^{-1} = 180 \text{ kJ mol}^{-1}$$

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 302. What will be the rate constant for the reaction at 25°C , if the half-life for the acid-catalyzed hydrolysis of sucrose to form glucose and fructose, which is first order overall, is 3.20 h ?

a. $6.02 \times 10^{-5} \text{ s}^{-1}$

b. $8.02 \times 10^{-5} \text{ s}^{-1}$

c. $8.02 \times 10^{-4} \text{ s}^{-1}$

d. $6.02 \times 10^{-3} \text{ s}^{-2}$

Correct Answer: A

The half-life for a first-order reaction does not carry composition and is related to the rate constant

$$t_{1/2} = \frac{\ln 2}{k_T}$$

Rearranging and remembering to convert from hours to seconds,

$$k_T = \frac{\ln 2}{t_{1/2}} = \frac{6.693}{(3.20 \times 3600) \text{ s}} = 6.02 \times 10^{-5} \text{ s}^{-1}$$

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 303. The strategies that would not normally be expected to reduce the rate of oxidation of an API is

- a. addition of a heavy metal to the formulation.
- b. reducing the temperature of the formulation.
- c. protecting the formulation from light.
- d. replacing the air in the package with nitrogen.

Correct Answer: A

Packaging can be modified to improve resistance to degradation by oxidation. Several strategies are used, including excluding as much oxygen from the formulation as possible. The more general strategies that will reduce the degradation rate, including temperature and tight effects, and the type of materials that may initiate or propagate the radical chain reactions that are characteristics of many oxidation reactions.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 304. Which one of the following is not a characteristic of a zero-order drug decomposition reaction?

- a. The rate of reaction is constant.
- b. The rate of reaction is independent of the concentration of any of the reactants.
- c. The half-life of the drug decomposition is directly proportional to the initial concentration of API.
- d. The units of the rate constant (k) are time^{-1} .

Correct Answer: D

The units of the rate constant (k) are time^{-1} .

Zero-order reactions, and the term "zero-order" means with regard to the rate of reaction and the rate constant. The rate constant, k , has units of $\text{mole L}^{-1}\text{s}^{-1}$.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 305. What will be the correct procedure, if a student wishes to prepare approximately 50 ml of an aqueous solution of 5M HCl using 10M HCl?

- a. Adding 50 mL of 12M HCl to 50 mL of water and then stirring the mixture steadily.
- b. Adding 50 mL of 12M HCl to 50 mL of water while stirring the mixture steadily.
- c. Adding 50 mL of water to 50 mL of 12M HCl and then stirring the mixture steadily.
- d. Adding 50 mL of water to 50 mL of 12M HCl while stirring the mixture steadily.

Correct Answer: B

Safety Rule always add acid to water. This prevents the acid from splattering. Never add water to acid, Place a glass stirring rod in the water and slowly pour the acid along the rod. Some concentrated acids like HCl have an exothermic reaction in water, releasing a large amount of heat and causing the water-acid solution to boil. Constant stirring diffuses the acid throughout the solution, helping to evenly distribute the generated heat.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 306. What will be the value of the change in free energy, G , when the chemical system is at equilibrium?

- a. Less than zero
- b. More than zero
- c. Zero
- d. Infinite

Correct Answer: C

If the free energy is zero, it implies that there is no net change occurring in the system - which is the case when the system is at equilibrium.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 307. What are the standard conditions for biochemical reactions?

- a. 1.0M, 25°C and pH 7
- b. 0.1M, 40°C and pH 0
- c. 1.0M, 25°C and pH 8
- d. All of the above

Correct Answer: A

The biochemical standard state mirrors the 'non-biochemical' standard state, with the exception that pH is taken to be pH 7, not pH 0.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 308. Conjugated base of a weak acid is

- a. moderately weak
- b. unstable
- c. weak
- d. strong

Correct Answer: D

The stronger the acid or base the weaker the conjugate, the weaker the acid or base the stronger the conjugate. However, a weak acid or base will not necessarily have a strong conjugate base or acid; there are a number of pairs of weak conjugates.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 309. The relationship between rate constant, k and absolute temperature, T , as predicted by the Arrhenius equation can be represented as

- a. a linear plot of $\log k$ against $1/T$
- b. a linear plot of k against T with a negative slope.
- c. a linear plot of k against T with a positive slope.
- d. None of the above

Correct Answer: A

This question is intended to test the basic understanding of what the Arrhenius equation represents and how it may be applied to pharmaceutical systems. The equation predicts that reaction rate increases exponentially with temperature.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 310. What will be the extent of reaction If the value of G is large and negative?

- a. The reaction is likely to happen to a large extent, with large amounts of product formed.
- b. The reaction will be at equilibrium.
- c. The reaction will happen to a moderate extent, with about as much product being formed as reactant being left.
- d. The reaction will happen to a moderate extent, with about as much product being formed as reactant being right.

Correct Answer: A

If the change in free energy is large and negative, it suggests a spontaneous reaction in which the equilibrium position lies heavily towards the products.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 311. From the drug monograph the decomposition rate constant (k) was found to be $6 \times 10^{-2} \text{ year}^{-1}$, for a drug that has remained in storage for 2 years since manufacture. The degradation reaction is known to proceed via first-order kinetics. Which one of the following is the remaining percentage of the original drug concentration?

- a. 20
- b. 86
- c. 89
- d. 90

Correct Answer: C

To apply the first-order rate equation in $\ln[A] = -kt + \ln[A]_0$. In this question, we know that $k = 6 \times 10^{-2} \text{ year}^{-1}$ and $t = 2$ years. If $[A]_0 = 100$ units, then rearrangement will give $[A]$ and this be numerically equivalent to the % of original drug remaining.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 312. In an experiment to determine Its enthalpy of vaporization, liquid tetrachloromethane, was placed in an open boiler that was equipped with a resistive heating coil and brought to the boil at a constant temperature of 350K and pressure of 1 bar. The passage of a current of 0.933A from a 24V supply for 30s was found to result in the vaporization of 3.45g of tetrachloromethane. Calculate the standard enthalpy of vaporization of tetrachloromethane at 350K.

- a. 0.671 kJ mol⁻¹
- b. 195 J mol⁻¹
- c. 105 J mol⁻¹
- d. 30.0 kJ mol⁻¹

Correct Answer: D

This is the heat required to vaporize 3.45g of tetrachloromethane. Because the process occurs at constant pressure,

$$\Delta H - q_p = q$$

The standard enthalpy of vaporization is a molar quantity

$$\Delta_{\text{vap}} H^{\circ} = \frac{\Delta H}{n}$$

and the amount vaporized is given by

$$n = \frac{m}{M}$$

So that, because the molar mass of tetrachloromethane is

$$M = (12.01 + 4 \times 35.45) \text{g mol}^{-1} + 153.81 \text{g mol}^{-1}$$

Then

$$\begin{aligned} \Delta_{\text{vap}} H^{\circ} &= \frac{IVt}{m/M} \\ &= \frac{(0.933\text{A}) \times (24.0\text{V}) \times (30.0\text{s})}{(3.45\text{g}) / (153.81\text{g mol}^{-1})} \\ &= 30.0 \times 10^3 \text{ J mol}^{-1} \\ &= 30.0 \text{ KJ mol}^{-1} \end{aligned}$$

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

1.E Bioenergetics and Glycolysis

Q. 313. Why ATP is known as universal energy currency in life?

- a. It traps energy released from the oxidation of different classes of food molecules.
- b. It enables cells to disobey the first law of thermodynamics.
- c. It releases energy as heat when it undergoes hydrolysis.
- d. It enable cells to disobey the second law of thermodynamics.

Correct Answer: A

Living cells obey the laws of physics and chemistry, including the first and second law of thermodynamics. Cells must harness the useful energy from oxidation of food in a form of chemical energy. Virtually all processes releasing energy from all food molecules trap it in a single compound, adenosine triphosphate (ATP). With trivial exceptions, all processes needing energy use the hydrolysis of ATP to supply it. For ATP to supply energy to a process rather than releasing energy as heat, its breakdown must, in some manner, be tightly coupled to the process.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 314. _____ is not likely to be enhanced shortly after waking up.

- a. Lipolysis
- b. Growth hormone secretion
- c. Glycogenesis
- d. None of the above

Correct Answer: C

A night's sleep represents a short period of fasting. In fasting, hyperglycemia hormones, particularly GH and cortisol are secreted. There is an increase in the utilization of fats (lipolysis). Glycogenesis will only be stimulated once a meal has been eaten and plasma glucose levels have started to rise.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 315. Which among the following statement is false regarding the diabetes mellitus?

- a. It leads to hypoglycaemia.
- b. It is associated with an increase in lipolysis.
- c. Both A and B
- d. None of the above

Correct Answer: A

Diabetes is the result of either a lack of pancreatic insulin or the absence of normal insulin receptors. It is characterized by raised plasma glucose, which leads to glycosuria and an osmotic diuresis. As glucose cannot be utilized effectively by many cells, fats are broken down to create alternative sources of energy. Acromegaly is caused by the excessive secretion of GH in adulthood. Because of the anti-insulin action of GH, acromegaly can result in diabetes.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 316. What can be inferred if the standard free energy (ΔG) is positive?

- a. Products of the reaction contain more energy than the reactants.
- b. Products of the reaction contain less energy than the reactants.
- c. Products of the reaction contain equal energy than the reactants.
- d. None of the above

Correct Answer: A

The standard free energy change ($\Delta G_0'$) of a reaction may be positive, for example the actual free energy change (ΔG) negative, depending on cellular concentrations of reactants and products. Many reactions for which $\Delta G_0'$ is positive are spontaneous because other reactions cause depletion of products or maintenance of high substrate concentrations.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 317. Which among the following statement regarding the reactions in glycolysis is true?

- a. Fructose-1, 6- bisphosphate is broken into G3P .
- b. Fructose-1, 6- bisphosphate is broken into DHAP .
- c. Both A and B
- d. None of the above

Correct Answer: C

In glycolysis since glucose- 6 -phosphate, a six-carbon molecule, does not have the correct aldol structure to be split into two three-carbon molecules, it is isomerized to fructose- 6 -phosphate first and then phosphorylated to fructose- 16 -bisphosphate by the enzyme phosphofructokinase. It can now be split by aldolase into two three-carbon phosphorylated products. Although the G' for the aldolase reaction is 24.3kJ mol^{-1} , this refers to 1M concentrations. In the cell these are one thousand times lower, and one molecule of reactant produces two molecules of product Under cellular conditions, the G is small and the reaction freely reversible.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 318. What is the first phase of breakdown of glucose in animal cells?

- a. TCA
- b. Krebs cycle
- c. Glycolysis
- d. All of the above

Correct Answer: C

Glycolysis is the first of the main metabolic pathways of cellular respiration to produce energy in the form of ATP.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 319. What is the one way to detoxify methanol poisoning?

- a. Feed the patient with glucose.
- b. Give an intravenous dose of steroids to the patient.
- c. Make the patient drink ethanol.
- d. Make the patient drink lemon juice.

Correct Answer: C

Ethanol prevents methanol from turning into formaldehyde. Alcohol dehydrogenase converts methanol into formaldehyde (CH_2O) and aldehyde dehydrogenase turns this formaldehyde into a formic acid radical (CH_2O^-). Both formaldehyde and formic acid are highly poisonous and quickly lead to blindness and death.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 320. Which among the following co-enzyme is involved in oxidative decarboxylation?

- a. Thiamine pyrophosphate
- b. Biotin
- c. NAD^+
- d. Pyridoxal phosphate

Correct Answer: A

Thiamine pyrophosphate (TPP) functions as a coenzyme vital to tissue respiration. It is required for the oxidative decarboxylation of pyruvate to form acetyl-coenzyme A, providing entry of oxidizable substrate into the Krebs cycle for the generation of energy. It is also a coenzyme for transketolase. Thiamine is most strongly linked with carbohydrate metabolism, but TPP is also

required for the oxidative decarboxylation of other alpha-keto acids such as alpha-ketoglutarate and branched-chain alpha-keto acids (i.e. 2 -ketocarboxylates) derived from certain amino acids (e.g., valine, isoleucine, leucine).

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 321. In case of Pasteur effect, glycolysis is inhibited by the high concentration of

- a. ADP
- b. ATP
- c. Pi
- d. AMP

Correct Answer: B

The respiratory inhibition of glycolysis and fermentation is due to a feedback inhibition by the high concentration of ATP produced by respiration. Glycolysis may be decreased by a creation. This was first observed by Pasteur in studies of the fermentation of glucose by yeast cells. Pasteur also noted that in the presence of O₂ less glucose was broken down by the yeast cells and less alcohol was formed, whereas under anaerobic conditions more alcohol was formed and more glucose was fermented. The phenomenon of inhibition of glycolysis by O₂ is termed as Pasteur Effect.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 322. Which of the following statements about the role of the pentose phosphate pathway Is correct?

- a. The pentose phosphate pathway produces ribose-5-phosphate and NADPH.
- b. The pentose phosphate pathway oxidises glucose-6-phosphate completely to carbon dioxide and water.

- c. The pentose phosphate pathway occurs in the mitochondria of most cells.
- d. All of the above

Correct Answer: A

The pentose phosphate pathway supplies ribose-5-phosphate for nucleotide and nucleic acid synthesis, and for synthesis of coenzymes such as NAD^+ , FAD^+ and CoA. The pentose phosphate pathway also supplies NADPH for reductive biosynthesis such as fatty acid synthesis. It is also a route for excess pentose sugars to be brought into the mainstream of glucose metabolism pathways. The pathway occurs in the cytoplasm of most cells and has two main parts. The first is the irreversible oxidation of glucose-6-phosphate to ribose-5-phosphate in which NADP^+ is reduced to NADPH. The rate-limiting reaction here is catalyzed by glucose-6-phosphate dehydrogenase. The second part of the pentose phosphate pathway is the reversible nonoxidative reactions that interconvert sugars according to the cell's needs using the enzyme transketolase and transaldolase.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 323. The oxidative section of the pentose phosphate pathway is

- a. the pathway that supplies ribose-5-phosphate and NADPH in the quantities the cells require.
- b. the pentose phosphate pathway that oxidizes NADPH to NADP^- .
- c. the rate-limiting reaction of the pentose phosphate pathway that is catalyzed by glucose-6-phosphatase.
- d. None of the above.

Correct Answer: A

The pentose phosphate pathway supplies ribose-5-phosphate for nucleotide and nucleic acid synthesis and for synthesis of coenzymes such as NAD^+ , FAD^+ and CoA. The pathway also supplies NADPH for reductive biosynthesis. It is a route for excess pentose sugars to be brought into the mainstream of glucose metabolism. The pathway has two main parts. One part is the irreversible oxidation of glucose-6-phosphate to ribose-5-phosphate while NADP^+ is reduced to NADPH. The rate-limiting reaction here is catalyzed by glucose-6-phosphate dehydrogenase. This section of the pathway is controlled by the availability of NADP^+ . The second part of the pentose phosphate pathway is made up of non-oxidative reaction sequences that interconvert

sugars according to the cell's needs. Excess ribose-5-phosphate is converted to glycolytic intermediates by a sequence of reversible reactions.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 324. An enzyme correctly paired with its allosteric effector is

- a. Hexokinase: ATP
- b. Phosphofructokinase: Glucose-6-phosphate
- c. Pyruvate kinase: Alanine
- d. Glucokinase: Fructose 2, 6-bisphosphate

Correct Answer: C

Pyruvate kinase is an enzyme involved in glycolysis. It catalyzes the transfer of a phosphate group from phosphoenolpyruvate (PEP) to ADP, yielding one molecule of pyruvate and one molecule of ATP. This reaction has a large negative free energy change, one of three in glycolysis. All three such steps regulate the overall activity of the pathway, and are, in general, irreversible under wildtype conditions. Pyruvate kinase activity is regulated by alanine, a negative allosteric modulator.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 325. The non-oxidative section of the pentose phosphate pathway is correctly described by the statement.

- a. that the non-oxidative reactions of the pentose phosphate pathway are not reversible.
- b. that the transketolase is an enzyme that transfers three-carbon units in the pentose phosphate pathway,
- c. that the transaldolase is an enzyme that transfers two-carbon units in the pentose phosphate pathway.

d. that the pentoses undergo isomerizations in the pentose phosphate pathway.

Correct Answer: D

The oxidative section of the pentose phosphate pathway supplies ribose-5-phosphate for nucleotide and nucleic acid synthesis, ribose for coenzymes such as NAD^+ and FAD^+ and NADPH for reductive biosynthesis. The non-oxidative section of the pathway is a route for excess pentose sugars to be brought into the mainstream of glucose metabolism. It is a mechanism by which sugars can be inter-converted according to the cell's needs. The key reactions are catalyzed by the enzymes transketolase and transaldolase. Transketolase transfers two-carbon units and transaldolase transfers three-carbon units from pentose sugar phosphates to other aldose sugars.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 326. Which of the following statements about the use of the NADPH generated from the pentose phosphate pathway is not true?

- a. NADPH generated from the pentose phosphate pathway is used for steroid synthesis.
- b. NADPH generated from the pentose phosphate pathway and cytoplasmic NADH is metabolically interchangeable.
- c. NADPH generated from the pentose phosphate pathway is used for the regeneration of glutathione to its reduced state.
- d. NADPH generated from the pentose phosphate pathway is used for the synthesis of fatty acids.

Correct Answer: B

There are multiple uses for the NADPH produced from the pentose phosphate pathway. It is required for reductive biosyntheses such as in fatty acid synthesis and for the regeneration of oxidised glutathione to its reduced state. Glutathione is involved in the glutathione peroxidase system for protection against peroxides. NADPH is also used in the cytochrome P_{450} monooxygenase system for drug metabolism and in the hydroxylation of steroids for cholesterol and steroid production.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 327. What happens in an endergonic reaction?

- a. The reactants contain more free energy than the products.
- b. The reactants contain less free energy than the products.
- c. More activation energy is required.
- d. No activation energy is required.

Correct Answer: B

In endergonic reaction, free energy is gained, products have more free energy than reactants and the reaction is not spontaneous.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 328. Which of the following statements about the pentose phosphate pathway is not true?

- a. The pentose phosphate pathway relies on the availability of NADP^+ .
- b. The pentose phosphate pathway has an irreversible oxidative section and a reversible non oxidative section.
- c. The pentose phosphate pathway enables excess ribose to be metabolised.
- d. The pentose phosphate pathway relies on the availability of NADPH.

Correct Answer: D

The pentose phosphate pathway produces ribose-5-phosphate for nucleotide and nucleic acid synthesis and for coenzymes such as NAD^+ and FAD^+ . The pathway also supplies NADPH for reductive biosynthesis and it is a route for excess pentose sugars to be brought into the mainstream of glucose metabolism. The pathway has two main parts. The first is the irreversible oxidation of glucose-6-phosphate to ribose-5-phosphate while NADP^+ is reduced to NADPH and the rate-limiting reaction is catalyzed by glucose-6-phosphate dehydrogenase. Control of this part of the pathway is mainly by the availability of NADP^+ . The other part of the pentose

phosphate pathway is made up of reversible nonoxidative reactions that interconvert sugars according to the cell's needs using the enzymes transketolase and transaldolase.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 329. Haemolytic anaemia can be triggered in people deficient in glucose-6-phosphatase by infection. What is the mechanism?

- a. Infection is accompanied by generation of oxidants which destroy the erythrocyte membrane.
- b. Infection leads to weakening of erythrocyte cell membranes by the attachment of bacterial toxins.
- c. Infection compromises the immune system which is unable to protect the erythrocyte.
- d. None of the above

Correct Answer: A

Infection is accompanied by generation of oxidants which the erythrocyte cannot cope with as its antioxidant defences are low because of the absence of glucose-6-phosphate dehydrogenase which would normally lead to the production of NADPH and use the reducing power of NADPH to maintain antioxidant action through production of reduced glutathione. Immunoglobulins are not involved nor do toxins attack the membrane.

Core Concept:

Topic Name:

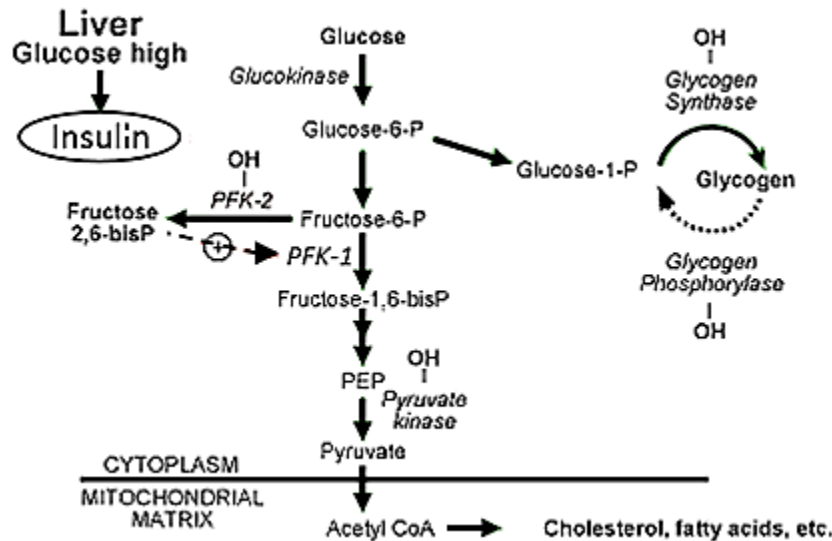
Complexity:

Difficulty Level: Difficult

Q. 330. Phosphofructokinase-1 (PFK-1) enzyme is regulated by insulin, but not via (de)phosphorylation, how is this regulation controlled?

- a. *Via* increased transcription of the gene encoding this enzyme.
- b. By recruitment of pre-existing enzyme from the golgi.
- c. An inhibitory subunit of the enzyme dissociates after binding cAMP.
- d. Via allosteric regulation by fructose-2, 6-bisphosphate.

Correct Answer: D



Activation of PFK-1 in liver is indirect, and occurs as follows dephosphorylation of the bifunctional PFK-2/Fructose-bisphosphatase enzyme places this enzyme in the PFK-2 mode, producing fructose-2,6-bis-P, which then allosterically activates PFK-1.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 331. How the 2,4-dinitrophenol uncouples electron transport from oxidative phosphorylation in mitochondria?

- It causes dissipation of the proton gradient generated by the electron transport.
- It allows the proton translocation function at ATP synthase while inhibiting its ATP synthesizing activity.
- It activates a second proton pump that sends back the protons into the mitochondrial matrix.
- It neutralizes the proton gradient by absorbing the protons generated during the electron transport.

Correct Answer: A

Oxidative phosphorylation is tightly coupled to electron transport. This means that blocking of the HTS system will prevent oxidative phosphorylation and importantly, that the reverse is true

also - blocking oxidative phosphorylation stops electron transport. Thus, at a resting state, oxidative phosphorylation is slowed considerably and the ETS system too stops - because the ever increasing gradient of H^+ becomes too difficult to pump more H^+ against. It is possible to "uncouple" these two processes as noted above, using agents that permeabilize the inner mitochondrial membrane to protons. Two such agents are 2, 4 -dinitrophenol (DNP) and carbonylcyanide-p-trifluoromethoxyphenylhydrazone (FCCP). An inhibitor such as DNP dissipates the proton gradient by transporting the protons into mitochondria at the sites other than F_0 proton channel.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 332. What is an important function of the pentose phosphate pathway?

- a. Generation of NADP needed in amino acid metabolism.
- b. Generation of NAD which is necessary for glycolysis.
- c. Generation of NADPH for fatty acid synthesis.
- d. Generation of NADH for the production of ATP by the electron transport chain

Correct Answer: A

The pentose phosphate pathway generates NADPH which is used for the synthesis of fat and compounds such as cholesterol and other steroids. It does not produce NAD or NADP or NADH.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 333. In case of Pentose Phosphate Pathway (PPP)

- a. only the C-1 carbon of glucose is oxidized to CO_2
- b. all the carbons of glucose are oxidized to CO_2
- c. no decarboxylation occurs

d. C-4 and C-5 of glucose are oxidized to CO_2

Correct Answer: A

Phosphogluconate dehydrogenase catalyzes oxidative decarboxylation of 6-phosphogluconate, to yield the 5-C ketose ribulose-5-phosphate. The hydroxyl at C_3 (C_2 of the product) is oxidized to a ketone. This promotes loss of the carboxyl at C-1 as CO_2 .

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 334. Which of the following statements about the use of the pentose phosphate pathway in red blood cells is correct?

- a. Mature red blood cells do not need the pentose phosphate pathway since they do not divide.
- b. Mature red blood cells need the pentose phosphate pathway for the production of NADPH.
- c. Mature red blood cells need the pentose phosphate pathway to oxidize the glucose-6-phosphate.
- d. Mature red blood cells do not need the pentose phosphate pathway since they do not synthesize fat.

Correct Answer: A

While mature red blood cells do not divide, or synthesize fat, they do utilize the pentose phosphate pathway for the production of NADPH which maintains glutathione in its reduced state to protect the cell against reactive oxygen species. It is involved in the glutathione peroxidase system for protection against peroxides.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 335. Choose the mismatch from the following given matches.

	Inhibitor	Function
a.	Malonate	Prevents oxidation of succinate

b.	Cyanide	inhibits cytochrome oxidase
c.	Oligomycin	inhibits ATP synthase
d.	Rotenone	Blocks CoQH_2 -cyt C- oxidoreductase

Correct Answer: D

Rotenone works by interfering with the electron transport chain in mitochondria. It inhibits the transfer of electrons from iron-sulfur centers in complex I to ubiquinone. This interferes with NADH during the creation of usable cellular energy (ATP).

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 336. High inhibits concentration of glucose- 6 -phosphate inhibits_____.

- a. fructokinase
- b. hexokinase
- c. glucokinase
- d. Both A and B

Correct Answer: B

A hexokinase is an enzyme that phosphorylates hexoses (six-carbon sugars), forming hexose phosphate. In most organisms, glucose is the most important substrate of hexokinases, and glucose- 6 -phosphate the most important product. Hexokinase can transfer an inorganic phosphate group from ATP to a substrate. Hexokinase is inhibited by the product of its reaction, glucose- 6 -phosphate. This is a very important regulatory step, since it prevents the consumption of too much cellular ATP to form G6P when glucose is not limiting.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 337. Which among the following statement is fake regarding the non-oxidative section of the pentose phosphate pathway?

- a. Glycolysis provide intermediates for the pentose phosphate pathway.
- b. There is a relationship between glycolysis and the pentose phosphate pathway in the liver.
- c. Both A and B
- d. The pentose phosphate pathway cannot provide pentoses in the quantities the cell requires.

Correct Answer: D

The pentose phosphate pathway begins with glucose-6-phosphate which is produced by the first step in glycolysis. Glucose-6-phosphate dehydrogenase, the first irreversible reaction, is the rate limiting step of the pentose phosphate pathway which provides NADPH for reductive biosyntheses and ribose-5-phosphate for nucleotide synthesis according to the cell's needs. If a fat cell needs to produce excess NADPH for fatty acid synthesis, the excess ribose-5-phosphate will be converted to glycolytic intermediates according to the cell's needs by the enzymes transketolase and transaldolase. If a cell is dividing intermediates from the glycolytic pathway can be converted to ribose-5-phosphate for DNA synthesis by the reversal of the transketolase and transaldolase reactions. This illustrates the relationship between the two pathways.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 338. Which of the following is the donor of new glucose molecules in glycogen?

- a. UDP-glucose-1-phosphate
- b. UDP-glucose
- c. UDP-glucose-6-phosphate
- d. Glucose-6-phosphate

Correct Answer: B

UDP-glucose, the glucose donor in the biosynthesis of glycogen, is an activated form of glucose, just as ATP and acetyl CoA are activated forms of orthophosphate and acetate, respectively. The C-1 carbon atom of the glucosyl unit of UDP-glucose is activated because its hydroxyl group is esterified to the diphosphate moiety of UDP. UDP-glucose is synthesized from glucose 1-phosphate and uridine triphosphate (UTP) in a reaction catalyzed by UDP-glucose pyrophosphorylase.

Core Concept:

Topic Name:

Complexity:

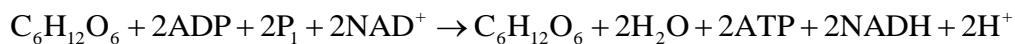
Difficulty Level: Medium

Q. 339. Each molecule of glucose, at the end of glycolysis, yield 2 molecules of _____ 2 molecules of _____ and a net of 2 molecules of _____.

- a. pyruvate; NADH; ATP
- b. CO₂; NAD⁺; ADP
- c. lactic acid; ethanol; CO₂
- d. H₂O; CO₂; ATP

Correct Answer: A

Glycolysis is a series of 10 reactions requiring two molecules of ATP to convert glucose to activated intermediates, followed by cleavage and conversions to two molecules of pyruvate. The summary below of glycolysis shows that the process produces two molecules of NADH and four molecules of ATP for a net yield of 2 ATP. A summary of glycolysis; the anaerobic generation of ATP:



Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 340. The natural uncoupler in brown fat mitochondria, thermogenin, generates heat based on its ability to

- a. inhibit electron transport by binding to *cyt b*.
- b. allow the protons to re-enter into the mitochondrial matrix.
- c. inhibit ATP production by binding to the ATP synthase.
- d. Both A and B

Correct Answer: B

Thermogenin (called uncoupling protein by its discoverers and now known as uncoupling protein 1 or UCP-1) is an uncoupling protein found in the mitochondria of brown adipose tissue (BAT).

It is used to generate heat by non-shivering thermogenesis. UCPs are transmembrane proteins that decrease the proton gradient generated in oxidative phosphorylation. They do this by increasing the permeability of the inner mitochondrial membrane, allowing protons that have been pumped into the intermembrane space to return to the mitochondrial matrix. UCPI-mediated heat generation in brown fat uncouples the respiratory chain, allowing for fast substrate oxidation with a low rate of ATP production.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 341. How the glucokinase is regulated by the insulin in the liver, but not via phosphorylation?

- a. By recruitment of pre-existing enzyme from the Golgi.
- b. *Via* allosteric regulation by fructose-2,6-bisphosphate.
- c. *Via* increased transcription of the gene encoding this enzyme.
- d. An inhibitory subunit of the enzyme dissociates after binding cAMP.

Correct Answer: C

This is a different type of regulation from the more rapid (de)phosphorylation mechanism, but is by no means unusual in metabolic systems. The actual mechanism of this insulin-initiated regulation is beyond the scope of this course. However, recall that glucokinase is the "high K_m " kinase for glucose, so there is really no reason for it to even be around if glucose concentrations stay low most of the time.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 342. Breakdown of glycogen to _____ is catalyzed by the enzyme glycogen phosphorylase.

- a. glucose
- b. glucose-1-phosphate
- c. glucose-6-phosphate

d. maltose

Correct Answer: C

Glycogen phosphorylase is one of the phosphorylase enzymes. Glycogen phosphorylase catalyzes the rate limiting step in glycogenolysis in animals by releasing glucose-1-phosphate from the terminal alpha-1, 4-glycosidic bond. Glycogen phosphorylase is also studied as a model protein regulated by both reversible phosphorylation and allosteric effects.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 343. Which among the following is the most important substrate for hexokinase?

- a. Glucose
- b. Sucrose
- c. Fructose
- d. All of the above

Correct Answer: A

A hexokinase is an enzyme that phosphorylates hexoses (six-carbon sugars), forming hexose phosphate. In most organisms, glucose is the most important substrate of hexokinases and glucose-6-phosphate the most important product. Hexokinase can transfer an inorganic phosphate group from ATP to a substrate.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 344. What is the site of electron transport chain?

- a. Outer membrane of the mitochondria.
- b. Inner membrane of the mitochondria.
- c. Matrix of the mitochondria.

d. None of the above

Correct Answer: B

The inner membrane of mitochondria contains the proteins of the electron transport chain and is the barrier allowing the formation of a H^+ gradient for ATP production through ATP synthetase.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 345. What do the incomplete oxidation of glucose into pyruvic acid called that Involves several steps?

- a. Krebs cycle
- b. TCA cycle
- c. Glycolysis
- d. None of the above

Correct Answer: C

Glycolysis is the biochemical change in which one molecule of glucose is converted into 2 molecules of pyruvic acid with the involvement of ten enzymes. It is independent of oxygen and is common to both aerobic and anaerobic condition. It takes place in cytoplasm and all the reactions are reversible. All the intermediates of glycolysis are not converted into pyruvic acid. Some of them build back the carbohydrates and the phenomenon is called as oxidative anabolism. TCA cycle and Krebs cycle are synonym where the pyruvic acid of glycolysis is utilized to form CO_2 . HMS is hexose monophosphate shunt or pentose phosphate pathway which is an alternative pathway of glycolysis.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 346. Which mineral Is associated with cytochrome activity?

- a. Cu

- b. Mg
- c. Cu and Mg
- d. Fe

Correct Answer: D

Cytochromes are generally membrane-bound hemoproteins that contain heme groups and carry out electron transport. The heme group is a highly conjugated ring system (which means its electrons are very mobile) surrounding a metal ion, which readily interconverts between the oxidation states. For many cytochromes the metal ion present is that of iron, which interconverts between Fe^{2+} (reduced) and Fe^{3+} (oxidized) states (electron-transfer processes) or between Fe^{2+} (reduced) and Fe^{3+} (formal, oxidized) states (oxidative processes). Cytochromes are thus capable of performing oxidation and reduction.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 347. In ____, NADP^+ is reduced to NADPH

- a. HMP
- b. TCA cycle
- c. PPP
- d. EMP

Correct Answer: A

HMP pathway generates NADPH molecule which are used as reductants in biosynthetic process under conditions when NADPH molecules are not generated by photosynthesis. It is, therefore, important in non- photosynthetic tissues such as in differentiating tissues, generating seeds and during periods of darkness. Production of NADPH is not linked to ATP generation in pentose phosphate pathway.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 348. What is the end product of glycolysis?

- a. Acetyl CoA
- b. Pyruvic acid
- c. ATP
- d. Glucose 1-phosphate

Correct Answer: B

In glycolytic cycle, each molecule of glucose (a hexose sugar) is broken down in step wise biochemical reactions under enzymatic control into two molecules of pyruvic acids. It takes place in cytosol.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 349. How is R.Q. represented?

- a. C/N
- b. N/C
- c. CO_2/O_2
- d. O_2/CO_2

Correct Answer: C

The respiratory quotient (or RQ or respiratory coefficient), is a dimensionless number used in calculations of basal metabolic rate (BMR) when estimated from carbon dioxide production. The respiratory quotient (RQ) is the ratio

$$\text{RQ} = \text{CO}_2 \text{ eliminated} / \text{O}_2 \text{ consumed}$$

Where the term "eliminated" refers to carbon dioxide (CO_2) removed ("eliminated") from the body.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Difficult

Q. 350. Which among the following statement is correct regarding the ATP?

- a. ATP can very easily diffuse through cell membranes.
- b. Hydrolysis of ATP is a strongly exergonic reaction.
- c. ATP is present in very high concentrations in the cell.
- d. All of the above

Correct Answer: B

If we consider cellular compounds containing a phosphoryl group, they can be divided into two categories low-energy phosphate compounds, the hydrolysis of which to liberate inorganic phosphate (P_i) is associated with negative ΔG^0 values in the range of about $9 - 20^{-1}$ and high-energy phosphate compounds with corresponding negative ΔG^0 values larger than about 30^{-1} . ATP is a 'high-energy phosphate compound'. It is transported to wherever work is to be performed in the cell, where the attached phosphates, known as high-energy phosphoryl groups, are converted back into inorganic phosphate ions with the liberation of the free energy that went into the formation of the groups in ATP. All reactions in the cell involving ATP must be enzymatically catalysed - the fact that hydrolysis of each of the two phosphoric anhydride groups is strongly exergonic (giving out energy) does not mean that ATP is an unstable or highly reactive molecule. Each cell contains only a small quantity of ATP at any one time. The amount would last only a very short time and the cell cannot get any ATP from the outside, since ATP, ADP, or AMP cannot diffuse through the cell membrane because they are highly charged. Each cell has to synthesize the molecule itself. ATP thus 'turns over' or cycles very rapidly in the cell, by which we mean it breaks down to ADP and P_i and is resynthesized to ATP.

Core Concept:

Topic Name:

Complexity:

Difficulty Level: Medium

Q. 351. How many total ATP are produced in EMP?

- a. 6
- b. 8

c. 24

d. 38

Correct Answer: B

Glycolysis is also known as EMP pathway after the names of its discoverers. Embden, Meyerhof and Paranas in glycolysis, 8 ATP are produced. 4 ATP are formed from substrate level phosphorylation, out of which 2 ATP are used up and net gain of 2 ATP. 6 ATP are produced from oxidative phosphorylation. Hence total ATP produced in glycolysis is 8 ATP.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 352. What is the connecting link between glycolysis and Krebs cycle before pyruvate entering Krebs cycle is changed?

a. Oxaloacetate

b. PEP

c. Pyruvate

d. Acetyl CoA

Correct Answer: D

End product of glycolysis is pyruvic acid which is converted into acetyl CoA before entering into the Krebs cycle, which is aerobic in nature.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 353. What is the process called that is involved in the synthesis of glucose from fat?

- a. Glycolysis
- b. Gluconeogenesis
- c. PPP
- d. None of the above

Correct Answer: B

Gluconeogenesis (GNG) is a metabolic pathway that results in the generation of glucose from non-carbohydrate carbon substrates such as pyruvate, lactate, glycerol, and glucogenic amino acids. While primarily odd-chain fatty acids can be converted into glucose, it is possible for at least some even-chain fatty acids. It is one of the two main mechanisms used by humans and many other animals to maintain blood glucose levels, avoiding (hypoglycemia). The other means of maintaining blood glucose levels is through the degradation of glycogen (glycogenolysis).

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 354. The enzymes that are either dephosphorylated or phosphorylated by insulin action (*e.g.* glycogen synthase, glycogen phosphorylase, PFK-2/FBPase-2 bifunctional enzyme and pyruvate kinase) are phosphorylated via glucagon and/or epinephrine action. The kinase that is responsible for these phosphorylation events is

- a. Protein kinase C
- b. Protein kinase A
- c. Calmodulin-dependent kinase
- d. Protein kinase B

Correct Answer: B

The general rule that insulin promotes dephosphorylation, while glucagon promotes phosphorylation via cAMP/protein kinase A, will hold up very well throughout the course.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 355. Which among the following statement could be used to correctly define the gluconeogenesis?

- a. Gluconeogenesis enables the liver to maintain blood glucose levels during starvation.
- b. Muscles have a large glycogen store which gives rise to blood glucose during prolonged starvation.
- c. The enzyme glucose-6-phosphatase hydrolyses glucose-6-phosphate and is present in most cells.
- d. None of the above

Correct Answer: A

The liver maintains blood glucose levels by breaking down its glycogen stores to release glucose into the blood but liver glycogen stores are exhausted after 24 hours of fasting. The brain and other cells such as red blood cells must have a constant supply of glucose to function normally. Unlike most other tissues these cells cannot use fatty acids. Fatty acids cannot penetrate the blood brain barrier; red blood cells lack mitochondria and cannot metabolise them. Gluconeogenesis is the production of glucose. It occurs in the liver in starvation. Glucose is released from glucose-6-phosphate by the enzyme glucose-6-phosphatase. Only liver and kidney have this enzyme though because of its small mass the latter is relatively insignificant in this respect. Amino acids released from muscle protein breakdown are the main source of carbon atoms for gluconeogenesis.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 356. During oxidation electrons are removed by _____, in glycolysis.

- a. ATP
- b. glyceraldehyde-3-phosphate
- c. NAD^+

d. molecular oxygen

Correct Answer: C

During glycolysis NAD (Nicotinamide adenine dinucleotide) removes electrons from 1,3-diphosphoglyceric acid using diphosphoglyceraldehyde dehydrogenase. NAD changes to NADH_2 and this is either utilized as such in anaerobic respiration or in the presence of oxygen.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 357. Metabolism of lactate by the 'Cori cycle'

- a. is taken up by the liver for synthesis of glucose.
- b. is removed from the blood as it inhibits glycolysis in erythrocytes.
- c. is used up by muscle cells.
- d. All of the above

Correct Answer: A

Lactate produced by the erythrocyte or muscle metabolism is taken to the liver where it enters the gluconeogenic pathway and returns to the circulation as glucose to be used by brain, erythrocyte etc. Reducing the risk of acidosis is also achieved, lactate certainly does not cause alkalosis. Lactate does not inhibit glycolysis in the erythrocyte, its production allows glycolysis to continue by regenerating NAD^+ . Lactate is not used by the muscle as fuel, it is produced by the muscle.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 358. The statement that is true regarding the use and synthesis of glucose in the body is that

- a. the brain can use glucose for all its energy needs.
- b. the red blood cells can use fatty acids for all their energy needs.

- c. Both A and B
- d. None of the above

Correct Answer: A

Glucose is essential for the brain, kidney medulla, red blood cells, retinal cells and any other cells without mitochondria. It cannot be made from acetyl-CoA and can only be made from any molecule that can be converted to pyruvate. The brain needs a constant supply of glucose to function normally. Fatty acids are unable to be used as a fuel source by the brain since they cannot cross the blood-brain barrier (they are reversibly bound to albumin in the circulation). Ketone bodies can be used as a proportion (40%) of the brain's fuel source, but it still requires a continual supply of glucose. Cells without mitochondria cannot use ketone bodies as a fuel.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 359. What is the main source of pyruvate used by the liver for gluconeogenesis?

- a. Pyruvate synthesized from acetyl-CoA
- b. Pyruvate released from muscles
- c. Alanine derived from breakdown of muscle proteins
- d. All of the above

Correct Answer: C

The main source of pyruvate used by the liver for gluconeogenesis is from the breakdown of muscle proteins promoted by the stress hormone cortisol. Several amino acids give rise to citric acid cycle acids and are converted to oxaloacetate. Pyruvate is converted to oxaloacetate by pyruvate carboxylase then to phosphoenolpyruvate by phosphoenolpyruvate carboxykinase. In muscles pyruvate accepts amino groups (from other amino acids), to form alanine which is released into the blood, In the liver it is converted back to pyruvate for gluconeogenesis.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 360. What is Oxidative phosphorylation?

- a. Process of formation of ATP in photosynthesis.
- b. Process of formation of NADPH in photosynthesis.
- c. Process of formation of ATP in respiration.
- d. Process of formation of NADH in respiration.

Correct Answer: C

In electron transport system the hydrogen donated by succinate is accepted by FAD^+ which is reduced to FADH_2 . This hydrogen dissociates into electrons and protons and then passes through a series of carriers involving the phenomenon of oxidation and reduction. During this flow, ATP synthesis occurs at different steps and the phenomenon is called as oxidative phosphorylation.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 361. What Is the effect of ethanol metabolism on gluconeogenesis?

- a. Metabolism of ethanol by the liver decreases the NADH/NAD^+ ratio reducing its ability to perform gluconeogenesis.
- b. Metabolism of ethanol by the liver increases the NADH/NAD^+ ratio reducing its ability to perform gluconeogenesis.
- c. Reduction of ethanol by the liver increases the NADH/NAD^+ ratio reducing its ability to perform gluconeogenesis.
- d. None of the above

Correct Answer: B

Ethanol is oxidised to acetaldehyde in the liver cytoplasm by alcohol dehydrogenase. This is oxidised to acetate by acetaldehyde dehydrogenase in the mitochondria. Two NADH molecules are produced in the liver cell from each ethanol molecule. Intake of large amounts of alcohol

results in the cellular NADH/NAD^+ ratio being increased. Several dehydrogenases such as lactate dehydrogenase can be inhibited by this so that the pyruvate/lactate equilibrium is disturbed resulting in reduced amounts of pyruvate available for gluconeogenesis. Excessive drinking often results in reduced food intake so that dietary sources of glucose diminish. This coupled with impaired gluconeogenesis can result in inadequate supply of glucose to the brain in extreme cases with dangerous consequences.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 362. The statement that is correct regarding gluconeogenesis is

- a. glucose-6-phosphatase hydrolyses glucose-6-phosphate and is found in liver and muscle.
- b. glucose-6-phosphatase hydrolyses glucose-6-phosphate to release glucose into the blood.
- c. Both A and B
- d. None of the above

Correct Answer: B

Gluconeogenesis involves reversal of several glycolytic reactions but there are three reactions that need to be bypassed because of thermodynamic considerations which make them irreversible. These are; the phosphorylation of glucose to glucose-6-phosphate using ATP, the phosphorylation of fructose-6-phosphate to fructose-1,6-bisphosphate, again with ATP. The third is the conversion of phosphoenolpyruvate (PEP) to pyruvate using pyruvate kinase. This forms ATP. In gluconeogenesis, pyruvate is first converted into oxaloacetate by the ATP-dependent pyruvate carboxylase reaction. This is then converted into PEP by PEP carboxykinase using GTP. The PEP is converted to fructose-1,6-bisphosphate then hydrolysed by fructose-1,6-bisphosphatase. Glucose-6-phosphate is hydrolysed by glucose-6-phosphatase to release glucose into the blood.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 363. All the statements regarding the gluconeogenesis are correct, except

- a. Fatty acids from the hydrolysis of triacylglycerols can be used as a carbon source in gluconeogenesis.
- b. Lactate from vigorous muscle activity can be used as a carbon source in gluconeogenesis.
- c. Glycerol from the hydrolysis of triacylglycerols is converted to glucose in gluconeogenesis.
- d. None of the above

Correct Answer: A

Fatty acids from the hydrolysis of triacylglycerols cannot be used as a carbon source in gluconeogenesis. Fatty acids are oxidised to acetyl-CoA, but the latter cannot be converted to pyruvate, so fatty acids cannot be converted to glucose. Lactate from muscle vigorous muscle activity can be used as a carbon source in gluconeogenesis. It travels via the blood to the liver where it is first converted to pyruvate by lactate dehydrogenase, then to glucose by gluconeogenesis. Glycerol from the hydrolysis of triacylglycerols in adipose cells travels to the liver and is converted to glucose in gluconeogenesis. The enzyme glycerol kinase converts the glycerol to glycerol-3-phosphate. It enters the gluconeogenesis pathway via dihydroxyacetone phosphate. Red blood cells can only undergo anaerobic glycolysis since they have no mitochondria so they produce lactate. The lactate travels to the liver where it is converted to pyruvate and is used as a carbon source in gluconeogenesis.

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

Q. 364. After the hydrolysis of triacylglycerols in the capillaries of adipose tissues, what happens to its glycerol part?

- a. It is transported to the kidney where it can be used as a buffer for H^+ released in metabolism.
- b. It is transported to the liver where it can enter the glycolytic or gluconeogenic pathway.
- c. It enters the adipocyte and is phosphorylated so that re-esterification of the released fatty acids can take place inside the cell.

d. It is transported to the muscle to be used as fuel.

Correct Answer: D

Glycerol is transported to the liver where it can enter glycolysis or gluconeogenesis depending on the metabolic situation. It cannot be phosphorylated in the adipocyte as it lacks glycerol kinase which is present in the liver. Glycerol is not a fuel used by muscle and it not able to buffer hydrogen ions as it is an alcohol.

Core Concept:

Topic:

Complexity:

Difficulty Level: Difficult

1.F Enzymology

Q. 365. _____ is an active enzyme that is made up of polypeptide chain and co-factor.

- a. Apoenzyme
- b. Holoenzyme
- c. Abenzyme
- d. Co-enzyme

Correct Answer: B

Holoenzyme is a catalytically active enzyme consisting of an apoenzyme combined with its cofactor. Holoenzymes are made up of two components apoenzyme (protenaceous part) and co factor (non-protenaceous part).

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 366. Which among the following is the property of competitive inhibitor?

- a. It increases the K_m , of an enzyme.
- b. It decreases the K_m , of an enzyme.
- c. It increases both the V_{max} , and the K_m of an enzyme.
- d. It decreases the K_m but increases the V_{max} of an enzyme.

Correct Answer: A

An enzyme inhibitor is a molecule that binds to an enzyme and decreases its activity. In competitive inhibition, the substrate and inhibitor cannot bind to the enzyme at the same time. This usually results from the inhibitor having an affinity for the active site of an enzyme where the substrate also binds; the substrate and inhibitor compete for access to the enzyme's active site. This type of inhibition can be overcome by sufficiently high concentrations of substrate (V_{max} remains constant), i.e. by out-competing the inhibitor. However, the apparent K_m will increase as it takes a higher concentration of the substrate to reach the K_m point, or half the V_{max} .

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 367. Catalytic activity of enzyme is restricted to which portion?

- a. Passive site
- b. Active site
- c. Allosteric site
- d. All of the above

Correct Answer: B

The active site is a small port in an enzyme where substrate molecules bind and undergo a chemical reaction.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 368. Which of the statements given below correctly describe the active site of an enzyme?

- a. An active site of an enzyme binds the substrate of the reaction it catalyzes less tightly than it does the transition state intermediate.
- b. An active site of an enzyme binds the substrate of the reaction it catalyzes more tightly than it does the transition state intermediate.
- c. An active site of an enzyme binds the product of the reaction it catalyzes more tightly than it does the transition state intermediate.
- d. All of the above

Correct Answer: A

The active or catalytic site of an enzyme is a very small part of the overall molecule, It is a three-dimensional pocket or cleft where the substrates) are aligned and bind reversibly via several weak, non-covalent bonds. These bonds are short range, directional and confer specificity. The substrate molecule(s) form a transition state intermediate which rapidly converts to products because it is unstable. The amino acid groups in the active site help to stabilize the electron distribution of the transition state. The latter binds to the enzyme (active site) more tightly than the substrate in its ground state liberating energy. The active site of the enzyme is therefore complementary to the transition state intermediate. This lowers the energy of activation for the reaction thus increasing the reaction rate. The active site may also position a metal group that may facilitate the reaction.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 369. Which among the following statements correctly describe the Michaelis-Menten kinetics?

- a. K_m , the Michaelis constant, is expressed in terms of reaction velocity.
- b. K_m , the Michaelis constant, is defined as the concentration of substrate required for the reaction to reach maximum velocity.
- c. K_m , the Michaelis constant, is defined as the dissociation constant of the enzyme-substrate complex.

d. K_m , the Michaelis constant, is a measure of the affinity the enzyme has for its substrate.

Correct Answer: D

An enzyme that displays hyperbolic kinetics (single substrate enzyme) is referred to as a Michaelis-Menten enzyme. For such an enzyme, the plot of velocity of the reaction against substrate concentration is hyperbolic. The Michaelis-Menten equation describes the kinetics of such an enzyme at initial rates before any product is formed. The Michaelis-Menten equation can be used to calculate the Michaelis constant (K_m). This is defined as that concentration of substrate at which the enzyme is working at half maximum velocity. K_m is expressed in units of molar concentration and is independent of the enzyme concentration. K_m is also a measure of the affinity that the enzyme has for its substrate *i.e.* the higher the K_m , the lower the affinity of the enzyme for its substrate.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 370. Koshland proposed _____ model.

- a. lock and key
- b. refractive index
- c. induced fit
- d. All of the above

Correct Answer: C

Induced fit model is a model for enzyme-substrate interaction to describe that only the proper substrate is capable of inducing the proper alignment of the active site that will enable the enzyme to perform its catalytic function. It suggests that the active site continues to change until the substrate is completely bound to it, at which point the final shape and charge is determined. The induced fit model or the hand in glove model was proposed by Daniel E Koshland. Daniel Edward Koshland was an American biochemist.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 371. The nature of an enzyme catalysis can be correctly defined with which of the following statement?

- a. An enzyme can lowers the energy of activation of the reaction it catalyzes by increasing the molecular collisions.
- b. An enzyme lowers the activation energy of the reaction and can also change the equilibrium position of the reaction it catalyzes.
- c. An enzyme lowers the activation energy of reaction but cannot change the equilibrium position of the reaction it catalyzes.
- d. None of the above

Correct Answer: C

For a biochemical reaction to occur, an energy barrier has to be overcome even if the reaction has a strong negative G (the free energy difference between the reactant(s) and product(s)). A substrate or reactant is first activated to form a higher energy transition state intermediate that is very unstable and rapidly converts to product(s). The energy required for this is the activation energy. In an uncatalyzed reaction, this energy is supplied by molecular collisions. In a catalyzed reaction, the enzyme positions the substrate molecule(s) in the most favorable relative orientation to form the transition state intermediate. The latter binds to the enzyme more tightly than the substrate (in its ground state) and stabilizes it. An enzyme can therefore increase the rate of the reaction it catalyzes by lowering the energy of activation but it cannot affect the equilibrium of the reaction.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 372. Inhibition of Succinic dehydrogenase by malonic acid is an example of_____.

- a. competitive inhibition
- b. non-competitive inhibition
- c. uncompetitive inhibition
- d. Both B and C

Correct Answer: A

The classic example of competitive inhibition is inhibition of succinate dehydrogenase, an enzyme, by the compound malonate. The structure of malonate is very similar to that of succinate. The enzyme will bind malonate but cannot act further on it. That is, the enzyme and inhibitor form a nonproductive complex. We call this competitive inhibition, as succinate and malonate appear to compete for the same site on the enzyme. With competitive inhibition, the percent of inhibition is a function of the ratio between inhibitor and substrate, not the absolute concentration of inhibitor.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 373. Which of the following statements correctly illustrates the competitive inhibition of an enzyme catalyzed reaction?

- a. The V_{\max} for a reaction remains unchanged in the presence of a competitive inhibitor.
- b. The V_{\max} and K_m (Michaelis constant) both remain unchanged in the presence of a competitive inhibitor.
- c. A competitive inhibitor and substrate can bind to the enzyme simultaneously.
- d. The K_m for a reaction remains unchanged in the presence of a competitive inhibitor.

Correct Answer: A

Competitive inhibitors have a similar structure to the substrate and compete with the latter for binding to the active site of an enzyme. A competitive inhibitor binds reversibly to the active site. It will have no effect on the reaction at infinite substrate concentration since the substrate will win in the competition to bind to the enzyme active site. Consequently, a competitive inhibitor and substrate cannot bind simultaneously to the enzyme. A comparison of the double

reciprocal plots of an enzyme reaction with and without competitive inhibitor shows that V_{\max} , the maximum velocity for the reaction, remains unchanged in the presence of a competitive inhibitor K_m , the Michaelis constant for the reaction, increases in the presence of a competitive inhibitor. This is because the affinity that the enzyme has for its substrate is reduced in the presence of a competitive inhibitor.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 374. Allosteric enzymes

- show Michaelis-Menten kinetics.
- are typically single-subunit enzymes.
- show greater sensitivity to changes in substrate concentration compared to classical type enzymes with hyperbolic kinetics.
- None of the above

Correct Answer: C

Allosteric enzymes are multi-subunit proteins which have allosteric sites ('allo' means other) separate from the active site to which bind allosteric modifiers (activators or inhibitors). These cause conformational changes in the enzyme, giving sigmoidal kinetics rather than the hyperbolic kinetics of classical enzymes. This affects the affinity of the enzyme for its substrate and hence the activity of the enzyme. An allosteric activator increases the affinity whereas an inhibitor decreases it. The sigmoid kinetics means that over a critical range, the enzyme is more sensitive to changes in substrate concentration than is the case for those with hyperbolic kinetics.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 375. Which among the following statements is correct regarding the mechanism of the catalytic triad or chymotrypsin?

- a. A proton moves from the serine to the histidine side chain in the catalytic triad of chymotrypsin.
- b. A proton moves from the aspartate to the serine to the histidine side chain in the catalytic triad of chymotrypsin.
- c. A proton moves from the serine to the histidine to the aspartate side chain in the catalytic triad of chymotrypsin.
- d. A proton moves from the aspartate to the histidine side chain in the catalytic triad of chymotrypsin.

Correct Answer: A

The active site of chymotrypsin consists of a catalytic triad of serine, histidine and aspartate amino acid residues. The histidine acts as a general base by accepting a proton from the serine. The serine oxygen now makes a nucleophilic attack on the carbonyl carbon of the susceptible peptide bond forming a tetrahedral intermediate. The histidine proton is then transferred to the tetrahedral intermediate produced causing it to break down. An acylated enzyme is formed and the first product is liberated. The histidine side chain again acts as a base accepting a proton from a water molecule, activating it and forming a second tetrahedral intermediate. As before, the protonated histidine (now an acid), donates its acquired proton back to the tetrahedral intermediate, completing the reaction. The aspartate holds the histidine side chain in the correct orientation to accept the proton from the serine.

Core Concept:

Topic:

Complexity:

Difficulty Level: Medium

Q. 376. In alcoholic fermentation, which of the following enzyme complex is involved?

- a. Hydrolase
- b. Invertase
- c. Zymase
- d. Amylase

Correct Answer: C

The ability of yeast cells to convert sugar into Carbon dioxide and Alcohol is down to enzymes. Several enzymes are involved each does its step in the process. The final step is zymase reduction which takes the end product of the other enzymes (acetaldehyde/glycerol) and turns this into good old ethyl alcohol.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 377. Fluorouracil drug that is used for the treatment of cancer, after series of changes, binds to Thymidylate synthase and block its cell division. What is the most probable mode of action of this drug?

- a. It acts as allosteric enzyme.
- b. It acts as competitive enzyme.
- c. It acts as non-competitive enzyme.
- d. It acts as suicidal enzyme.

Correct Answer: D

5 -fluorouracil acts as a suicide inhibitor of thymidylate synthase during the synthesis of thymine from uridine. This reaction is crucial for the proliferation of cells, particularly those that are rapidly proliferating (such as fast-growing cancer tumors). By inhibiting this step, cells die from a thymineless death because they have no thymine to create more DNA. This is often used in combination with Methotrexate, a potent inhibitor of dihydrofolate reductase enzyme.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 378. Which of the following descriptions best describes an induced fit?

- a. The process by which an active site alters shape such that it is ready to accept a substrate.
- b. The process by which a substrate adopts the correct binding conformation before entering an active site.
- c. The process by which a substrate binds to an active site and alters the shape of the active
- d. None of the above

Correct Answer: C

An induced fit is a consequence of the binding interactions taking place between a substrate and the active site. The active site cannot undergo the induced fit before these interactions occur and so option a) is wrong. The substrate has to be in the correct conformation for binding to occur but this is not an induced fit, and so option b) is wrong. Option d) is wrong since the active site has no control over whether the substrate will be in the active conformation when it enters the active site.

Core Concept:

Topic Name:

Complexity:

Difficulty Level:

Q. 379. What is the substance called that reduces the effectiveness of a catalyst?

- a. Enzyme inhibitors
- b. Promoters
- c. Poisoning catalyst
- d. None of these

Correct Answer: C

Catalyst poisoning refers to the partial or total deactivation of a catalyst caused by exposure to a range of chemical compounds. Poisoning may be desirable when it results in improved selectivity (e.g. Lindlar's catalyst) but may be undesirable when the catalyst is rendered ineffective (e.g. in catalytic converters). Poisoning refers specifically to chemical deactivation, rather than other mechanism of catalyst degradation such as thermal decomposition or physical damage.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 380. What is the process called when catalysts and reactants are in more than one phase?

- a. Catalysis
- b. Heterogeneous catalysis
- c. Homogeneous catalysis
- d. All of the above

Correct Answer: B

In chemistry, heterogeneous catalysis refers to the form of catalysis where the phase of the catalyst differs from that of the reactants. Phase here refers not only to solid, liquid or gas, but also immiscible liquids, *e.g.* oil and water. The great majority of practical heterogeneous catalysts are solids and the great majority of reactants are gases or liquids.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 381. What are abzymes?

- a. Zymogens
- b. Enzymes that hydrolyze antibodies.
- c. Antibodies that have catalytic activity.
- d. All of the above

Correct Answer: C

An abzyme (from antibody and enzyme), also called catmab (from catalytic monoclonal antibody) and most often called catalytic antibody, is a monoclonal antibody with catalytic activity.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 382. Activity of an enzyme is sensitive to

- a. temperature
- b. pH
- c. Both A and B
- d. Only the active site

Correct Answer: C

Enzymes are very sensitive to the conditions at which they work. Many enzymes work best at a particular pH and stop working if the pH becomes too acidic or alkaline. Enzymes are also sensitive to temperature. Many work best at temperatures close to body temperatures and most lose their ability to catalyse if they are heated above 60°C or 70°C.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 383. Which of the following inhibitor types is expected to change the K_m of an enzyme, but not the V_{max} ?

- a. Uncompetitive
- b. Competitive
- c. Non-competitive
- d. Inhibitory

Correct Answer: B

The value of K_m as a measurement of affinity, the presence of a competitive inhibitor effectively lowers the enzyme's affinity for its substrate. As we can see from the Michaelis-Menten plot, the value of K_m has increased, it takes a higher concentration of substrate to reach half of V_{max} . The value of V_{max} tells us the maximum velocity (rate) at which an enzyme can work in the presence of infinite substrate. The presence of a competitive inhibitor does not affect the value of V_{max} , this tells us that the effect of a competitive inhibitor can be overcome by increasing substrate concentration.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 384. What secondary messenger is generated as a result of the action of nitrous oxide?

- a. cyclic GMP
- b. GTP
- c. cyclic AMP
- d. Both A and C

Correct Answer: A

Nitrous oxide activates cyclase enzymes to generate the secondary messenger cyclic GMP from GTP. Cyclic AMP is a secondary messenger generated from ATP by a different enzyme that is activated by G-proteins.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 385. All the following statements regarding the allosteric enzymes are false, except

- a. allosteric enzymes display Michaelis-Menten kinetic.
- b. allosteric enzymes control metabolism.
- c. allosteric enzymes are usually single subunit enzymes.
- d. All the statements are false.

Correct Answer: B

Allosteric enzymes are regulatory enzymes. Their activities are controlled by chemical signals in the cell and which, in turn, control metabolism. Allosteric enzymes do not have hyperbolic kinetics nor do they follow Michaelis-Menten kinetics. Allosteric enzymes are not usually single subunit enzymes. They are made up of multiple subunits assembled into a single enzyme complex by non-covalent bonds and have more than one active site.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 386. All the given statements are correct about the effect of increasing temperature on enzyme activity, except

- a. kinetic energy of the molecules changes after rising the temperature.
- b. it is not suitable to store enzymes at or below 5°C .
- c. activity of an enzyme increase by 5–100% with every 1°C rise in temperature.
- d. at temperature above 40°C all the animal enzyme gets degraded.

Correct Answer: B

Over a period of time, enzymes will be deactivated at even moderate temperatures. Storage of enzymes at 5°C or below is generally the most suitable. Some enzymes lose their activity when frozen.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 387. Competitive Inhibition of an enzyme-catalyzed reaction

- a. can be overcome by the addition of large amounts of substrate to a reaction.
- b. cannot be overcome by the addition of large amounts of substrate to a reaction.
- c. decreases the V_{\max} of a reaction.
- d. None of the above

Correct Answer: A

Competitive inhibition can be overcome by the addition of large amounts of substrate to a reaction. Both the substrate and the competitive inhibitor bind to the active site of the enzyme. Consequently a competitive inhibitor will have no effect at infinite substrate concentration since the substrate will completely win in the competition to bind to the active site. Competitive inhibitors can only bind to the enzyme at the active site. They cannot bind to the enzyme-substrate complex.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 388. Which among the following statements is false about the Lineweaver-Burk plots?

- a. A Lineweaver-Burk plot for a classical enzyme is a straight line.
- b. A Lineweaver-Burk plot for a classical enzyme can provide estimates of V_{\max} and K_m by linear extrapolation.
- c. All enzyme-catalyzed reactions give a linear Lineweaver-Burk plot.
- d. None of the above

Correct Answer: C

When the reciprocal of the velocity of a reaction is plotted against the reciprocal of the substrate concentration, a double reciprocal or Lineweaver-Burk plot is obtained. For a classical single substrate enzyme, the hyperbolic curve obtained by plotting the reaction velocity against the substrate concentration becomes a straight line which can be extrapolated. The intercept on the Y axis becomes the reciprocal of V_{\max} the maximum velocity of the reaction at infinite substrate concentration. The intercept on the X axis becomes the negative reciprocal of the K_m the Michaelis constant. Not all enzymes give linear Lineweaver-Burk plots. Allosteric enzymes, which display a sigmoidal curve by plotting the reaction velocity against the substrate concentration, give curved double reciprocal plots.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 389. From which of the following amino acid is nitrous oxide generated?

- a. Aspartic acid
- b. Arginine
- c. Glutamic acid
- d. Both A and C

Correct Answer: B

Arginine contains a guanidine functional group that provides the nitrous oxide. The enzyme NO synthase converts arginine to citrulline with release of nitrous oxide.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 390. Co-enzymes are

- a. proteins
- b. non-proteins
- c. lipids
- d. sugars

Correct Answer: B

Coenzymes are non-protein organic molecules that are mostly derivatives of vitamins soluble in water by phosphorylation; they bind apoenzyme to proteins to produce an active holoenzyme.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 391. What reagent would be useful to determine the C-terminal amino acid of a polypeptide chain?

- a. Carboxypeptidase
- b. Phenyl isothiocyanate
- c. 1N HCl
- d. Trypsin

Correct Answer: A

A carboxypeptidase is a protease enzyme that hydrolyzes (cleaves) a peptide bond at the carboxy-terminal (C-terminal) end of a protein or peptide.

Core Concept:

Topic:

Complexity:

Difficulty Level:

Q. 392. The peptide, Ala-Arg-Gln-Met-Thr-Trp-Lys-Val, was digested with trypsin to produce?

- a. Ala - Arg + Gln - Met - Thr-Trp + Lys-Val
- b. Ala - Arg - Gln-Met + Thr-Trp - Lys - Val
- c. Ala - Arg - Gln - Met - Thr-Trp + Lys - Val
- d. Ala - Arg + Gln - Met -Thr-Trp -Lys + Val

Correct Answer: D

Trypsin is a serine protease from the PA clan super family, found in the digestive system of many vertebrates, where it hydrolyses proteins. Trypsin is produced in the pancreas as the inactive protease trypsinogen. Trypsin cleaves peptide chains mainly at the carboxyl side of the amino acids lysine or arginine, except when either is followed by proline. It is used for numerous biotechnological processes. The process is commonly referred to as trypsin proteolysis or trypsinisation, and proteins that have been digested/treated with trypsin are said to have been trypsinized.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 393. Which among the following statement regarding the Michaelis-Menten kinetics is false?

- a. The Michaelis constant (K_m) of an enzyme is unchanged when the enzyme concentration is increased.
- b. A low Michaelis constant (K_m) indicates a high affinity of an enzyme for its substrate.

c. The Michaelis constant (K_m) of an enzyme increases when the enzyme concentration is increased.

d. None of the above

Correct Answer: C

For a classical Michaelis-Menten (single substrate) enzyme, the plot of velocity of the reaction against substrate concentration is hyperbolic. The Michaelis-Menten equation describes the kinetics of such an enzyme at initial rates before any product is formed and can be used to calculate the Michaelis constant (K_m). This constant is defined as that concentration of substrate at which the enzyme is working at half maximum velocity. K_m is also a measure of the affinity that the enzyme has for its substrate. The higher the K_m the lower the affinity of enzyme for its substrate. K_m is independent of the enzyme concentration. Allosteric enzymes are a class of enzymes that are not regarded as classical Michaelis-Menten enzymes. They display sigmoidal rather than hyperbolic kinetics.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 394. Which among the following enzyme is most likely to be deficient, if a 3 month old infant got infected with hepatosplenomegaly and fall to thrive? A liver biopsy reveals glycogen with an abnormal, amylopectin like structure with long outer chains and missing branches.

a. Branching enzyme

b. Alfa amylase

c. Both A and B

d. Debranching enzyme

Correct Answer: A

During the process of glycogen synthesis, branching enzyme creates branch points and further elongation is carried out glycogen synthase. In its deficiency stored glycogen is abnormal in chemistry, in the form of long polysaccharide chains with few branch points, resembling the

structure of amylopectin, thus this defect is also called amylopectinosis. Alfa amylase is an enzyme for the digestion of starch and glycogen. Debranching enzyme deficiency, results in the accumulation of abnormal glycogen. There is inability to remove the branch points, the resultant structure resembles limit dextrins and thus it is also called limit dextrinosis.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 395. Name the enzyme which catalyze the reactions that involve transfer of electrons

- a. Isomerases
- b. Transferases
- c. Oxidoreductases
- d. Lyases

Correct Answer: C

An oxidoreductase is an enzyme that catalyzes the transfer of electrons from one molecule, the reductant, also called the electron donor, to another, the oxidant, also called the electron acceptor. This group of enzymes usually utilizes NADP or NAD^+ as cofactors.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 396 Isozymes can be easily characterized by

- a. antibodies that shows catalytic activities.
- b. differences in their amino acid sequences.
- c. differences in the chemical reactions that they catalyse.
- d. All of the above

Correct Answer: B

Isozymes (also known as isoenzymes or more generally as multiple forms of enzymes) are enzymes that differ in amino acid sequence but catalyze the same chemical reaction. These enzymes usually display different kinetic parameters (*e.g.* different K_m values), or different regulatory properties.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 397 _____ is a substrate specific enzyme.

- a. Phosphofructokinase
- b. Urease
- c. Hexokinase
- d. Lactase

Correct Answer: D

Lactase is an enzyme that breaks lactose down into galactose and glucose. People who are lactose intolerant can purchase lactase in pill form. These people lack the enzyme, lactase, and cannot break down the sugar lactose into its component parts. Although lactose is similar to sucrose, lactase will break down only lactose because of the shape of the sugar.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 398. Which among the following given peptide sequence is most likely to be cleaved by the trypsin digestive enzyme?

- a. -----Val-Lys-Pro-Met-----
- b. -----Arg-Val-Phe-Tyr-----
- c. -----Trp-Asp-Gln-Pro-----

d. -----Glu-Gly-Trp-Gly-----

Correct Answer: B

Trypsin is a serine protease from the PA clan superfamily, found in the digestive system of many vertebrates, where it hydrolyses proteins. Trypsin is produced in the pancreas as the inactive protease trypsinogen. Trypsin cleaves peptide chains mainly at the carboxyl side of the amino acids lysine or arginine, except when either is followed by proline.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 399. Which among the following given statement is true regarding the Michaelis-Menten hypothesis?

- a. It enables to calculate the isoelectric point of an enzyme.
- b. It postulates the formation of enzyme-substrate complex.
- c. It postulates that all the enzymes are proteins.
- d. None of the above

Correct Answer: B

The Michaelis-Menten model (I) is the one of the simplest and best-known approaches to enzyme kinetics. It takes the form of an equation relating reaction velocity to substrate concentration for a system where a substrate S binds reversibly to an enzyme E to form an enzyme-substrate complex ES , which then reacts irreversibly to generate a product P and to regenerate the free enzyme E .

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 400. The reciprocal of Michaelis-Menten equation can be represented as

- a. $1/V = K_m + [S]/V_{max} [S]$
- b. $V/[S] = V/K_m + V_{max}/K_m$
- c. $V = K_{cat}/K_m [E]t [s]$
- d. $V = V_{max} [S]/K_m + [S]$

Correct Answer: A

The Michaelis-Menten equation can be transformed into a linear equation by taking the reciprocal of both sides as,

$$\frac{1}{V} = \frac{K_m + [S]}{V_{max} + [S]} = \left(\frac{K_m}{V_{max}} \right) \frac{1}{[S]} + \frac{1}{V_{max}}$$

This new equation is called the Lineweaver-Burk equation after the researchers who derived it in 1934. The Lineweaver-Burk equation is a linear equation, where $1/V$ a linear function of $1/[S]$ instead of V being a rational function of $[S]$. The Lineweaver-Burk equation can be readily represented graphically to determine the values of K_m and V_{max} .

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 401. Allosteric inhibition of an enzyme involves

- a. binding of a negative modulator to a site other than the substrate binding site.
- b. binding of a negative modulator competitively to the substrate binding site.
- c. binding of a negative modulator non-competitively to the substrate binding site.
- d. cooperative binding of substrate to an enzyme.

Correct Answer: A

Allosteric regulation is the regulation of a protein by binding an effector molecule at a site other than the protein's active site. The site the effector binds to is termed the *allosteric site*. Allosteric sites allow effectors to bind to the resulting in a conformational change. Effectors that enhance

the protein's activity are referred to as allosteric activators, whereas those that decrease the protein's activity are called allosteric inhibitors.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 402. Why do Bisphosphoglycerate (BPG) cannot bind to the oxygenated R state of hemoglobin?

- a. It is displaced from the heme by the movement of proximal histidine.
- b. Its binding pocket becomes too small to accommodate BPG.
- c. It is displaced from the heme by oxygen.
- d. BPG binds to the R state with the same affinity as the T state.

Correct Answer: B

2,3-Bisphosphoglyceric acid is a three-carbon isomer of the glycolytic intermediate 1,3-bisphosphoglyceric acid (1,3-BPG). 2,3-BPG is present in human red blood cells at approximately 5 mmol/L. It binds with greater affinity to deoxygenated hemoglobin (*e.g.* when the red cell is near respiring tissue) than it does to oxygenated hemoglobin (*e.g.*, in the lungs) due to spatial changes 2,3-BPG (with an estimated size of about 9 angstroms) fits in the deoxygenated hemoglobin configuration (11 angstroms), but not as well in the oxygenated (5 angstroms). It interacts with deoxygenated hemoglobin beta subunits by decreasing their affinity for oxygen, so it allosterically promotes the release of the remaining oxygen molecules bound to the hemoglobin, thus enhancing the ability of RBCs to release oxygen near tissues that need it most. 2,3-BPG is thus an allosteric effector.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 403. What is the role of kinase enzyme?

- a. Removes phosphate groups of substrates.
- b. Uses ATP to add a phosphate group to the substrate.
- c. Uses NADH to change the oxidation state of the substrate.
- d. None of the above

Correct Answer: B

A kinase is a type of enzyme that catalyzes the transfer of phosphate groups from high-energy, phosphate-donating molecules to specific substrates. This process is known as phosphorylation when the substrate gains a phosphate group and the high energy molecule of ATP donates a phosphate group (producing a phosphorylated substrate and ADP).

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 404. Which of the following statement is true regarding amino transferases?

- a. This enzyme usually require α - ketoglutarate or glutamine as one of the reacting pair.
- b. This enzyme catalyzes the reaction that results in the production of amino acids.
- c. This enzyme requires pyridoxal phosphate as an essential cofactor.
- d. All of the above

Correct Answer: C

Amino transferases or transaminases are a group of enzymes that catalyze the interconversion of amino acids and oxoacids by transfer of amino groups. All amino transferases require pyridoxal phosphate (derived from vitamin B₆) as a cofactor.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 405. Which among the following equations represent the Henderson's equation?

- a. $\text{pH} = \text{pK}_a + \log \frac{[\text{Acid}]}{[\text{Salt}]}$
- b. $\text{pH} = \text{pK}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$
- c. $\text{pK}_a = \text{pH} + \log \frac{[\text{Salt}]}{[\text{Acid}]}$
- d. $\text{pK}_a = \text{pH} - \log \frac{[\text{Salt}]}{[\text{Acid}]}$

Correct Answer: B

In chemistry, the Henderson-Hasselbalch equation describes the derivation of pH as a measure of acidity (using pKa, the negative log of the acid dissociation constant) in biological and chemical systems. The equation is also useful for estimating the pH of a buffer solution and finding the equilibrium pH in acid-base reactions (it is widely used to calculate the isoelectric point of proteins).

The equation is given by

$$\text{pH} = \text{pK}_a + \log_{10} \left(\frac{[\text{A}^-]}{[\text{HA}]} \right)$$

Formula to calculate the acidic buffer is $\text{pH} = \text{pka} + \log \frac{\text{conc.salt}}{\text{conc.acid}}$.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 406. RNAs with enzymatic activities are called

- a. isozymes
- b. abzymes
- c. ribozymes
- d. None of the above

Correct Answer: C

A ribozyme is a ribonucleic acid enzyme or RNA enzyme that catalyzes a chemical reaction the ribozyme catalyses specific reactions in a similar way to that of protein enzymes. Also called catalytic RNA, ribozymes are found in the ribosome where they join amino acids together to form protein chains. Ribozymes also play a role in other vital reactions such as RNA splicing, transfer RNA biosynthesis, and viral replication.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 407. What is an enzyme called that is activated by cleavage?

- a. Abzyme
- b. Holoenzyme
- c. Zymogen
- d. Apoenzyme

Correct Answer: C

A zymogen (or proenzyme) is an inactive enzyme precursor. A zymogen requires a biochemical change (such as a hydrolysis reaction revealing the active site or changing the configuration to reveal the active site) for it to become an active enzyme.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 408. Sulfa drug, that acts as _____, is an effective antibiotic that inhibits the formation of folic acid.

- a. irreversible inhibitor
- b. competitive inhibitor
- c. uncompetitive inhibitor

d. allosteric inhibitor

Correct Answer: B

Sulfonamide or sulphonamide is the basis of several groups of drugs. The original antibacterial sulfonamides (sometimes called sulfadruugs or sulphadruugs) are synthetic antimicrobial agents that contain the sulfonamide group. In bacteria, antibacterial sulfonamides act as competitive inhibitors of the enzyme dihydropteroate synthetase (DHPS), an enzyme involved in folate synthesis. Sulfonamides are therefore bacteriostatic and inhibit growth and multiplication of bacteria, but do not kill them. Humans, in contrast to bacteria, acquire folate (vitamin B_g) through the diet.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 409. What is the reason that conversion of substrate $[S]$ to product $[P]$ has increased in a linear fashion for about initial 15 minutes, but after that it is seen as a plateau?

- a. Enzyme has reached its K_m .
- b. Enzyme has reached its V_{max} .
- c. Enzyme activity is inactivated after 15 minutes.
- d. All of the above

Correct Answer: B

As enzyme - catalysed reactions are storable, their rate of catalysis does not show a linear response to increasing substrate. If the initial rate of the reaction is measured over a range of substrate concentrations (denoted as $[S]$), the reaction rate (v) increases as $[S]$ increases.

However, as $[S]$ gets higher, the enzyme becomes saturated with substrate and the rate reaches V_{max} the enzyme's maximum rate.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 410. Where do an uncompetitive inhibitor does binds?

- a. At an active site of an enzyme.
- b. At an enzyme-substrate complex.
- c. At the site other than active site.
- d. None of the above

Correct Answer: B

Uncompetitive inhibition, also known as anti-competitive inhibition, takes place when an enzyme inhibitor binds only to the complex formed between the enzyme and the substrate.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 411. What type of molecules are involved in the transfer of functional groups from one molecule to other?

- a. Catalases
- b. Transferases
- c. Ligases
- d. Transacetylase

Correct Answer: B

Transferase is the general name for the class of enzymes that enact the transfer of specific functional groups (*e.g.* a methyl or glycosyl group) from one molecule (called the donor) to another (called the acceptor). They are involved in hundreds of different biochemical pathways throughout biology, and are integral to some of life's most important processes.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 412. All the given statements about the different types of enzyme inhibition are correct, except

- a. competitive inhibition occurs when a substrate competes with an enzyme for binding to an inhibitor protein.
- b. competitive inhibition occurs when the substrate and the inhibitor compete for the same active site on the enzyme.
- c. non-competitive inhibition of an enzyme cannot be overcome by adding large amounts of substrate.
- d. competitive inhibitors are often similar in chemical structure to the substrate of the inhibited enzyme.

Correct Answer: A

Uncompetitive inhibition, also known as anti-competitive inhibition, takes place when an enzyme inhibitor binds only to the complex formed between the enzyme and the substrate (the E-S complex). While uncompetitive inhibition requires that an enzyme-substrate complex must be formed, non-competitive inhibition can occur with or without the substrate present.

Competitive inhibition is a form of enzyme inhibition where binding of the inhibitor to the active site on the enzyme prevents binding of the substrate and vice-versa.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 413. What kind of enzyme inhibition is caused by a substance resembling substrate molecule?

- a. Allosteric inhibition
- b. Competitive inhibition
- c. Non-competitive inhibition

d. Feedback inhibition

Correct Answer: B

In competitive inhibition, the substrate and inhibitor cannot bind to the enzyme at the same time, as shown in the figure on the left. This usually results from the inhibitor having an affinity for the active site of an enzyme where the substrate also binds; the substrate and inhibitor compete for access to the enzyme's active site.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 414. The catalytic efficiency for an enzyme is defined as

- a. K_{cat}
- b. V_{max}/K_{cat}
- c. K_{cat}/K_m
- d. K_{cat}/V_{max}

Correct Answer: C

The ratio K_{cat}/K_m – often referred to as the ‘specificity constant’ - is a useful index for comparing the relative rates of enzyme acting on alternative, competing substrates. However, an alternative description, ‘catalytic efficiency’, is frequently used, and on occasions misused, to compare the reactivity of two enzymes acting on the same substrate.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 415. Binding site is

- a. the area of a macromolecular target that is occupied by enzyme when it binds.

- b. the portion of an enzyme to which a enzyme target binds.
- c. Both A and B
- d. None of the above

Correct Answer: A

The binding site is part of the macromolecular target and not the drug. It is normally a hollow or cleft on the surface of the target. The functional groups and regions of the drug that are involved in binding to the binding site are known as the pharmacophore.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 416 To which receptor does epinephrine bind in order to stimulate phosphorylation of glycogen synthase, glycogen phosphorylase, PFK-2/FBPasc-2 bifunctional enzyme and pyruvate kinase?

- a. $\alpha-1$
- b. $\alpha-2$
- c. Glucagon
- d. Beta (β)

Correct Answer: D

The major action of epinephrine to mobilize glycogen from liver and also muscle (which lacks PFK-2 and glucose-6-phosphatase). The liver's role is to release fuel into the blood, while muscle would then use the fuel, from either the liver or from its own glycogen stores, for the "fight or flight response" during acute stress. The coordinate regulation of glucose metabolism is via phosphorylation, the opposite of insulin's action via dephosphorylation. The G_g / cAMP / protein kinase A pathway is involved in many important phosphorylation events, including the ones here. Recall also that epinephrine, unlike the peptide hormone glucagon, is a catecholamine and thus must bind to an adrenergic receptor.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 417. Who coined the term enzyme?

- a. Miller
- b. Kuhne
- c. Buchner
- d. None of the above

Correct Answer: B

Wilhelm Friedrich Kühne was a German physiologist. Born in Hamburg, he is best known today for coining the word enzyme.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 418. _____ is the fastest enzyme.

- a. Pepsin
- b. Rennin
- c. Carbonic anhydrases
- d. Polymerase

Correct Answer: C

The carbonic anhydrases form a family of enzymes that catalyze the rapid interconversion of carbon dioxide and water to bicarbonate and protons (or vice versa), a reversible reaction that occurs relatively slowly in the absence of a catalyst. The active site of most carbonic anhydrases contains a zinc ion; they are therefore classified as metalloenzymes. The reaction rate of carbonic anhydrase is one of the fastest of all enzymes, and its rate is typically limited by the diffusion rate of its substrates.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 419. Who gave the Lock and Key model of an enzyme?

- a. Koshland
- b. Fischer
- c. Kuhne
- d. None of the above

Correct Answer: B

The specific action of an enzyme with a single substrate can be explained using a Lock and Key analogy first postulated in 1894 by Emil Fischer. In this analogy, the lock is the enzyme and the key is the substrate. Only the correctly sized key (substrate) fits into the key-hole (active site) of the lock (enzyme).

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 420. What is the term used for a molecule, that is required by some enzymes and is covalently bind a non-protein organic molecule to the active site?

- a. Cofactor
- b. Prosthetic group
- c. Coenzyme
- d. Modulator

Correct Answer: B

A cofactor is the best general term to describe the non-protein substances required by an enzyme to function properly. This term covers both organic molecules and metal ions. A co-enzyme is an

organic molecule that acts as a cofactor. A prosthetic group is a co-enzyme that is covalently bound to the enzyme. A modulator has nothing to do with cofactors and is a ligand that binds to an allosteric binding site.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 421. The molecule which is involved in the feedback control of the enzyme phosphorylase *a* is

- a. AMP
- b. glucose-1 -phosphate
- c. adrenaline
- d. All of the above

Correct Answer: B

The products of enzyme-catalysed reactions are often involved in the feedback control of those enzymes. Glucose-1 -phosphate is the product formed from this enzyme-catalysed reaction. As its concentration increases, it increasingly inhibits the enzyme. Glycogen is the substrate for this reaction. Adrenaline is a hormone that can trigger a cascade of cellular events that will eventually activate phosphorylase *a*. AMP acts as an enzyme modulator to directly activate the enzyme.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 422. The molecule that acts as an activator of carbonic anhydrase is

- a. copper
- b. zinc

- c. cobalt
- d. magnesium

Correct Answer: B

Zinc act as an activator of certain enzymes like carbonic anhydrase. Carbonic anhydrase is important in the transport of CO_2 in blood.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 423. With respect to an enzyme's ability to catalyse a reaction, which of the following statement is incorrect?

- a. Enzyme binds reactants such that they are positioned correctly and can attain their transition-state configurations.
- b. Enzyme provides a reaction surface and a hydrophilic environment for the reaction to take place.
- c. Enzyme can weaken bonds in reactants through the binding process.
- d. None of the above

Correct Answer: B

An enzyme certainly provides a reaction surface for a reaction to take place. This is normally a hollow or cleft in the enzyme which is called the active site, but it is normally hydrophobic in nature rather than hydrophilic.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 424. Enzymes are classified into

- a. 5 groups

- b. 6 groups
- c. 3 groups
- d. 7 groups

Correct Answer: B

Oxidoreductases catalyze oxidation-reduction reactions. At least one substrate becomes oxidized and at least one substrate becomes reduced.

Transferases catalyze group transfer reactions- the transfer of a functional group from one molecule to another.

Hydrolase: In hydrolysis reactions, C–O, C–N, and C–S bonds are cleaved by addition of H₂O in the form of OH⁻ and H⁺ to the atoms forming the bond. Lyase Lyases cleave C–C, C–O, C–N, and C–S bonds by means other than hydrolysis or oxidation.

Isomerase: Isomerases just rearrange the existing atoms of a molecule, that is, create isomers of the starting material.

Ligase: Ligases synthesize C–C, C–S, C–O, and C–N bonds in reactions coupled to the cleavage of high energy phosphate bonds in ATP or some other nucleotide.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 425. Which of the following term is the best general term for such a substance that is required by some enzymes if they are to catalyse a reaction?

- a. Modulator
- b. Cofactor
- c. Co-enzyme
- d. Prosthetic group

Correct Answer: B

A cofactor is the best general term to describe the non-protein substances required by an enzyme to function properly. This term covers both organic molecules and metal ions. A co-enzyme is an

organic molecule that acts as a cofactor. A prosthetic group is a co-enzyme that is covalently bound to the enzyme. A modulator has nothing to do with cofactors and is a ligand that binds to an allosteric binding site.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 426. The enzyme tyrosinase is activated by _____ metal ion.

- a. copper
- b. iron
- c. cobalt
- d. potassium

Correct Answer: A

The two copper atoms within the active site of tyrosinase enzymes interact with dioxygen to form a highly reactive chemical intermediate that then oxidizes the substrate. The activity of tyrosinase is similar to catechol oxidase, a related class of copper oxidase. Tyrosinases and catechol oxidases are collectively termed polyphenol oxidases.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 427. An allosteric binding site

- a. is a binding site, which is separate from the active site, and affects the activity of an enzyme when it is occupied by a ligand.
- b. is a description of an active site which has undergone an induced fit.
- c. is a binding site containing amino acids with aliphatic side chains.
- d. is a binding site that can accept a wide variety of differently shaped molecules.

Correct Answer: A

An allosteric binding site is separate from the active site. When it is occupied by a ligand, it undergoes an induced fit which affects the shape of the active site. This will affect the ability of the active site to 'recognise' the substrate and hence affect enzyme activity.

Both the active site and allosteric binding site are likely to contain amino acids with aliphatic side chains, some of which may be important to the binding process. The ability of a binding site to accept a wide variety of differently shaped molecules will vary depending on the specific binding site involved.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 428. What is true about the peptide bond of a protein?

- a. Planar, but rotates to three preferred dihedral angles.
- b. Non-polar, but rotates to three preferred dihedral angles.
- c. Polar and fixed in a *trans* conformation.
- d. Planar and usually found in a *trans* conformation.

Correct Answer: D

A peptide bond (amide bond) is a covalent chemical bond formed between two amino acid molecules. Significant delocalization of the lone pair of electrons on the nitrogen atom gives the group a partial double bond character. The partial double bond renders the amide group planar, occurring in either the *cis* or *trans* isomers. The *trans* form is preferred overwhelmingly in most peptide bonds (roughly 1000:1 ratio in *trans* : *cis* populations), to keep the side chains as far as possible.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 429. All the following statements in relation to Ramachandran plot are true, except

- a. the restriction of ϕ and Ψ angles limits structures accessible to unfolded proteins.
- b. almost all the peptide bonds in protein are *cis*.
- c. almost all the protein bonds in protein are *trans*.
- d. three-quarters of, possible (ϕ, ψ) combination are excluded by their steric clashes.

Correct Answer: B

The two torsion angles of the polypeptide chain, also called Ramachandran angles describe the rotations of the polypeptide backbone around the bonds between N-C α (called Phi, ϕ) and C α -C (called Psi, ψ). The two planes can twist around the alpha carbon. The rotation angles for the two planes are called phi (ϕ) and psi (ψ) are analogous to the torsion angles in the acyl chains of fatty acid. The R group substituent attached to the alpha C can also rotate around the alpha C and the beta C of the side chain. This angle is defined as chi in trans confirmation.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 430. What do an α - helix of a protein represents?

- a. Primary structure of a protein.
- b. Second structure of a protein.
- c. Tertiary structure of a protein.
- d. Both A and B

Correct Answer: B

The secondary protein structure is the specific geometric shape caused by intra-molecular and intermolecular hydrogen bonding of amide groups. The most common type of secondary structure in proteins is the alpha-helix. Linus Pauling was the first to predict the existence of α -helices, which was confirmed with the determination of the first three-dimensional structure of a protein, myoglobin.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 431. What will happen during the thermal denaturation of proteins?

- a. Conformational change in the protein.
- b. Cleavage of the peptide bonds.
- c. Covalent modification of amino acids.
- d. Increase in isoelectric point of the protein.

Correct Answer: A

During heating, there is a conformational changes (heat denaturation) of the protein system occurs. These changes take place at a particular temperature called the denaturation temperature.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 432. Which of the following pairs of amino acids might contribute to protein conformation by forming electrostatic interactions?

- a. Lysine and arginine
- b. Glutamate and lysine
- c. Phenylalanine and tyrosine
- d. Lysine and arginine

Correct Answer: B

Electrostatic interactions operate most strongly between amino acid side chains carrying full, and opposite charges. Glutamate and lysine have oppositely charged side chains at physiological pH, so will experience attractive electrostatic interactions.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 433. Which technique can be used to detect conformation of the protein?

- a. Fluorescence emission
- b. Circular dichroism (CD)
- c. Spectrophotometer
- d. All of the above

Correct Answer: B

Circular dichroism (CD) is dichroism involving circularly polarized light, *i.e.*, the differential absorption of left- and right-handed light. Left-hand circular (LHC) and right-hand circular (RHC) polarized light represent two possible spin angular momentum states for a photon and so circular dichroism is also referred to as dichroism for spin angular momentum. CD spectra can be readily used to estimate the fraction of a molecule that is in the α -helix conformation, the β -sheet conformation, the β -turn conformation, or some other (e.g. random coil) conformation.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 434. What structure of protein is represented in the four subunits of hemoglobin?

- a. Primary
- b. Secondary
- c. Tertiary
- d. Quaternary

Correct Answer: D

In biochemistry, quaternary structure is the arrangement of multiple folded protein or coiling protein molecules in a multi-subunit complex. Examples of proteins with quaternary structure include hemoglobin, DNA polymerase and ion channels.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 435. Which protein, from those given below represents an example of trimeric protein? a.

Myoglobin

b. Keratin

c. Collagen

d. Hemoglobin

Correct Answer: C

A trimer is a macromolecular complex formed by three, usually non-covalently bound, macromolecules like proteins or nucleic acids. A homo-trimer would be formed by three identical molecules. A hetero-trimer would be formed by three different macromolecules.

Collagen is an example of homo-trimeric protein.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 436. _____ mediate protein folding.

a. Chaperones

b. Ribosomes

c. Protein itself

d. All of the above

Correct Answer: A

Molecular chaperones are proteins that assist the non-covalent folding or unfolding and the assembly or disassembly of other macromolecular structures. Chaperones are not present when the macromolecules perform their normal biological functions and have correctly completed the processes of folding and/or assembly.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 437 Which among the following protein is also an enzyme?

- a. Actin
- b. Myosin
- c. Both A and B
- d. Trypsin

Correct Answer: B

Myosins comprise a family of ATP-dependent motor proteins and are best known for their role in muscle contraction and their involvement in a wide range of other eukaryotic motility processes. Myosin is the protein responsible for generating muscle contraction.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 438 _____ has a quaternary structure.

- a. Insulin
- b. Hemoglobin
- c. Myoglobin
- d. Both A and B

Correct Answer: B

Hemoglobin has a quaternary structure characteristic of many multi-subunit globular proteins. Most of the amino acids in hemoglobin form alpha helices, connected by short non-helical segments. Hydrogen bonds stabilize the helical sections inside this protein, causing attractions within the molecule, folding each polypeptide chain into a specific shape. Hemoglobin's quaternary structure comes from its four subunits in roughly a tetrahedral arrangement.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 439. What is the oxidation state of iron when oxygen binds to hemoglobin?

- a. +1
- b. +2
- c. +3
- d. +4

Correct Answer: B

The iron ion may be either in the Fe^{2+} or in the Fe^{3+} state, but ferrihemoglobin (methemoglobin) (Fe^{3+}) cannot bind oxygen. In binding, oxygen temporarily and reversibly oxidizes (Fe^{2+}) to (Fe^{3+}) while oxygen temporarily turns into superoxide, thus iron must exist in the +2 oxidation state to bind oxygen. If superoxide ion associated to Fe^{3+} is protonated, the hemoglobin iron will remain oxidized and incapable of binding oxygen. In such cases, the enzyme methemoglobin reductase will be able to eventually reactivate methemoglobin by reducing the iron center.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 440. What can be obtained using the Circular Dichromism?

- a. 3-D structure of protein.
- b. Sequence of amino acids in the protein.
- c. Relative proportions of α - helices, β - sheets and loops in the protein.
- d. None of the above

Correct Answer: C

Circular dichroism (CD) is an excellent tool for rapid determination of the secondary structure and folding properties of proteins that have been obtained using recombinant techniques or purified from tissues. The most widely used applications of protein CD are to determine whether an expressed, purified protein is folded or if a mutation affects its conformation or stability.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 441. Unfolding of regular secondary structure causes _____ in the entropy of the protein.

- a. increase
- b. decreases
- c. either increase or decrease
- d. None of the above

Correct Answer: A

A polypeptide that has folded into a functional protein is much more restricted in orientation than an unfolded polypeptide, which is like a string that can be bent and twisted into countless conformations. So for a protein that undergoes folding, the entropy change is negative, whereas for a protein that unfolds, the entropy increases and the change is positive.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Q. 442. Which amino acid can form disulphide bonds?

- a. Cysteine
- b. Proline
- c. Both A and B
- d. None of the above

Correct Answer: A

A disulphide bond joins two atoms of sulphur. The only amino acid with a sulphhydryl group in its side chain is cysteine.

Core Concept :

Topic Name :

Complexity :

Difficulty Level :

Molecules & Their Interaction Relevant to Biology

Q. 443. Technically, D-Alanine and L-Alanine are

- a. anomers
- b. enantiomers
- c. epimers
- d. None of the above

Correct Answer: B

An enantiomer is one of two stereoisomers that are mirror images of each other that are non-superposable (not identical), much as one's left and right hands are the same except for opposite orientation.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 444. _____ is most likely to influence how a protein folds into its native conformation.

- a. The establishment of bonding interactions with other parts of the peptide backbone
- b. The rotation of the peptide bond
- c. Both A and B
- d. None of the above

Correct Answer: A

Proteins always fold into a specific shape, called the native confirmation, to carry out their biological function. Knowledge of protein folding is important to understand how proteins work. Proteins never exist (and wouldn't be active) as an unfolded chain. The peptide bond is a trans-amide and cannot rotate; movement around the remaining single bonds in the peptide backbone achieves folding. There is no single secondary structure (*e.g.* a β -sheet) that is more stable/preferable to others.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 445. Many marathon runners eat foods with high starch content such as pasta, to increase their glycogen concentration, an enzyme α -amylase, that is secreted by pancreas, will digest this starch into what products?

- a. Maltose, Fructose and Glucose
- b. Glucose and Galactose
- c. Limit dextrins, Maltose and Maltotriose
- d. Fructose and Glucose

Correct Answer: C

The hydrolysis of starch is catalyzed by salivary and pancreatic amylases, which catalyze random hydrolysis of a (1,4) glycoside bonds, yielding dextrins and further hydrolysis yields a mixture of glucose, maltose, isomaltose (from the branch points of amylopectin) and maltotriose. Sucrose, galactose and fructose are not components of starch.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 446. Which among the following statements is true?

- a. 2,3– Bisphosphoglycerate (BPG) increases the affinity of haemoglobin for oxygen.
- b. One molecule of haemoglobin binds sixteen molecules of oxygen - four per subunit.
- c. Deoxygenated haemoglobin has a higher binding affinity for protons than has oxyhaemoglobin.
- d. All of the above

Correct Answer: C

Hemoglobin in the deoxygenated state has a higher binding affinity for protons than has the oxyhemoglobin.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 447. Which type of bonding is responsible for the secondary structure of proteins?

- a. Salt bridges between charged side chains of amino acids.
- b. Hydrogen bonding between the C=O and N–H groups of peptide bonds.
- c. Disulphide bridges between cysteine residues.
- d. All of the above

Correct Answer: B

The sequence of amino acids that are linked together covalently in a polypeptide chain is the primary structure. In the first level of protein folding the polypeptide backbone itself is arranged in a particular conformation known as the secondary structure, which includes sections of regular repeating structures known as a helices (helices being the plural of helix) and β sheets. The

secondary structure is folded on itself to give the tertiary structure. A polypeptide has polar groups capable of hydrogen bonding—two bonds per amino acid unit, since the C=O and N–H of the peptide bond are capable of participating in hydrogen bond formation. There are two main classes of secondary structures formed by hydrogen bonding between these groups - the α helix in which the backbone is arranged in a spiral and the β – pleated sheet in which extended polypeptide backbones are side by side. The bonds involved in protein tertiary structure are predominantly non-covalent hydrogen bonds and Van der Waal forces with some salt bridges between charged amino acid side chains. Hydrophobic interactions that bury non-polar side chains in the interior are also important. Some protein tertiary structures are ‘locked’ or strongly stabilized by disulphide bridges (S-S), which, being covalent, are very strong. This stabilization is achieved by pairs of thiol (-SH) groups of the cysteine side chains, brought together by polypeptide folding.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 448. The histidine is present at the active site of enzyme because

- a. It is the only polar residue with a five-membered ring at the side chain.
- b. it can form salt bridges.
- c. its pK_a is close to 7.
- d. it can interact with the substrates better than any other residue.

Correct Answer: C

Histidine is perhaps the most versatile of all the amino acids that is why it is most often found in the enzyme's site. It has two titrable N-H groups, each of which have the pK_a value around 6.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 449. What is the protein domain?

- a. The α –helical portion of a protein.
- b. A discrete region of polypeptide chain that has folded into a self-contained three-dimensional structure.
- c. The β –pleated sheet portion of a protein.
- d. None of the above

Correct Answer: B

A protein domain is one continuous stretch of polypeptide, which can fold into a self-contained ‘unit’ independent of any other part of the polypeptide chain. A fully-functional protein may comprise several distinct domains linked together by unstructured polypeptide.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 450. Which one of the following statement about protein secondary structure is correct?

- a. α –helix is primarily stabilized by ionic interactions between the side chains of the amino acids.
- b. β –sheets exist only in antiparallel form.
- c. β –turns often contain proline.
- d. α –helix can be composed of more than one polypeptide chain.

Correct Answer: C

Beta turns, also known as beta bends or tight turns, are a type of secondary structure. Proline and Glycine are frequently found in beta turns, proline because its cyclic structure is ideally suited for the beta turn, and glycine because, with the smallest side chain of all the amino acids, it is the most sterically flexible.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 451. Which phenomenon can be best applied for the situation that “as haemoglobin binds oxygen molecules, its affinity for oxygen increases, driving the binding of further oxygen molecules”?

- a. Catalysis
- b. Isomerism
- c. Saturation
- d. Allostery

Correct Answer: D

Allostery describes the way that the binding of a ligand drives the further binding of that ligand. In the case of haemoglobin, the binding of an oxygen molecule causes subtle changes in the three-dimensional structure of the haemoglobin complex, which results in the affinity of haemoglobin for other oxygen molecules increasing; making it easier for further oxygen molecules to bind.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 452. Which of the following statements correctly describes the behaviour of the haemoglobin protein in sickle-cell disease?

- a. Neighbouring haemoglobin proteins aggregate together.
- b. The haemoglobin protein dissociates into four subunits.
- c. The haemoglobin protein possesses an iron atom in the Fe (III) form rather than the normal Fe (II) form.
- d. The haemoglobin protein lacks a heme group.

Correct Answer: A

Neighbouring haemoglobin molecules tend to aggregate together, leading to a distortion in the shape of the red blood cell into the sickle shape from which the disease takes its name.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 453. Which among the following are paralogous proteins?

- a. Rat myoglobin and Rat cytochrome
- b. Rat hemoglobin and Rat cytochrome
- c. Rat myoglobin and Rat hemoglobin
- d. None of the above

Correct Answer: C

Homologous sequences are paralogous if they were separated by a gene duplication event if a gene in an organism is duplicated to occupy two different positions in the same genome, then the two copies are paralogous. Paralogous genes often belong to the same species, but this is not necessary.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 454. What do the protein moiety of lipoprotein called?

- a. Pre-protein
- b. Apoprotein
- c. Hollow protein
- d. None of the above

Correct Answer: B

Apoprotein is a protein that combines with a prosthetic group to form a conjugated protein. And apoenzyme is the protein part of an enzyme without its characteristic prosthetic group.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 455. What type of forces are responsible for the maintenance of the three dimensional structures of a protein?

- a. Covalent
- b. Non-covalent
- c. Co-ordinate
- d. Intramolecular

Correct Answer: B

A non-covalent interaction differs from a covalent bond in that it does not involve the sharing of electrons, but rather involves more dispersed variations of electromagnetic interactions between molecules or within a molecule. Non-covalent interactions are the dominant type of interaction between supermolecules in supermolecular chemistry and are critical in maintaining the three-dimensional structure of large molecules, such as proteins and nucleic acids.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 456. What factor influence how a protein folds into its native conformation?

- a. The rotation of the peptide bond.
- b. The formation of the maximum possible number of β – sheets in the final folded structure.
- c. The establishment of bonding interactions with other parts of the peptide backbone.

d. Both A and B

Correct Answer: C

Proteins always fold into a specific shape, called the native confirmation, to carry out their biological function. Knowledge of protein folding is important to understand how proteins work. Proteins never exist (and wouldn't be active) as an unfolded chain. The peptide bond is a trans-amide and cannot rotate; folding is achieved by movement around the remaining single bonds in the peptide backbone. There is no single secondary structure (e.g. a β - sheet) that is more stable/preferable to others.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 457. Which of the following statements is correct regarding the sequence Lys-Ser-Gly-Ala-Ala-Glu-Tyr-Pro-Thr-Val-Phe?

- a. This protein could also be represented by the abbreviation KSGAAEYPTVF.
- b. This protein could be classified as a decapeptide.
- c. This protein is an example of tertiary structure.
- d. This is an example of a quaternary protein.

Correct Answer: A

This small protein can be defined as a peptide but a decapeptide would contain 10 amino acids. It is very helpful to learn the three-letter and single letter abbreviation for the amino acids and to know the side chain properties of each. This peptide contains several non-polar amino acids, e.g. Ala, Pro, Val and is comprised of one continuous chain - therefore it cannot be a quaternary protein (which is comprised of more than one peptide backbone).

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 458. _____ can be used to determine the helix content of a protein.

- a. An infrared spectrometer
- b. A fluorescence spectrometer
- c. A circular dichroism spectrometer
- d. A UV-Visible spectrophotometer

Correct Answer: C

Circular dichroism (CD) is an excellent tool for rapid determination of the secondary structure and folding properties of proteins that have been obtained using recombinant techniques or purified from tissues. Therefore, the alpha helix of proteins and the double helix of nucleic acids have CD spectral signatures representative of their structures. The capacity of CD to give a representative structural signature makes it a powerful tool in modern biochemistry with applications that can be found in virtually every field of study.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 459. Which among the following is the function of chaperons?

- a. It provide protective environment for the proper folding of prroteins.
- b. Provide a template for the folding of protein.
- c. Rescue the protein that is folded properly and allow them to refold in proper conformation.
- d. All of the above

Correct Answer: C

Chaperones are a functionally related group of proteins assisting protein folding in the cell under physiological and stress conditions. They share the ability to recognize and bind non native proteins thus preventing unspecific aggregation. In molecular biology, molecular chaperones are proteins that assist the non-covalent folding or unfolding and the assembly or disassembly of other macromolecular structures. Chaperones are not present when the macromolecules perform their normal biological functions and have correctly completed the processes of folding and/or assembly. The common perception that chaperones are concerned primarily with protein folding is incorrect.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 460. "Proteins can act as therapeutic targets." This statement best describes the role of proteins as

- a. drugs targeting proteins are often very specific and can be less likely to produce side effects.
- b. drugs often work by enhancing the binding of an enzyme's substrate.
- c. very few drugs exert their effects by interacting with proteins
- d. drugs targeting enzymes usually activate their target protein.

Correct Answer: A

Enzymes and receptors, both types of proteins, are very important drug targets. The majority of drugs function by targeting a protein. The function of an enzyme is normally inhibited when a drug binds to its active or allosteric site, both of which reduce binding affinity for the normal substrate. Due to the highly unique structure of most proteins and with the help of modern technology, drugs can be designed to interact very precisely with a given target. This can prevent off-target binding to other proteins and help reduce unwanted side effects.

Core Concept:

Topic:

Difficulty Level:

Complexity:

1. H Conformation of Nucleic Acids

Q. 461. _____ is the most abundant intracellular free nucleotide.

- a. ATP
- b. FADH
- c. Both A and B

d. NADP⁺

Correct Answer: A

Adenosine triphosphate (ATP) is a nucleotide that consists of an adenosine and a ribose linked to three sequential phosphoryl ($-\text{PO}_3^{2-}$) groups via a phosphoester bond and two phosphoanhydride bonds. ATP is the most abundant nucleotide in the cell and the primary cellular energy currency in all life forms. The primary biological importance of ATP rests in the large amount of free energy released during its hydrolysis. This provides energy for other cellular work, such as biosynthetic reactions, active transport and cell movement. ATP is used in cellular metabolism in plants. It involved with light to create energy for plant. Besides, ATP is also one of components of DNA.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 462. Which of following process would not lead to disruption of the nucleosomal structure?

- a. Methylation
- b. Acetylation
- c. Phosphorylation
- d. None of the above

Correct Answer: A

The dynamics of the formation and disruption of nucleosome structure and therefore an important part of eukaryotic gene regulation. Histone acetylation and deacetylation is an important determinant of gene activity. Acetylation is known to occur on only lysine residues in the amino terminal tails of histone molecules. This modification reduces the positive charge of these tails and decreases the binding affinity of histone for the negatively charged DNA. Accordingly, the acetylation of histones could result in disruption of nucleosomal structure and access of transcription machinery for transcription of required genes. Like histone acetylation, the phosphorylation of histones is highly dynamic. It takes place on serines, threonines and tyrosines, predominantly, but not exclusively, in the N-terminal histone tails. The levels of the modification are controlled by kinases and phosphatases that add and remove the modification, respectively Histone methylation mainly occurs on the side chains of lysines and arginines.

Unlike acetylation and phosphorylation, however, histone methylation does not alter the charge of the histone protein.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 463. What is true about Z-DNA?

- a. It has a double helical structure.
- b. It give a zig-zag appearance.
- c. It consists of uracil bases.
- d. All of the above

Correct Answer: B

Z- DNA is a form of DNA in which the double helix twists in a left-hand direction, thus producing a zigzag appearance.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 464. At the melting temperature (T_m) of DNA

- a. DNA melts completely.
- b. 50% of the DNA is denatured.
- c. 100% of the DNA is denatured.
- d. 90% of the DNA is denatured.

Correct Answer: B

The T_m is defined as the temperature in degrees Celsius, at which 50% of all molecules of a given DNA sequence are hybridized into a double strand and 50% are present as single strands.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 465. _____ causes the loss of viscosity of the double-stranded DNA molecule.

- a. Denaturation
- b. Filtration
- c. Sedimentation
- d. Freezing

Correct Answer: A

The term denaturation refers to the disruption of native conformation of a biomolecule, so that it does not retain its higher order structure. In case of DNA, denaturation refers to separation of double strands of DNA into two component strands. The solutions of native DNA possess a high viscosity because of the relatively rigid double helical structure and long rod like character of DNA. Disruption of the hydrogen bonds causes a marked decrease in viscosity.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 466. Which among the following technique can be used to determine the helical structure of DNA?

- a. Electron diffraction measurement
- b. Neutron diffraction measurement
- c. X-ray diffraction measurement

d. Diffraction of visible light

Correct Answer: C

X-ray crystallography is a tool used for identifying the atomic and molecular structure of a crystal, in which the crystalline atoms cause a beam of incident X-rays to diffract into many specific directions. By measuring the angles and intensities of these diffracted beams, a crystallographer can produce a three-dimensional picture of the density of electrons within the crystal. One of the most famous X ray diffraction patterns is the one for crystals of the genetic material DNA, first obtained in the early 1950s.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 467. Identify the wrong statement amongst the following

- a. Nucleotide bases in tRNA are extensively modified after transcription.
- b. One particular tRNA is always specific for one particular amino acid.
- c. The size of a tRNA generally varies from 600 bases to 1000 bases.
- d. Both A and B

Correct Answer: C

A transfer RNA is an adaptor molecule composed of RNA, typically 76 to 90 nucleotides in length, that serves as the physical link between the nucleotide sequence of nucleic acids (DNA and RNA) and the amino acid sequence of proteins.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 468. By feeding the cell with radioactive _____, RNA can be specifically radiolabeled.

- a. adenosine

- b. guanosine
- c. thymine
- d. uridine

Correct Answer: D

Uridine is a glycosylated pyrimidine-analog containing uracil attached to a ribose ring (or more specifically, a ribofuranose) via a β -N1-glycosidic bond. Radioactive precursors of DNA and RNA, ^3H (thymidine) and ^3H (uridine) respectively, may be introduced to living cells to determine the timing of several phases of the cell cycle. RNA or DNA viral sequences can also be located in this fashion.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 469. What will be the total number of nucleotide present in the segment, if a segment of DNA has 120 cytosine bases?

- a. 240
- b. 480
- c. 120
- d. 60

Correct Answer: B

According to the Chargaff's rule A pair with T and C pair with G. Here, adenine residues are 120 and cytosine residues are 120.

$$[A] = [T], [A = 120] = [T = 120]$$

$$[C] = [G]$$

$$[C = 120] = [G = 120]$$

Therefore, the total number of nucleotides = $[A] + [T] + [C] + [G] = 120 \times 4 = 480$.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 470. Which feature of the DNA is revealed from the statement that, 'It is believed that life evolved with RNA as the genetic material, but RNA has been replaced by DNA in all current cellular life?'

- a. DNA can direct its own replication while RNA cannot.
- b. DNA is more stable than RNA.
- c. DNA is a nucleic acid while RNA is not.
- d. All of the above

Correct Answer: B

DNA and RNA are both nucleic acids. The structure of both DNA and RNA lends itself to self-directed replication. DNA is the basis of all cellular life, in that it carries the information necessary for reproduction. RNA has the same role in certain viruses. It is believed that life originated with RNA as the 'genetic' material, but RNA has been replaced in all cellular life with DNA. DNA is chemically more stable and therefore more suitable for storing genetic information.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 471 Which form of DNA is left handed?

- a. A-form
- b. B-form
- c. Z-form
- d. All of the above

Correct Answer: C

Z-DNA is one of the many possible double helical structures of DNA. It is a left-handed double helical structure in which the double helix winds to the left in a zig-zag pattern (instead of to the right, like the more common B-DNA form). Z-DNA is thought to be one of three biologically active double helical structures along with A- and B-DNA.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 472. What type of sugars is present in DNA?

- a. Sucroses
- b. Pentoses
- c. Trioses
- d. All of the above

Correct Answer: B

Nucleic acids are linear polymers (chains) of nucleotides. Each nucleotide consists of three components a purine or pyrimidine nucleobase (sometime termed nitrogenous base or simply base), a pentose sugar and a phosphate group.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 473. Chromatin can be correctly described as

- a. the total genetic content of a cell.
- b. a complex structure of DNA and proteins.
- c. proteins that give structural support to a chromosome.
- d. None of the above

Correct Answer: B

Chromatin is a complex of DNA and proteins that forms chromosomes within the nucleus of eukaryotic cells. Chromatin exists in two forms. One form, called euchromatin, is less condensed and can be transcribed. The second form, called heterochromatin, is highly condensed and is typically not transcribed.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 474. What is nucleotide in terms of DNA and RNA?

- a. A nucleotide is a sugar molecule bonded to phosphate group(s) and a heterocyclic base.
- b. A nucleotide is a sugar molecule bonded to phosphate group.
- c. A nucleotide is a phosphate group(s) bonded to a heterocyclic base.
- d. None of the above

Correct Answer: A

Nucleotides are organic molecules that serve as the monomers or subunits, of nucleic acids like DNA and RNA. The building blocks of nucleic acids, nucleotides are composed of a nitrogenous base, a five-carbon sugar (ribose or deoxyribose) and at least one phosphate group.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 475. What is the reason that DNA exists in a double-stranded form whereas RNA is mainly a single stranded molecule?

- a. RNA strands cannot form base pairs.
- b. Double stranded DNA is a more stable structure.

- c. DNA cannot exist in the single stranded form.
- d. It is easier to replicate double stranded DNA than single stranded RNA.

Correct Answer: B

Double stranded DNA is much more stable than single stranded RNA and this helps to protect our genetic code. Having a second copy of our genetic code means there is a reference for repair in the event of a mutation or damage.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 476. How many stop codons are present in genetic codon?

- a. 2
- b. 3
- c. 4
- d. 5

Correct Answer: B

Stop codons act as 'stop' translation signals and none of them code for an amino acid. The genetic code has 3 different stops codons UAG, UGA and UAA.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 477. What is the percentage of other nitrogenous bases, if there is approximately 30% adenine?

- a. A = 20%, T = 20%, G = 30%, C = 30%

- b. A = 30%, T = 20%, G = 20%, C = 30%
- c. A = 30%, T = 30%, G = 20%, C = 20%
- d. A = 25%, T = 25%, G = 25%, C = 205%

Correct Answer: C

According to Chargaff's rule, $[A] + [G] = [C] + [T]$.

$$[A] + [G] = [C] + [T] = 100\%$$

Adenine is paired with Thymine, $A = T$ and Cytosine is paired with Guanine $G = C$,.

Here, $[A] = 30\%$ therefore, % of $[T]$ is also 30%. And hence

$$[G] + [C] = 100 - 60 = 40\%.$$

$$[G] = 20\% \text{ and } [C] = 20\%.$$

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 478. What is the function of DNA?

- a. Autocatalytic
- b. Heterocatalytic
- c. Both A and B
- d. None of the above

Correct Answer: C

Hereditary material should have both the property of autocatalytic and heterocatalytic functions. Due to autocatalysis precise copies are made while heterocatalytic process is responsible for directing and controlling the metabolic function of the cell and ultimately of the organism as a whole.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 479. _____ of DNA is more stable under normal physiological conditions.

- a. A-form
- b. B-form
- c. C-form
- d. Z-form

Correct Answer: B

The structure explained by Watson and Crick is commonly known as B-DNA and it is type found in the cells of living organisms under normal physiological conditions.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 480. RNA is a genetic material in _____.

- a. some viruses only
- b. some prokaryotes only
- e. some primitive prokaryotes only
- d. All of the above

Correct Answer: A

The genetic material in some viruses is DNA; in others it is RNA.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 481. Thymine is present in

- a. mRNA
- b. tRNA
- c. prokaryotic mRNA
- d. eukaryotic mRNA

Correct Answer: B

Ribosyl-thymine is a minor constituent of tRNA in both prokaryotes and eukaryotes.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 482. Which among the following statement is true about the RNA structure?

- a. mRNA translates the base sequence of DNA.
- b. A double helix is the predominant three-dimensional structure of most forms of RNA.
- c. Hydrogen bonding within the same strand of RNA is necessary to maintain its three dimensional structure.
- d. All of the above

Correct Answer: C

Despite its close chemical similarity to DNA, RNA forms a variety of three-dimensional structures, which doesn't include the familiar double helix of DNA. tRNA transfers single amino acids to the ribosome and mRNA is responsible for transcribing DNA sequences. In contrast to DNA, RNA structures are formed by base pairing (stabilised by hydrogen bonds) within the same nucleic acid strand.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 483. Which among the following statement is true regarding the A-DNA?

- a. It is formed by the dehydration of DNA samples.
- b. It is formed by increasing the temperature of DNA.
- c. It is stable to form RNA-DNA hybrids.
- d. All of the above

Correct Answer: A

DNA can adopt double helical forms other than the B conformation. An alternative right handed form is A-DNA, a shorter squatter helix formed upon slight dehydration of B-DNA. A DNA has 11 base pairs per turn. A-DNA is one of the possible double helical structures which DNA can adopt.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 484. The only nucleoside with base to sugar C-C linkage is

- a. Cytidine
- b. Pseudouridine
- c. Thymidine
- d. Adenosine

Correct Answer: D

Pseudouridine is the most abundant natural modified nucleotide found in RNA. One of unique modification generated by breaking the glycosidic bond of uridine and generating a new C-C linkage between the base and sugar to give pseudouridine.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 485. Which among the following statement is true regarding the structure of DNA?

- a. DNA is comprised of nucleotide subunits each containing a base, a ribose sugar and a phosphate group.
- b. All base pairs interact by forming three hydrogen bonds.
- c. Interactions between adjacent ribose sugars stabilize the double helix of DNA.
- d. DNA sequence folds into a unique and complex three-dimensional structure.

Correct Answer: A

The three dimensional structure of DNA is rather simple compared to other biological macromolecules but it is perfectly suited to its biological purpose storage of information (as base pairs) and the ability to copy itself (unwinding of the double helix). All DNA sequences form a similar, regular, three-dimensional structure stabilized by a network of hydrogen bonds between the base pairs. The A-T base pair forms two hydrogen bonds; the G-C base pair forms three. The DNA monomer unit is known as a nucleotide and comprises three elements stated in the question.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 486. Which of the following enzyme can remove or insert supercoil twists into circular DNA?

- a. Spliceosomes
- b. Topoisomerases
- c. Helicase
- d. None of the above

Correct Answer: B

The total amount of twisting present in a DNA molecule is referred to as the linking number. The enzyme topoisomerase is used in inserting or losing supercoiling in DNA during replication. It is of different type like gyrase, helicase etc. and are found in prokaryotes and eukaryotes respectively. Type I topoisomerases break only one strand of DNA, which changes the linking number in steps of one. In contrast, type II topoisomerases (including DNA gyrases) break both strands of the DNA and pass another part of the double helix through the gap. This changes the linking number in steps of two.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 487. Nucleoside, either purine or pyrimidine, is

- a. ionically bonded to sugar.
- b. covalently bonded to sugar.
- c. Both A and B
- d. None of the above

Correct Answer: B

A nucleoside is a pyrimidine or purine that is covalently bonded to a sugar. In DNA, the sugar is deoxyribose and so this is a deoxynucleotide.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 488. What will happen to the absorbance if solution of double stranded DNA is heated above its melting temperature?

- a. Decrease
- b. Increase

- c. Remain unchanged
- d. Initially increase and then decrease

Correct Answer: B

When native (double stranded) DNA is heated above its 'melting temperature', it is denatured and gets separated into single strands. An abrupt increase in the absorbance, corresponding to the sudden melting of DNA, is seen at T_m . The UV absorption is increased when the two single DNA strands are being separated, either by heat or by addition of denaturant or by increasing the pH level.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 489. What type of molecules move most quickly through a gel, in gel electrophoresis?

- a. Large fragments
- b. Small fragments
- c. Small genome
- d. Large genome

Correct Answer: B

Gel electrophoresis a method for separation and analysis of macromolecules (DNA , RNA and proteins) and their fragments, based on their size and charge. A solution of DNA molecules is placed in a gel. Because each DNA molecule is negatively charged, it can be pulled through the gel by an electric field. Small DNA molecules move more quickly through the gel than larger DNA molecules.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 490. Which among the following statements is true about Z-DNA?

- a. It has fewer base pairs per turn than the B-DNA.
- b. It is favoured by an alternating GC sequence.
- c. It tends to be found at the 3' end of genes.
- d. It is the most common conformation of DNA.

Correct Answer: B

Z-DNA is a radically different duplex structure, with the two strands coiling in left-handed helices and a pronounced zig-zag (hence the name) pattern in the phosphodiester backbone. As previously mentioned, Z-DNA can form when the DNA is in an alternating purine-pyrimidine sequence such as GCGCGC and indeed the G and C nucleotides are in different conformations, leading to the zig-zag pattern.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 491. What will be the ratio in complementary strand, if the ratio $(A+G)/(T+C)$ in one strand of the DNA is 0.7?

- a. 1.23
- b. 0.7
- c. 1.43
- d. 52

Correct Answer: C

$(A+G)/(T+C) = 0.7$ or $7/10$ or otherwise $7/10$. Here

$A+G = 7$ and $T+C = 10$ as $A = T$ and $G = C$ in the complementary strand. $(A+G)/(T+C)$ in the complementary strand will be $(T+C)/(A+G) = 10/7$ or $10/7 = 1.4285 = 1.43$.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 492. Which among the following sequence will be most stable at higher temperature?

- a. AATTATCTTA
- b. AATCCGGGC
- c. AGGCCGGCA
- d. All of the above

Correct Answer: C

This sequence will be most stable of all, as it is having more amount of GC content as compared to all other given sequences.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 493. B forms of DNA can be easily characterized by

- a. helical turns having 2 base pairs per turn.
- b. left handed structure.
- c. major and minor grooves that allow molecules to interact.
- d. All of the above

Correct Answer: C

The double-helical structure of DNA deduced by Watson and Crick immediately suggested how genetic information is stored and replicated. Since the structural variation and deformability of the double helix affects the accessibility and position of hydrogen bonding groups in the minor and major grooves it is essential part of protein nucleic acid recognition.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 494. _____ molecule is involved in regulation of gene expression.

- a. 16s RNA
- b. miRNA
- c. tRNA
- d. rRNA

Correct Answer: B

A microRNA (abbreviated miRNA) is a small non-coding RNA molecule (containing about 22 nucleotides) found in plants, animals and some viruses, which functions in RNA silencing and post-transcriptional regulation of gene expression.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 495. What type of molecule is always found in virions?

- a. miRNA
- b. RNA
- c. DNA
- d. Protein

Correct Answer: D

Virion is a complete virus particle that consists of an RNA or DNA core with a protein coat sometimes with external envelopes and that is the extracellular infective form of a virus. So the answer is protein as molecules, that are found in all viruses and thus virions.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 496. The base pairs that play a major role in the context of secondary structures in RNA is

- a. A : U
- b. G : U
- c. G : C
- d. C : U

Correct Answer: B

The G·U wobble base pair is a fundamental unit of RNA secondary structure that is present in nearly every class of RNA from organisms of all three phylogenetic domains. IT has comparable thermodynamic stability to Watson-Crick base pairs and is nearly isomorphic to them. Therefore, it often substitutes for G·C or A·U base pairs. The G·U wobble base pair also has unique chemical, structural, dynamic and ligand-binding properties, which can only be partially mimicked by Watson-Crick base pairs or other mispairs. These features mark sites containing G·U pairs for recognition by proteins and other RNAs and allow the wobble pair to play essential functional roles in a remarkably wide range of biological processes.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 497. What is the distance between two successive nitrogenous base pairs?

- a. 34Å
- b. 36Å
- c. 20Å
- d. 3.4Å

Correct Answer: D

DNA is made of two (“duplex DNA”) dextrogyre (like a screw; right-handed) helical chains or strands (“the double helix”), coiled around an axis to form a double helix of 20Å of diameter.

The two strands are antiparallel (*i.e.*, their 5' → 3' orientations are in opposite direction). The general appearance of the polymere shows a periodicity of 3.4Å , corresponding to the distance between 2 bases, and another one of 34Å , corresponding to one helix turn (and also to 10 bases pairs).

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 498. Glucokinase

- a. catalyzes the phosphorylation of fructose.
- b. has a lower K_m for glucose than does hexokinase.
- c. is found in the liver.
- d. is inhibited by glucose

Correct Answer: C

Glucokinase is an enzyme that facilitates phosphorylation of glucose to glucose –6– phosphate. Glucokinase occurs in cells in the liver, pancreas, gut and brain of humans and most other vertebrates. In each of these organs it plays an important role in the regulation of carbohydrate metabolism by acting as a glucose sensor, triggering shifts in metabolism or cell function in response to rising or falling levels of glucose, such as occur after a meal or when fasting.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 499. RNA nucleotides are joined together by

- a. 5'3' phosphodiester bond
- b. 3'5' phosphodiester bind
- c. Both A and B
- d. None of the above

Correct Answer: B

Ribonucleic acid is a polymer of ribonucleotides of adenine, uracil, guanine and cytosine, that are joined together by 3'5' phosphodiester bonds.

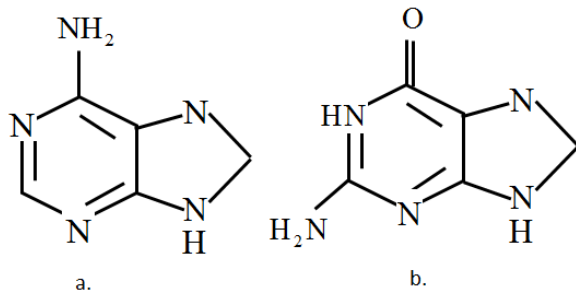
Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 500. What is the type of ring structure that is present in a and b?



- a. Naphthalene
- b. Pyrimidine
- c. Purine
- d. Quinoline

Correct Answer: C

The bicyclic nucleic acid base ring systems are purines and the monocyclic ring systems are pyrimidines. Quinoline and naphthalene ring systems are not present in nucleic acids.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 501. Site of synthesis of rRNA is

- a. nucleus

- b. cytoplasm
- c. nucleolus
- d. mitochondria

Correct Answer: C

Molecules of rRNA are synthesized in a specialized region of the cell nucleus called the nucleolus, which appears as a dense area within the nucleus and contains the genes that encode rRNA.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 502. RNA is composed of

- a. proteins and DNA
- b. RNA and proteins
- c. DNA and RNA
- d. only RNA

Correct Answer: B

Ribosomes are 62% RNA and 38% protein formed into two complexes in prokaryotes, the 50S ribosome subunit and the 30S ribosome subunit. Ribosome associated proteins are positively charged. This helps them to bind to the negatively charged mRNA.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 503. _____ is referred to as charged tRNA.

- a. Aminoacyl tRNA
- b. Hypomethyl tRNA
- c. Pseudouridyl tRNA

d. Hyperuridyl tRNA

Correct Answer: A

Aminoacyl-tRNA (also aa-tRNA or charged tRNA) is tRNA to which its cognated amino acid is chemically bonded (charged). The aa-tRNA, along with some elongation factors, deliver the amino acid to the ribosome for incorporation into the polypeptide chain that is being produced.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 504. Which of the following about DNA helix is correct?

- a. The bases are separated by 3.4\AA and the helical structures repeat every 34\AA
- b. The bases are separated by 3.4 nm and the helical structures repeat every 43\AA
- c. The bases are separated by 3.4\AA and the helical structures repeat every 34nm .
- d. The bases are separated by 3.4 nm and the helical structures repeat every 34nm .

Correct Answer: A

The structure of DNA of all species comprises two helical chains each coiled round the same axis, and each with a pitch of 34\AA (3.4 nanometres) and a radius of 10\AA (1.0 nanometres). The bases are nearly perpendicular to the helix and adjacent bases are separated by 3.4\AA .

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 505. Why does DNA twist?

- a. Due to 2-D structure
- b. Due to 3-D structure
- c. Both A and B
- d. None of the above

Correct Answer: B

DNA twists because of the 3– dimensional structure of the linking molecules along its backbone. These are phosphate molecules and 2 -deoxy-D-ribose molecule. The base pairs links to this backbone using covalent bonds but link in the centre using hydrogen bonds. The linking holds are strand in place and support this twist from both sides.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 506. After how many base pairs, DNA molecules make a complete turn?

- a. 20
- b. 34
- c. 30
- d. 10

Correct Answer: D

The DNA double helix polymer of nucleic acids, held together by nucleotides which base pair together, In B-DNA, the most common double helical structure, the double helix is right-handed with about 10–10.5 nucleotides per turn.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 507. What is replaced, in RNA, in place of thymine in DNA?

- a. Uracil
- b. Adenine
- c. Guanine
- d. None of the above

Correct Answer: A

Thymine is nothing but 5-Methyl Uracil. In DNA, thymine is preferred over uracil due to the following 2 main reasons Thymine base pairs only with Adenine. Although Uracil shows higher affinity for Adenine, it can also bind to cytosine, guanine and another uracil. Chances of errors during replication are possible if uracils were to be present in DNA.

The methyl group in thymine protects the DNA. When cytosine in the DNA molecules are found to undergo deamination to form uracil. This can lead incorrect genetic information. Use of prevents this. The DNA repair systems detects the presence of uracil in the DNA and changes it to cytosine. If uracil were to be present the repair system will have hard time recognising which is the correct uracil which is the deaminated cytosine.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 508. What is the most abundant form of RNA?

- a. tRNA
- b. rRNA
- c. mRNA
- d. All of the above

Correct Answer: B

There are three main types of RNA- tRNA, mRNA and rRNA. The most abundant form of RNA is rRNA or ribosomal RNA because it's responsible for coding and producing all of the proteins in cells. rRNA is found in the cytoplasm of cells and is associated with ribosomes. rRNA takes the coded information delivered from the nucleus by mRNA and translates it so that proteins can be produced and modified.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 509. Where to an extra nuclear DNA found?

- a. Mitochondria

- b. Plastids
- c. Both A and B
- d. Cytoplasm

Correct Answer: C

Extra chromosomal DNA is any DNA that is found outside of the nucleus of a cell. It is also referred to as extra nuclear DNA or cytoplasmic DNA. Most DNA in an individual genome is found in chromosomes but DNA found outside of the nucleus also serves important biological functions. In prokaryotes, non viral extra chromosomal DNA is primarily found in plasmids whereas in eukaryotes extra chromosomal DNA is primarily found in organelles. Mitochondrial DNA is a main source of this extra chromosomal DNA in eukaryotes.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 510. Deoxyribose in a nucleotide is

- a. primary alcohol
- b. secondary alcohol
- c. tertiary alcohol
- d. phenol

Correct Answer: B

Deoxyribose nucleosides have only one primary and one secondary alcoholic group.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 511. What are the types of RNA molecules that have an internally complementary sequence that form hairpin-like structure, synthesized as precursor RNAs and cleaved by end nucleases to form short duplex?

- a. snRNA

- b. mRNA
- c. tRNA
- d. miRNA

Correct Answer: D

Pre-miRNA hairpins are exported from the nucleus in a process involving the nucleocytoplasmic shuttle Exportin-5. This protein, a member of the karyopherin family, recognizes a two-nucleotide overhang left by the RNase III enzyme Drosha at the 3' end of the pre-miRNA hairpin. Exportin-5-mediated transport to the cytoplasm is energy-dependent, using GTP bound to the Ran protein.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 512. Which among the following is the function of 5' Cap of RNA?

- a. Stability of RNA only
- b. Stability and transport of RNA
- c. Transport of RNA only.
- d. Methylation of RNA.

Correct Answer: B

The 5' cap has four main functions

- i. Prevention of degradation by exonucleases
- ii. Promotion of translation
- iii. Promotion of 5' proximal intron excision
- iv. Regulation of nuclear export

Nuclear export of RNA is regulated by the cap binding complex (CBC), which binds exclusively to capped RNA. The CBC is then recognized by the nuclear pore complex and exported. Once in the cytoplasm after the pioneer round of translation, the CBC is replaced by the translation factors eIF-4E and eIF-4G. This complex is then recognized by other translation initiation machinery including the ribosome.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 513. What is the role of internal ribosome entry site (IRES) in mRNA?

- a. It helps in inhibiting translation.
- b. It promotes post-transcriptional mRNA processing.
- c. It promotes its translation under adverse conditions.
- d. None of the above

Correct Answer: C

An internal ribosome entry site, abbreviated IRES, is a nucleotide sequence that allows for translation initiation in the middle of a messenger RNA (mRNA) sequence as part of the greater process of protein synthesis. Usually, in eukaryotes, translation can be initiated only at the 5' end of the mRNA molecule, since 5' cap recognition is required for the assembly of the initiation complex. The location for these sites is often in the 5'UTR.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 514. 5-Bromouracil is a base analog that can cause mutation when incorporated into DNA. Which of the following is the most likely change that 5-Bromouracil induces:

- a. T : A to C : G
- b. T : A to A : T
- c. G : C to T : A
- d. C : G to A : T

Correct Answer: A

Mispairs can also occur when bases become spontaneously ionized. The mutagen 5-bromouracil (5-BU) is an analog of thymine that has bromine at the carbon -5 position in place of the CH₃ group found in thymine. Its mutagenic action is based on enolization and

ionization. In 5-BU, the bromine atom is not in a position in which it can hydrogen-bond during base pairing, so the keto form of 5-BU pairs with adenine. However, the presence of the bromine atom significantly alters the distribution of electrons in the base ring, so 5-BU can frequently change to either the enol form or an ionized form, the latter of which pairs with guanine, 5-BU causes $G \cdot C \rightarrow A \cdot T$ or $A \cdot T \rightarrow G \cdot C$ transitions in the course of replication, depending on whether 5-BU has been ionized in situ or as an incoming base. Hence the action of 5-BU as a mutagen is due to the fact that the molecule spends more of its time in the enol or ion form.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 515. Which molecule has property of self replication?

- a. Protein
- b. Carbohydrate
- c. Lipids
- d. Nucleic acid

Correct Answer: D

Nucleic acids are biopolymers or large biomolecules, essential for all known forms of life. Nucleic acids, which include DNA (deoxyribonucleic acid) and RNA (ribonucleic acid), are made from monomers known as nucleotides. Together with proteins, nucleic acids are the most important biological macromolecules; each are found in abundance in all living things, where they function in encoding, transmitting and expressing genetic information in other words, information is conveyed through the nucleic acid sequence, or the order of nucleotides within a DNA or RNA molecule. Nucleic acid has a property of self replication. Strings of nucleotides strung together in a specific sequence are the mechanism for storing and transmitting hereditary or genetic information via protein synthesis.

Core Concept:

Topic:

Complexity:

Difficulty level:

1.1 stability of proteins and Nucleic Acids

Q. 516. In chemical terms, when you boil an egg and convert the albumin into a white solid mass

- a. the protein is dehydrated by heat.
- b. the protein is denatured by heat.
- c. the protein is cross-linked by heat.
- d. None of the above

Correct Answer: B

Eggs are rich in protein, especially the egg whites. It's this protein that causes eggs to become hard when boiled. On heating an egg, the proteins gain energy and literally shake apart the bonds between the parts of the amino-acid strings, causing the proteins to unfold. As the temperature increases, the proteins gain enough energy to form new, stronger bonds (covalent) with other protein molecules. On boiling an egg, the heat first breaks (unfolds) the proteins, and then allows the proteins to link to other proteins, As the proteins form these new, strong bonds, the water that surrounded each protein molecule when the egg was liquid is forced out. That's why the egg turns hard. (Heat affects all of the proteins in an egg, so it's the best way to cook an egg).

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 517. What is the cause of stability of DNA to alkaline hydrolysis, relative to RNA?

- a. The greater stability of ribose over deoxyribose.
- b. DNA having β - glycosidic bonds and RNA having α - glycosidic bonds.
- c. DNA being more soluble in water than RNA.
- d. The absence of 2'- hydroxyl to assist in the hydrolysis.

Correct Answer: D

The small structural differences between RNA and DNA may not look substantial but, in practice, these small differences have major significance for the biological role of RNA. The α 2' hydroxyl (OH) group present in RNA, but lacking in DNA, has effects that range from the biogenesis of life on earth to how RNA oligonucleotides should be stored. Importantly, the addition of the 2' OH group increases melting temperature (T_m) and stability by locking an RNA duplex into a compact A-form helix that is more stable than DNA's standard B-form helix.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 518. The enzymatic method of DNA sequencing uses

- a. RNA as template.
- b. di-deoxy-ribonucleoside triphosphates, in which the deoxyribose 3'-OH is missing
- c. di-deoxy-ribonucleoside triphosphates, in which the deoxyribose 3'-OH is present.
- d. different chemical treatment to cleave DNA at A, T, C or G.

Correct Answer: B

The DNA to be sequenced is used as template for the *in vitro synthesis*, by DNA polymerase, of a set of partial replicas, all beginning at the same place, but terminating at different points along the DNA chain. The key to this method is the use of dideoxyribonucleoside triphosphates in which the deoxyribose 3'-OH group present in normal nucleotides is missing; when such a modified nucleotide is incorporated into a DNA chain, it blocks the addition of the next nucleotide.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 519. What will be the sequence of the template, if the sequence reading from the bottom to the top of a di-deoxy sequencing gel is TAACGT?

- a. 5'-TAACGT-3'
- b. 3'-TGCAAT-5'
- c. 5'-ACGTTA-3'
- d. 3'-ACGTTA-5'

Correct Answer: C

The sequence of the strand of DNA complementary to the sequenced strand is 5' to 3' TAACGT while the sequence of the sequenced strand, 5' to 3' is ACGTTA.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 520. The T_m melting temperature, of the DNA is the temperature at which half of the molecules of DNA are dissociated into the single stranded. Under which of the following conditions T_m will be maximum?

- a. Low ionic strength and high DNA concentration.
- b. High ionic strength and high DNA concentration.
- c. High ionic strength and low DNA concentration.
- d. Low ionic strength and low DNA concentration.

Correct Answer: B

The melting temperature correlates with how easily a double stranded DNA complex is formed. This, in turn, depends on the likelihood of each pair of nucleotides to bond. The T_m is affected by a number of factors

- i. Concentration of DNA
- ii. Concentration of ions in the solution, most notably Mg^{+} and K^{+}
- iii. DNA sequence
- iv. Length of DNA

The concentration of ions affects T_m because DNA is electrically charged. Therefore it interacts with ions, which can compensate this charge.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 521. _____ favors the strand separation in the melting of dsDNA.

- a. Hydrogen bonding between bases
- b. Repulsion between phosphate groups
- c. Van der Waal interactions between bases.
- d. High content of G+C and A+T

Correct Answer: B

Lower ionic strength reduces the screening of the negative charges on the phosphate groups by positive ions in the medium, The result is stronger charge-charge repulsion between the phosphates, which favours strand separation.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 522. A, B and C are the nucleotides of the ds B-DNA, their base sequences are given below

- i. AAGCG
- ii. CCTGA
- iii. GACTA

Thermodynamically, which among the following statement is correct?

- a. A is most stable of all.
- b. B is most stable of all.
- c. C is most stable of all.
- d. All are equally stable.

Correct Answer: A

AAGCG is most stable of all because it contains G = C in it, which forms a double bond and hence increase the stability of the DNA structure.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 523. The protein that was first sequenced by Sanger was

- a. Insulin
- b. Myosin
- c. Hemoglobin
- d. None of the above

Correct Answer: A

In 1955, insulin became the first protein to be fully sequenced. That work resulted in a 1959 Nobel Prize for Frederick Sanger. Through Sanger's work we now know that all human proteins have a unique sequence of any or all of 20 types of amino acids. The amino acids are strung together into chains called peptides, somewhat like letters combining into long words.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 524. Why is DNA presence important for cellular metabolic activities?

- a. Because it is the structural component of the cell walls.
- b. Because it is the major component of cytoplasm.
- c. Because it directs the production of enzymes.
- d. None of the above.

Correct Answer: C

Enzymes are necessary for most chemical reactions that occur in our bodies. DNA controls the production of proteins, of which enzymes are an example of, in a process called protein synthesis.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 525. A solution of glutamic acid is titrated from pH 1.0 to 7.0 by the addition of 5 mL of a solution of 1M NaOH. What is the approximate number of millimoles of amino acid in the sample ($pK_{a1} = 2.19, pK_{a2} = 4.25, pK_{a3} = 9.67$)?

- a. 12
- b. 10
- c. 3
- d. 2.5

Correct Answer: C

To reach pH 7.0, approximately 100% of the α - carboxyl group ($pK_a = 2.19$) and 90% of the γ -carboxyl group ($pK_{a2} = 4.25$) of glutamic acid must be dissociated. At that pH, approximately twice the amount of NaOH as glutamic acid molecules has been utilized to titrate the two carboxyl groups. Since each milliliter of a 1M NaOH solution contains 1 mmol of NaOH ion, about 3 mmol of the amino acid is present.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 526. Why do the DNA duplex melt at a specific temperature (T_m) on heating?

- a. Loss of base stacking energy.
- b. DNA helix is co-operative structure that is stabilized by hydrogen bonds and base pairing.
- c. Single helix is more stable than double helix.
- d. All of the above

Correct Answer: B

The stability of the DNA double helix depends on a fine balance of interactions including hydrogen bonds between bases, hydrogen bonds between bases and surrounding water molecules and base-stacking interactions between adjacent bases. That is why the DNA molecules melt at a specific melting temperature.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 527. Chirality of DNA is due to

- a. the bases.
- b. base stacking
- c. hydrogen bonds between bases.
- d. deoxyribose

Correct Answer: D

Deoxyribose is a chiral molecule, meaning that its mirror image can be made as well. The two different molecules are called D- deoxyribose and L-deoxyribose; D-deoxyribose is the molecule appearing in DNA, whereas its mirror image L-deoxyribose does not occur naturally. As nucleotide molecules come together to form the structure of DNA, they develop a twist that forms the double helix structure of DNA. DNA develops a twist in the chain because each component contains chirality or handedness. It is this handedness that gives DNA the spiral shaped helical structure, If one molecule in the DNA structure had the wrong chirality, DNA would not exist in the double helix form, and DNA would not function properly.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 528. DNA base stacking can be easily diagnosed by

- a. pH change
- b. hyperchromacity
- c. Both A and B
- d. None of the above

Correct Answer: B

Hyperchromicity is the increase of absorbance (optical density) of a material. Heat denaturation of DNA, also called melting, causes the double helix structure to unwind to form single stranded

DNA. When DNA in solution is heated above its melting temperature (usually more than 80°C), the double-stranded DNA unwinds to form single-stranded DNA. The bases become unstacked and can thus absorb more light. In their native state, the bases of DNA absorb light in the 260–nm wavelength region. When the bases become unstacked, the wavelength of maximum absorbance does not change, but the amount absorbed increases by 37%. A double strand DNA dissociating to single strands produces a sharp cooperative transition.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 529. The type of modifications that is common to both protein and DNA is

- a. nitrosylation
- b. methylation
- c. ubiquitination
- d. Both B and C

Correct Answer: B

Methylation contributing to epigenetic inheritance can occur through either DNA methylation or protein methylation. DNA methylation in vertebrates typically occurs at CpG sites (cytosine-phosphate-guanine sites, that is, where a cytosine is directly followed by a guanine in the DNA sequence) this methylation results in the conversion of the cytosine to 5–methylcytosine. Protein methylation typically takes place on arginine or lysine amino acid residues in the protein sequence. Arginine can be methylated once (monomethylated arginine) or twice, with either both methyl groups on one terminal nitrogen (asymmetric dimethylated arginine) or one on both nitrogens (symmetric dimethylated arginine) by peptidylarginine methyltransferases (PRMTs).

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 530. Why DNA is more stable than RNA, under alkaline conditions?

- a. RNA forms secondary structures.

- b. RNA is a single stranded molecule.
- c. RNA has uracil in place of thymidine.
- d. RNA is susceptible of hydrolysis.

Correct Answer: D

Removal of the 2' -hydroxyl group from RNA to form DNA results in a backbone that is less susceptible to cleavage by hydrolysis. Thus enables more-stable storage of genetic information. The genetic material must be extremely stable so that sequence information can be passed on from generation to generation without degradation. RNA itself is a remarkably stable molecule; negative charges in the sugar-phosphate backbone protect it from attack by hydroxide ions that would lead to hydrolytic cleavage. However, the 2'- hydroxyl group makes the RNA susceptible to base-catalyzed hydrolysis. The removal of the 2'- hydroxyl group from the ribose decreases the rate of hydrolysis by approximately 100 -fold under neutral conditions and perhaps even more under extreme conditions. Thus, the conversion of the genetic material from RNA into DNA would have substantially increased its chemical stability.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 531. Which among the following statement is correct regarding the amino acids?

- a. Charged amino acids are never buried in the interior of a protein.
- b. Charged amino acids are seldom buried in the interior of a protein.
- c. All hydrophobic amino acids are buried when a protein folds.
- d. Both A and B

Correct Answer: B

Charged amino acids are found on the surface of the protein as well as seldom buried in the interior of a folded protein. They can interact with water and other important biological molecules. The positively and negatively charged amino acids form salt bridges.

Core Concept:

Topic:

Complexity:

Difficulty level:

1. J Metabolisms

Q. 532. Which of the following statements correctly defines the salvage pathway for the synthesis of purine nucleotides?

- a. Salvaged purines used in the salvage pathway are mainly from the diet.
- b. The salvage pathway for the synthesis of purine nucleotides is not energetically advantageous.
- c. The salvage pathway for the synthesis of purine nucleotides is energetically advantageous.
- d. None of the above

Correct Answer: C

The salvage pathway for the synthesis of purine nucleotides is energetically advantageous since six molecules of ATP are required to synthesize one purine nucleotide by the *de novo* pathway. Some cells, such as red blood cells have no *de novo* pathway.

Salvaged purines used in the salvage pathway are not mainly from the diet. Purines in the diet appear to be destroyed by epithelial cells of the intestine and are not absorbed. The liver is a major site of purine synthesis and there is evidence it releases purines into the blood for use by other cells (such as red blood cells). The salvage pathway uses purine bases released from the breakdown of nucleotides.

The nucleotides produced from the salvage pathway decrease the *de novo* pathway partly because the AMP and GMP produced inhibit the *de novo* pathway.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 533. What is the alternate source of energy, if a 30 yrs old man is fasting since many days and it was observed that his brain has reduced the use of glucose by replacing it with the other?

- a. Glycerol
- b. Fats
- c. Amino acids
- d. β - hydroxy butyrate

Correct Answer: D

β -hydroxy butyrate, ketone body Ketone bodies serves as alternate fuel for brain during prolonged fasting or starvation. Fatty acids due to long hydrophobic chains cannot cross blood barrier. Glycerol is a substrate of gluconeogenesis. In fact during prolonged fasting this is the only substrate left to provide glucose through pathway of gluconeogenesis. It can also be oxidized through glycolysis upon phosphorylation. β -carotene is a provitamin, it is not a source of energy. Alanine is a transporter of amino group of amino acids from the muscle (glucose-alanine cycle), but it cannot be used as an alternate source of energy.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 534. In skeletal muscles, _____ generates free glucose during the enzymatic breakdown of glycogen.

- a. α -amylase
- b. phosphorylase
- c. G-6- Pcase
- d. α -1,6- amyloglucosidase

Correct Answer: D

Free glucose is released by the action of alfa-1,6 - amyloglucosidase enzyme, a component of debranching enzyme. Debranching enzyme has two components. α -[1-4] to α -[1-4] glucan transferase and α -1-6- amyloglucosidase enzyme. Glucan transferase shifts the trisaccharide on a branch bound by α -[1,4] linkage to a straight chain and joins by α -[1,4] linkage. The exposed branch point is hydrolysed by α -1,6- amyloglucosidase enzyme. Both components are present on the same polypeptide chain. Glucose -6- phosphatase does produce free glucose but it is absent in skeletal muscles. α amylase is a digestive enzyme, it has no role in glycogen degradation in the muscle.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 535. Which among the following statements regarding the glucose is false?

- a. Glycogenesis is stimulated when cellular ATP reserves are low.
- b. Glucose may be stored as glycogen or converted to fat.
- c. Glycogenolysis and gluconeogenesis are functions of the liver.
- d. None of the above

Correct Answer: A

When plasma glucose levels are high and cellular ATP reserves are adequate, glucose is stored in the form of glycogen or is converted to triglyceride. When plasma glucose levels fall, glycogen is broken down (glycogenolysis) to liberate glucose and glucose is synthesized from non-carbohydrate precursors (gluconeogenesis). The liver carries out both these processes.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 536. _____ is an end product of leucine metabolism.

- a. ATP
- b. Pyruvic acid
- c. Oxaloacetic acid
- d. Acetyl CoA

Correct Answer: D

Leucine is ketogenic, being metabolized to acetoacetate and acetyl CoA.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 537. Which among the following is true regarding the urea cycle?

- a. It took place in liver.
- b. The sources of ammonia and the formation of aspartate from oxaloacetate.
- c. Both A and B
- d. None of the above

Correct Answer: C

The urea cycle is a cycle of biochemical reaction occurring in many animals that produces urea $[(\text{NH}_2)_2\text{CO}]$ from ammonia (NH_3). In mammals, the urea cycle takes place primarily in the liver and the lesser extent in the kidney. In the urea cycle, oxaloacetate is one of the keto acids preferred by transaminases and so will be recycled to aspartate, maintaining the flow of nitrogen.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 538. Which among the following statement about the absorptive and post-absorptive states is false?

- a. Events of the absorptive state are controlled by insulin.
- b. In the post-absorptive state glucagon secretion is inhibited.
- c. Both A and B
- d. None of the above

Correct Answer: B

In the absorptive state (after a meal), plasma glucose is high, insulin secretion is stimulated and glucose entry and utilization by cells is enhanced. In the post-absorptive state, plasma glucose falls, output of the hyperglycaemic hormones (including GH and glucagon) is stimulated and reserves of fat and glycogen are mobilized for ATP production.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 539. _____ will be enhanced shortly after a carbohydrate rich meal.

- a. Glycogenesis
- b. Cortisol secretion
- c. Growth hormone secretion
- d. None of the above

Correct Answer: A

After eating, plasma glucose is elevated so glycogen synthesis is favoured. Breakdown of glycogen to glucose (glycogenolysis) and the synthesis of glucose from non-carbohydrate precursors (gluconeogenesis) are unnecessary. Hyperglycaemic hormones such as cortisol and growth hormone are depressed.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 540. Which of the following vitamin contains cobalt?

- a. Vitamin D
- b. Vitamin B₁₂
- c. Vitamin C
- d. Vitamin A

Correct Answer: B

Vitamin B₁₂ consists of a class of chemically related compounds (vitamers), all of which have vitamin activity. It contains the biochemically rare element cobalt sitting in the center of planar tetra-pyrrole ring called a Corrin ring.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 541. Which of the following statement cannot be applied to a person if he is on strike for more than a week?

- a. Ketosis
- b. Ketonuria
- c. Increased release of fatty acids.
- d. Elevated levels of glucose in the plasma.

Correct Answer: D

During fasting, plasma glucose is likely to be low. Levels of all the hyperglycaemic hormones (including the catecholamines) will be increased. Glycogen synthesis will be inhibited but there will be an increase in lipolysis leading to the liberation of fatty acids from adipose tissue. In prolonged starvation, excessive mobilization of fats will lead to the production of ketones in the liver. Although some of these are metabolized by the tissues if the CNS excess ketones will appear in the plasma and urine.

Core Concept:

Topic:

Complexity:

Difficulty level:

Q. 542. What could be the suitable cause for the symptoms that are given in the following given situation?

“A breast-fed infant began to vomit frequently and lost weight and several days he developed jaundice, hepatomegaly and bilateral cataract.”

- a. Gaucher disease
- b. Hereditary disease
- c. Galactosemia
- d. None of the above

Correct Answer: C

The clinical manifestations are typical of classical galactosemia. Bilateral cataract rules out the possibility of hereditary disease, although the symptoms are related to such disease.

Core Concept:

Topic:

Complexity:

Difficulty level:

Molecules & Their Interaction Relevant to Biology

Q. 543. An enzyme, thymidylate synthetase is involved the synthesis of TMP from

- _____.
- a. UMP
 - b. dUMP
 - c. AMP
 - d. thymidine

Correct Answer: B

Thymidylate synthetase is an enzyme that catalyzes the conversion of deoxyuridine monophosphate (dUMP) to deoxythymidine monophosphate (dTMP). dTMP is one of the three nucleotides (dTMP, dTTP, and dTDP) that form thymine. Thymidilic acid (TMP) is synthesized by two different biochemical pathways. In the *de novo* synthesis pathway, deoxyuridylic acid(dUMP) is converted to TMP in a reductive methylation reaction catalysed by thymidylate synthase (TS). The methyl donar is N⁵,N¹⁰–methyleneteretrahydrofolate (me-THFA), which is oxidised to dihydrofolate (DHFA) during the course of reaction. DHFA is converted back to tetrahydrofolate (THFA) by dihydrofolate reductase (DHFR). The salvage pathway involves the transfer of the phosphate to ATP to the 5' position of thymidine and is catalysed by thymidine kinase (TK).

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 544. Which process is common in the synthesis of all steroid hormones?

- a. Dehydration.
- b. Conversion of pregnenolone to progesterone.
- c. Isomerization.
- d. None of the above

Correct Answer: B

Pregnenolone is the final precursor of all the steroid hormones (estrogen, progesterone, androgen and corticoids). In mammals, progesterone, like all other steroid hormones, is synthesized from pregnenolone, which in turn is derived from cholesterol.

Core Concept:

Topic:

Difficulty Level:

Complexity:

- Q. 545. The complication that is less likely to occur in type II diabetes than type I diabetes is
- Weight loss
 - Retinopathy
 - Hypoglycemia coma
 - Cardiovascular disease

Correct Answer: C

Hypoglycemia coma occurs as a result of insulin over dosage in Type I diabetes mellitus. It is not observed in Type II diabetes. Weight gain can occur in both types, it is the result of treatment with insulin or certain hypoglycemia drugs. Non-ketonic hypoglycemia coma is a frequent complication of coma especially in the elder group.

Core Concept:

Topic:

Difficulty Level:

Complexity:

- Q. 546. In the biosynthesis of _____, acyl carrier protein (ACP) plays an important role.
- amino acids
 - fatty acids
 - carbohydrates
 - All of the above

Correct Answer: B

The acyl carrier protein (ACP) is an important component in both fatty acid and polyketide biosynthesis with the growing chain bound during synthesis as a thiol ester at the distal thiol of a 4'-phosphopantetheine moiety.

Core Concept:

Topic:

Difficulty Level:

Complexity:

- Q. 547. In cellular respiration, which of the following processes occur only inside mitochondria and not in the cytoplasm?
- Glycolysis and the pentose - phosphate pathway
 - Glycolysis and the citric acid cycle.
 - The citric acid cycle and oxidative phosphorylation.
 - Glycolysis and oxidative phosphorylation

Correct Answer: C

The citric acid cycle - also known as the tricarboxylic acid (TCA) cycle or the Krebs cycle - is a series of chemical reactions used by all aerobic organisms to generate energy through the oxidation of acetate derived from carbohydrates, fats and proteins into carbon dioxide and chemical energy in the form of adenosine triphosphate(ATP). In the presence of oxygen, the pyruvate produced at the end of glycolysis is converted to acetyl-CoA. In the presence of oxygen the mitochondria will undergo aerobic respiration which leads to Krebs cycle. In the absence of

oxygen fermentation of the pyruvate molecule will occur. When acetyl-CoA is produced, this molecule enters the citric acid cycle, which takes place in the mitochondrial matrix. In eukaryotic cells, the citric acid cycle occurs in the matrix of the mitochondrion. In prokaryotic cells, such as bacteria which lack mitochondria, the TCA reaction sequence is performed in the cytosol. Oxidative phosphorylation (or OXPHOS in short) is the metabolic pathway in which the mitochondria in cells use their structure, enzymes, and energy released by the oxidation of nutrients to reform ATP. Although the many forms of life on earth use a range of different nutrients, ATP is the molecule that supplies energy to metabolism. Almost all aerobic organisms carry out oxidative phosphorylation. This pathway is probably so pervasive because it is a highly efficient way of releasing energy, compared to alternative fermentation processes such as anaerobic glycolysis.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 548. _____ do not contribute to net gluconeogenesis in mammalian liver.

- a. Pyruvate
- b. Alanine
- c. Glutamate
- d. Palmitate

Correct Answer: D

Palmitate is a 16 carbon fatty acid, is not a substrate for gluconeogenesis. Even chain fatty acids, predominantly present in our body, yield acetyl CoA upon oxidation, which cannot contribute towards gluconeogenesis. The pyruvate to acetyl CoA conversion is irreversible and moreover both of the carbon atoms of acetyl CoA are lost in the TCA cycle in the form of CO_2 . Odd chain fatty acids do act as substrates of gluconeogenesis, since propionyl CoA the product of their oxidation can enter TCA cycle through the formation of succinyl CoA, hence can contribute towards glucose production.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 549. The common structural feature in all the steroid hormones is

- a. methyl groups at position 8 and 9.
- b. hydrocarbon functional group at position 17.
- c. hydrocarbon functional group at position 19.
- d. hydrocarbon functional group at position 25.

Correct Answer: B

Steroids, a class of lipids, have a wide variety of biochemical roles and pharmaceutical uses. Despite the large number of different steroids, the core structure of this class of molecules is largely constant, with variation of functional groups occurring at key positions in the structure.

Unlike other biological molecules, it doesn't take long to commit the basic structure of steroids to memory - all contain the characteristic pattern of four fused rings 3 six-membered and one five membered. Steroids often contain oxygen, especially at position 3, but rarely nitrogen. Methyl groups are often found at 10 and 13 but not at 8 and 9 which are ring functions. There is often (but not always) a hydrocarbon group at position 17; cholesterol is a good example of this.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 550. Which lipoprotein is most likely to be elevated in the blood of a person, who continues to grow obese on a fat free carbohydrate rich diet?

- a. LDL
- b. HDL
- c. VLDL
- d. All of the above

Correct Answer: C

Very low density lipoprotein (VLDL) is a type of lipoprotein made by the liver. VLDL is one of the five major groups of lipoproteins that enable fats and cholesterol to move within the water-based solution of the bloodstream. VLDL is assembled in the liver from triglycerides, cholesterol and apolipoproteins. VLDL is converted in the bloodstream to low-density lipoprotein (LDL).

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 551. TCA cycle is the central pathway of metabolism of the cell because

- a. other metabolic pathways depends on it.
- b. its intermediates are used in other metabolic pathways.
- c. Both A and B
- d. None of the above

Correct Answer: B

The citric acid cycle also known as the tricarboxylic acid cycle (TCA cycle) or the Krebs cycle, is a series of chemical reactions used by all aerobic organisms to generate energy through the oxidation of acetate derived from carbohydrates, fats and proteins into carbon dioxide and chemical energy in the form of adenosine triphosphate (ATP). In addition, the cycle provides precursors of certain amino acids as well as the reducing agent NADH that is used in numerous other biochemical reactions. Its central importance to many biochemical pathways suggests that it was one of the earliest established components of cellular metabolism and may have originated abiogenically.

Core Concept:

Topic:

Difficulty Level:

Complexity:

*****Data incomplete from Q. 552 to Q. 560*****

Q. 561. Folic acid is reduced to _____, with the help of enzyme L-folate reductase.

- a. hydrofolic acid
- b. trihydrofolic acid
- c. dihydrofolic acid
- d. None of the above

Correct Answer: C

An enzyme L-folate reductase, reduces folic acid to dihydrofolic acid (H_2F), this compound is reduced, in turn, by dihydrofolic reductase to tetrahydrofolic acid (H_4F). The reducing agent in both the reactions is NADPH.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 562. The lipid that can act as lungs surfactant is

- a. ceramide
- b. phosphatidyl inositol
- c. phosphatidyl choline
- d. All of the above

Correct Answer: C

Phosphatidyl choline also known as lecithin acts as lungs surfactant. This helps to maintain the alveolar viscosity and surface tension. The absence of phosphatidyl choline in newborn leads to fatal condition known as respiratory distress syndrome. LS (Lecithin spingomyelin) ratio is generally used for assessing the respiratory distress syndrome.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 563. _____ is an essential fatty acid.

- a. Oleic acid
- b. Palmitic acid
- c. Linolenic acid
- d. Arachidonic acid

Correct Answer: C

Essential fatty acids, or EFAs, are fatty acids that humans and other animals must ingest because the body requires them for good health but cannot synthesize them. The term "essential fatty acid" refers to fatty acids required for biological processes but does not include the fats that only

act as fuel. Only two fatty acids are known to be essential for humans alpha-linolenic acid (an omega-3 fatty acid) and linoleic acid (an omega-6 fatty acid).

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 564. Which among the following molecule help in the synthesis of bile acid?

- a. Bilirubin
- b. Cholesterol
- c. Fatty acid
- d. None of the above

Correct Answer: B

Bile acid are synthesized from cholesterol in liver, secreted into the bile where it goes the conjugation and modification to become secondary bile acids and bile salts. Most of the bile acids are re-absorbed via entero-hepatic circulation. Bile salts are important for lipid digestion and absorption.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 565. Which enzyme catalyse the reaction that help in the regulation of fatty acid biosynthesis?

- a. Carnitine acyl transferase I
- b. Acetyl-CoA carboxylase
- c. Pyruvate carboxylase
- d. Citrate-malate translocase

Correct Answer: B

Acetyl-CoA Carboxylase catalyzes the 2-step reaction by which acetyl-CoA is carboxylated to form malonyl-CoA. The function of ACC is to regulate the metabolism of fatty acids. When the enzyme is active, the product, malonyl-CoA, is produced which is a building block for new fatty acids and can inhibit the transfer of the fatty acyl group from acyl CoA to carnitine with carnitine acyltransferase, which inhibits the β -oxidation of fatty acids in the mitochondria.

Core Concept:

Topic:

Difficulty Level:

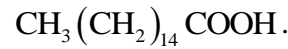
Complexity:

Q. 566. What is the other the name of 16 carbon fatty acid?

- a. Oelic acid
- b. Palmitic acid
- c. Octadecanoic acid
- d. None of the above

Correct Answer: B

Palmitic acid or hexadecanoic acid in IUPAC nomenclature, is the most common fatty acid (saturated) found in animals, plants and microorganisms. Its chemical formula is



Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 567. All are the functions of cholesterol, except

- a. Bile acid synthesis
- b. Steroid hormone synthesis
- c. Membrane fluidity
- d. Thyroid hormone synthesis

Correct Answer: D

Cholesterol is precursor for bile acid and steroid hormones. It is essential component of membrane that helps to maintain membrane fluidity. But thyroid hormones are synthesized from coupling of two tyrosine residues of thyroglobin protein in follicular cells of thyroid gland.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 568. Which enzyme activates the facilitated uptake of triacylglycerol in adipose tissues, which is enhanced by insulin?

- a. LCAT
- b. Lipoprotein lipase
- c. Both A and B
- d. None of the above

Correct Answer: B

The lipoprotein lipase is the enzyme anchored on endothelial tissues and cleaves out VLDL triglycerides into fatty acid and glycerol. Insulin enhances the expression of LPL into the endothelial tissues.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 569. 18 carbon fatty acid is called

- a. Palmitic acid
- b. Oleic acid
- c. Octadecanoic acid
- d. All of the above

Correct Answer: C

The C_{18} saturated fatty acid is called octadecanoic acid because the parent hydrocarbon is octadecane. A C_{18} fatty acid with one double bond is called octadecenoic acid; with two double bonds, octadecadienoic acid; and with three double bonds, octadecatrienoic acid. The notation 180 denotes a C_{18} fatty acid with no double bonds, whereas 182 signifies that there are two double bonds.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 570. Which among the following enzyme convert acetyl CoA to acetoacetyl CoA?

- a. Enolase
- b. Thiolase
- c. Hexokinase
- d. None of the above

Correct Answer: B

Thiolases also known as acetyl-coenzyme A acetyltransferases (ACAT) are enzymes which converts two units of acetyl-CoA to acetoacetyl CoA in the mevalonate pathway.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 571. All of the given statements regarding the fatty acid synthesis is false, except

- a. fatty acids can be used to synthesize glucose.
- b. fatty acids can be synthesised from glucose.
- c. fatty acids can be used to synthesize amino acids.
- d. Both A and B

Correct Answer: B

Fatty acids are synthesized from acetyl-CoA, two carbons at a time, so most naturally occurring fatty acids contain an even number of carbon atoms. When the liver glycogen storage limit has been reached, excess glucose (from dietary carbohydrates) is converted into fat via acetyl-CoA formed from pyruvate by pyruvate dehydrogenase. Therefore glucose can be converted to fatty acids. The reverse cannot occur in animals for there is no mechanism by which fatty acids can be used to give a net pyruvate increase, needed for glucose synthesis. Fat can also be formed from alcohol and certain amino acids.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 572. Citrate in fatty acid synthesis

- a. transports acetyl groups for fatty acid synthesis from the mitochondrion to the cytosol.
- b. transports acetyl groups for fatty acid synthesis from the cytosol to the mitochondrion.
- c. transports CO_2 for fatty acid synthesis from the mitochondrion to the cytosol.
- d. None of the above

Correct Answer: A

Fatty acid synthesis occurs mainly in the cytosol of liver and adipose tissues, two carbons at a time, from acetyl-CoA. The major source of the acetyl-CoA is the mitochondrial pyruvate dehydrogenase reaction. Acetyl-CoA is then converted into citrate by citrate synthase. When the demand for ATP is low, the oxidation of acetyl-CoA via the citric acid cycle and oxidative phosphorylation is reduced, and citrate accumulates. It is transported to the cytosol where it is cleaved back to acetyl-CoA and oxaloacetate by the ATP-citrate lyase since there is no transport mechanism for the acetyl-CoA. The breakdown of ATP here makes the reaction irreversible. Oxaloacetate is reduced to malate using NADH and malate is decarboxylated to pyruvate and CO_2 by the malic enzyme reducing NADP^+ to NADPH for use in fatty acid synthesis.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 573. _____ is/are ketone bodies.

- a. Acetone
- b. Acetoacetate
- c. β -hydroxy butyrate
- d. All of the above

Correct Answer: D

Ketone bodies are three water-soluble molecules that are produced by the liver from fatty acids during periods of low food intake (fasting) or carbohydrate restriction for cells of the body to use as energy instead of glucose. The three endogenous ketone bodies are acetone, acetoacetic acid and β -hydroxybutyric acid. Other ketone bodies such as β -ketopentanoate and β -hydroxypentanoate may be created as a result of the metabolism of synthetic triglycerides such as triheptanoin.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 574. Malonyl CoA is an important intermediate in fatty acid synthesis as

- a. it inhibits the carnitine shuttle that takes fatty acids into the mitochondrion for oxidation.
- b. it activates the synthesis of NADPH which is necessary for fatty acid synthesis.
- c. Both A and B
- d. None of the above

Correct Answer: A

Malonyl-CoA inhibits the carnitine shuttle so that newly synthesized fatty acids in the cytosol are not taken into the mitochondria for oxidation, so a futile cycle is avoided. NADPH is needed for fatty acid synthesis but malonyl CoA has no effect on NADPH synthesis or oxidative phosphorylation. Insulin is needed for fatty acid synthesis but malonyl CoA does not stimulate insulin release.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 575. Which among the following is an active donor of two carbon atoms in fatty acid synthesis?

- a. Coenzyme A
- b. Malonyl-CoA
- c. Acetyl-CoA
- d. None of the above

Correct Answer: B

The first step in the synthesis of fatty acids is the carboxylation of acetyl-CoA to malonyl-CoA (with CO_2 and ATP) by the enzyme acetyl-CoA carboxylase that uses biotin as a prosthetic group. Malonyl-CoA is the active donor of two carbon atoms in fatty acid synthesis. The acyl group carrier of the intermediates in fatty acid synthesis here is not coenzyme A, but a protein called ACP or acyl carrier protein to which the growing fatty acyl chain is attached. ACP, like coenzyme A contains the group 4-phosphopantotheine that forms a thiol ester with the acyl group. The enzyme that synthesizes fatty acids is a large multifunctional complex in mammals.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 576. Which among the following statements is correct regarding the synthesis of fatty acids?

- a. NADH is formed from fatty acid synthesis.
- b. NADPH is used for fatty acid synthesis.
- c. NADPH is formed from fatty acid synthesis.
- d. NADH is used for fatty acid synthesis.

Correct Answer: B

The ketoacyl groups attached to ACP (the acyl carrier protein) are reduced by NADPH-dependent reactions. The NADH and NADPH coenzymes are a metabolic compartmentation allowing the cell to separate reductive power for ATP generation from reductive power needed for synthetic reactions. In 'times of plenty' citrate is transported to the cytosol where it is cleaved back to oxaloacetate and acetyl-CoA for fatty acid synthesis since there is no transport mechanism for the acetyl-CoA. The oxaloacetate is reduced to malate using NADH and malate is

decarboxylated to pyruvate and CO_2 by the malic enzyme reducing NADP^+ to NADPH for use in fatty acid synthesis. NADPH is also produced in the pentose phosphate pathway.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 577. All of the following given statements regarding prostaglandins are correct, except

- a. Prostaglandins are eicosanoids made from unsaturated fatty acids.
- b. Prostaglandins are eicosanoids made from saturated fatty acids.
- c. Prostaglandins synthesized from arachidonic acid have a fever-reducing effect.
- d. None of the above

Correct Answer: B

Prostaglandins are a group of eicosanoids derived from arachidonic acid by cyclooxygenase enzymes. Arachidonic acid is an unsaturated fatty acid released from membrane phospholipids by a phospholipase in response to various signals. These prostaglandins are released from cells immediately after synthesis and act like local hormones on adjacent cells by combining with receptors. They have a wide range of physiological effects. Some can cause pain, inflammation, fever, smooth muscle contraction, while others have a protective effect such as suppressing acid production in the stomach or controlling blood pressure.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 578. Why in the case of anaerobic cells the ratio of pyruvate/ lactate is much less than 1 although under aerobic conditions the ratio of pyruvate/ lactate is much greater than 1?

- a. Lactate is produced from pyruvate only under anaerobic conditions.
- b. Under anaerobic conditions pyruvate is converted to oxygen and carbon dioxide.
- c. Lactate is the terminal electron acceptor in the case of aerobic conditions.
- d. Pyruvate is transported into mitochondria under anaerobic conditions.

Correct Answer: A

The glycolytic pathway produces pyruvate, which in the presence of oxygen will be further metabolized in the citric acid cycle to produce NADH and FADH_2 for oxidative phosphorylation in the mitochondria. Normally, lactic acid will be low under these conditions. In the absence of oxygen (anaerobic), pyruvate must be converted to lactic acid, the only reaction that can regenerate NAD^+ allowing further glycolysis. The production of lactic acid only under anaerobic conditions explains why pyruvate/lactate is much less than 1 in anaerobic cells and much greater than one in aerobic cells.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 579. Statin, a drug, lowers the blood cholesterol (LDL) concentrations by

- a. inhibiting acetyl CoA carboxylase.
- b. inhibiting the synthesis of thromboxanes.
- c. inhibiting cyclo-oxygenase.
- d. inhibiting HMG CoA reductase.

Correct Answer: D

Statins inhibit the enzyme HMG CoA reductase which catalyses the rate limiting step in cholesterol synthesis. They do not affect cyclo-oxygenase which is involved in prostaglandin synthesis nor the synthesis of thromboxanes. Acetyl CoA carboxylase is the rate limiting step in fatty acid synthesis and is not inhibited by statins.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 580. Reducing equivalents in the form of NADPH required for fatty acid synthesis are obtained from cytoplasmic NADH by transfer to cytoplasmic NADP⁺.

- a. True
- b. False
- c. May be true or false
- d. Can't say

Correct Answer: A

Reducing equivalents in the form of NADPH are obtained from cytoplasmic NADH by transfer to cytoplasmic NADP⁺. Citrate is transported to the cytosol where it is cleaved back to acetyl-CoA and oxaloacetate by the ATP-citrate lyase enzyme. Oxaloacetate is reduced to malate using NADH. Malate is decarboxylated to pyruvate and CO₂ reducing NADP⁺ to NADPH. It is a mechanism for transferring reducing equivalents from the NADH 'metabolic compartment' to the NADP⁺ one.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 581. Which among the following act as a precursor of vitamin D formation, via the UV light?

- a. Calciferol
- b. Cholesterol
- c. Triacylglycerols
- d. All of the above

Correct Answer: B

One of cholesterol's many functions in the body is to act as a precursor to vitamin D. Vitamin D can also be obtained from foods. Interestingly, foods that provide this vitamin (all of which are animal foods) tend to be high in cholesterol.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 582. What is the end product of purine catabolism in human body?

- a. Uric acid
- b. Xanthine
- c. Urea
- d. Cholesterol

Correct Answer: A

Uric acid is a heterocyclic compound of carbon, nitrogen, oxygen and hydrogen with the formula $C_3H_4N_4O_3$. It forms ions and salts known as urates and acid urates, such as ammonium acid urate. Uric acid is a product of the metabolic breakdown of purine nucleotides.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 583. _____ inhibit the synthesis of prostaglandin.

- a. Cyanide
- b. Flouride
- c. Aspirin
- d. Both A and B

Correct Answer: C

Aspirin causes several different effects in the body, mainly the reduction of inflammation, analgesia (relief of pain), the prevention of clotting and the reduction of fever. Aspirin's ability to suppress the production of prostaglandins and thromboxanes is due to its irreversible inactivation of the cyclooxygenase (COX) enzyme. Aspirin blocks an enzyme called cyclooxygenase, COX-1 and COX-2, which is involved with the ring closure and addition of oxygen to arachidonic acid converting to prostaglandins. The acetyl group on aspirin is **hydrolysed** and then bonded to the alcohol group of serine as an ester. This has the effect of blocking the channel in the enzyme and arachidonic cannot enter the active site of the enzyme.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 584. Which among the following amino acid is required for purine synthesis?

- a. Glutamate

- b. Aspartate
- c. Glycine
- d. All of the above

Correct Answer: D

Purine ring synthesis starts from the activated ribose PRPP with the sequential addition of nitrogen and carbon containing units, donated from either glutamine (N), glycine (N&C), aspartate (N), folic acid (C) or CO₂.

Core Concept:

Topic:

Difficulty Level:

Complexity:

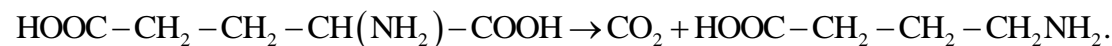
Q. 585. GABA synthesis require

- a. glutamate synthase
- b. glutamate decarboxylase
- c. glutamate carboxylase
- d. glutamate

Correct Answer: B

Glutamate decarboxylase or glutamic acid decarboxylase (GAD) is an enzyme that catalyzes the decarboxylation of glutamate to GABA and CO₂. GAD uses PLP as a cofactor.

The reaction proceeds as follows



Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 586. What could be the constituent of the following given situation? “A 20 years old patient, in coma, is brought to an emergency department and an ambulance attendant note a smell of acetone from breathe”.

- a. Herion overdose
- b. Diabetic ketoacidosis
- c. Alcohol intoxication
- d. All of the above

Correct Answer: B

The smell of acetone on the breathe of a carnatose patient is an important, rapid diagnosis clue that strongly suggests ketoacidosis and is usually seen in patients with poorly controlled type I diabetes. Other features of diabetic ketoacidosis include high blood glucose, increased serum osmolarity, hypovolemia, acedosis and electrolyte imbalance.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 587. Which among the following statement best describes the xanthine?

- a. It binds covalently to allopurinol.
- b. It is oxidised to form uric acid.
- c. It is oxidised to form guanine.
- d. None of the above

Correct Answer: B

Uric acid is a heterocyclic compound of carbon, nitrogen, oxygen and hydrogen with the formula $C_5H_4N_4O_3$. The enzyme xanthine oxidase makes uric acid from xanthine and hypoxanthine, which in turn are produced from other purines. Xanthine oxidase is a large enzyme whose active site consists of the metal molybdenum bound to sulfur and oxygen.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 588. _____ causes feedback inhibition of pyrimidine nucleotide synthesis.

- a. CTP allosteric effect
- b. Increased activity of aspartate transcarbamoylase
- c. UMP allosteric effect
- d. TTP allosteric effect

Correct Answer: A

CTP synthase is precisely regulated by the intracellular concentrations of CTP and UTP. The molecule CTP is also known to be used in feedback inhibition in conjunction with aspartate transcarbamoylase. CTP, which is the final product of the metabolic pathway started by ATCase, inhibits ATCase when there is CTP in excess. When there is excess CTP, the enzyme activity decreases which explains why CTP favors the T state which is less active.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 589. _____ is used as purine analog.

- a. 5 FU
- b. Ara C
- c. 5 methyl thymidine
- d. All of the above

Correct Answer: A

Fluorouracil or 5-FU (trademarked as Adrucil (IV), Carac (topical), Efudex and Efudix (topical)) is a drug that is a pyrimidine analog that is used in the treatment of cancer. It is a suicide inhibitor and works through irreversible inhibition of thymidylate synthase. It belongs to

the family of drugs called the antimetabolites. It is on the World Health Organization's List of Essential Medicines, a list of the most important medications needed in a basic health system.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 590. _____ is an analogue of hypoxanthine.

- a. 5 FU
- b. 3 Ala
- c. Allopurinol
- d. PRPP

Correct Answer: C

Allopurinol is a structural analogue of the natural purine base, hypoxanthine. it is an inhibitor of xanthine oxidase, the enzyme responsible for the conversion of hypoxanthine to xanthine and of xanthine to uric acid, the end product of purine metabolism in man. Allopurinol is metabolized to the corresponding xanthine analogue, oxipurinol (alloxanthine), which also is an inhibitor of xanthine oxidase.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 591. Epinephrine bind to _____ of adrenergic receptor subtype in order to further activate glycogen phosphorylase in liver.

- a. $\alpha 1$
- b. $\alpha 2$
- c. $\beta 1$
- d. $\beta 2$

Correct Answer: A

The liver is one of the main sources of quick fuel in the "Fight or flight" response and so it needs a second pathway for maximum responsiveness. The only receptor left is $\alpha-1$, the correct answer, $\alpha-1$ receptors act by generating DAG/IP3 signals and mobilizing intracellular Ca^{2+} .

Elevated intracellular Ca^{2+} then allosterically activates phosphorylase kinase in the absence of phosphorylation, which then can activate glycogen phosphorylase via an abbreviated phosphorylation pathway. (There is one other allosteric activator besides Ca^{2+} that can activate glycogen phosphorylase by bypassing the normal PKA step - the (non-cyclic) AMP "cellular distress signal" which acts to directly activate glycogen phosphorylase b in the absence of a phosphorylation signal.)

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 592. Molecule primarily responsible for the formation of lipid raft are

- a. phosphatidyl serine and phosphatidyl choline.
- b. phosphatidyl inositol and cholesterol.
- c. glycosylphosphatidyl inositol and cholesterol.
- d. sphingolipids and cholesterol.

Correct Answer: D

Sphingolipids are a class of lipids containing a backbone of sphingoid bases, a set of aliphatic amino alcohols that includes sphingosine. Cholesterol is an organic molecule. It is a sterol (or modified steroid), a lipid molecule and is biosynthesized by all animal cells because it is an essential structural component of animal cell membrane that is required to maintain both membrane structural integrity and fluidity.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 593. What is the precursor for dopamine synthesis?

- a. Phenylalanine
- b. Alanine
- c. Histidine
- d. All of the above

Correct Answer: A

Dopamine is synthesized in a restricted set of cell types, mainly neurons and cells in the medulla of the adrenal glands. This is the metabolic pathway

L-Phenylalanine → L-Tyrosine → L-DOPA → Dopamine

Thus the direct precursor of dopamine is L-DOPA, but this itself can be synthesized from the essential amino acid phenylalanine or the non-essential amino acid tyrosine. These amino acids are found in nearly every protein and as such are provided from ingestion of protein-containing food, with tyrosine being the most common. Tyrosine hydroxylase or tyrosine 3-monooxygenase is the enzyme responsible for catalyzing the conversion of the amino acid L-tyrosine to L-3,4-dihydroxyphenylalanine (L-DOPA).

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 594. Lysine is synthesized from

- a. Glutamate
- b. Histidine
- c. Aspartate
- d. Phenylalanine

Correct Answer: C

Lysine is synthesized from aspartate via the diaminopimelate (DAP) pathway. The initial two stages of the DAP pathway are catalyzed by aspartokinase and aspartate semialdehyde dehydrogenase and play a key role in the biosynthesis of lysine, threonine and methionine.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 595. Which of the following statements about triacylglycerols is correct?

- a. Triacylglycerols are carried in the blood bound to albumin.
- b. Triacylglycerols are stored in all cells.
- c. Triacylglycerols are oxidised to glycerol and fatty acids.
- d. Triacylglycerols are hydrolysed to glycerol and fatty acids.

Correct Answer: D

Fat in the form of triacylglycerol is stored in the adipose cells. In adipose tissue, hydrolysis of fats to fatty acids and glycerol is accomplished by hormone-sensitive triacyl-glycerol lipase. Free fatty acids are released there into the blood stream where they bind to albumin. Fatty acids are oxidized to acetyl-CoA in cells with mitochondria (with the exception of brain cells) providing energy via the citric acid cycle and the electron transport chain. The glycerol is converted to glucose in the liver *via* the gluconeogenesis pathway.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 596. Which among the following is a key enzyme that is involved in the regulation of fatty acid synthesis?

- a. Protein phosphatase.
- b. AMP activated proteinkinase.
- c. Acetyl CoA carboxylase.
- d. None of the above

Correct Answer: C

Fatty acid metabolism is stringently controlled so that synthesis and degradation are highly responsive to physiological needs. Fatty acid synthesis is maximal when carbohydrate and energy are plentiful and when fatty acids are scarce. Acetyl CoA carboxylase plays an essential role in regulating fatty acid synthesis and degradation. The carboxylase is controlled by three global signals glucagon, epinephrine and insulin that correspond to the overall energy status of the organism.

Core Concept:

Topic:

Difficulty Level:

Complexity:

- Q. 597. During the mechanism of synthesis of fatty acids
- reverse of β -oxidation of fatty acids takes place.
 - acetyl-CoA act as an active donor of two carbon atoms.
 - malonyl-CoA act as an active donor of two carbon atoms.
 - coenzyme A is the acyl group carrier of intermediates.

Correct Answer: C

The first step in the synthesis of fatty acids is the carboxylation of acetyl-CoA to malonyl-CoA (with CO_2 and ATP) by the enzyme acetyl-CoA carboxylase that uses biotin as a prosthetic group. Malonyl-CoA is the active donor of two carbon atoms in fatty acid synthesis. The acyl group carrier of the intermediates in fatty acid synthesis here is not coenzyme A, but a protein called ACP or acyl carrier protein to which the growing fatty acyl chain is attached. ACP, like coenzyme A contains the group 4-phosphopantotheine that forms a thiol ester with the acyl group. The enzyme that synthesizes fatty acids is a large multifunctional complex in mammals.

Core Concept:

Topic:

Difficulty Level:

Complexity:

- Q. 598. In the case of *de novo* synthesis of purine nucleotide
- IMP is a competitive inhibitor of PRPP synthetase.
 - the enzyme PRPP amidotransferase catalyses the committed step of the *de novo* synthesis pathway.
 - Both A and B
 - None of the above

Correct Answer: B

The *de novo* synthesis pathway of purine nucleotides involves the assembly of the purine ring, piece by piece, onto 5-phosphoribosylamine made from PRPP (5-phosphoribosyl-1-pyrophosphate) by PRPP amidotransferase. PRPP is made from ribose-5-phosphate and ATP by PRPP synthetase. Hypoxanthine is the first base assembled onto the, ribose-5-phosphate to form the nucleotide IMP (inosinic acid). This is a branch point in the purine synthesis pathway since either adenine or guanine can be formed from it. This pathway is energetically expensive for a cell (six molecules of ATP are required) for each purine nucleotide molecule synthesised. The control of the *de novo* nucleotide synthesis pathway is a classical example of allosteric feedback control. The enzymes committed to each pathway are allosterically inhibited by the nucleotides AMP, ADP, GMP and GDP. This ensures a balanced production of ATP and GTP both of which are required for nucleotide synthesis.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 599. What is the role of citrate in fatty acid synthesis?

- a. Transport of CO₂ from the mitochondrion to the cytosol.
- b. Transport of acetyl groups from the mitochondrion to the cytosol.
- c. Transport of acetyl groups from the cytosol to the mitochondrion.
- d. Transport of reducing equivalents from the mitochondrion to the cytosol.

Correct Answer: B

Fatty acid synthesis occurs mainly in the cytosol of liver and adipose tissues, two carbons at a time, from acetyl-CoA. The major source of the acetyl-CoA is the mitochondrial pyruvate dehydrogenase reaction. Acetyl-CoA is then converted into citrate by citrate synthase. When the demand for ATP is low, the oxidation of acetyl-CoA via the citric acid cycle and oxidative phosphorylation is reduced, and citrate accumulates. It is transported to the cytosol where it is cleaved back to acetyl-CoA and oxaloacetate by the ATP-citrate lyase since there is no transport mechanism for the acetyl-CoA. The breakdown of ATP here makes the reaction irreversible. Oxaloacetate is reduced to malate using NADH and malate is decarboxylated to pyruvate and CO₂ by the malic enzyme reducing NADP⁺ to NADPH for use in fatty acid synthesis.

Core Concept:

Topic:

Difficulty Level:

Complexity:

Q. 600. Which of the following statements about aminolevulinic acid synthase (ALA synthase) is correct?

- a. ALA synthase catalyses the rate-limiting reaction in heme synthesis.
- b. ALA synthase synthesis decreases in individuals treated with drugs such as barbiturates.
- c. Both A and B
- d. None of the above

Correct Answer: A

The haem biosynthesis pathway begins with glycine and succinyl-CoA forming aminolevulinic (ALA) acid using aminolevulinic acid synthase (ALA synthase) in the mitochondrial matrix. This is the committed step in porphyrin synthesis. Two molecules of ALA condense to form porphobilinogen finally producing haem via protoporphyrin synthesis. When drugs such as barbiturates are administered to a patient the synthesis of hepatic cytochrome P₄₅₀ required for their metabolism increased. The synthesis of ALA synthase is also increased in response to the demand for haem. Individuals with acute intermittent porphyria cannot handle the increased supply of ALA due to a deficiency in an enzyme of the biosynthetic pathway. This results in the preceding metabolites ALA and porphobilinogen accumulating. The symptoms of the disease are associated with this.

Core Concept:

Topic:

Difficulty Level:

Complexity:

