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Biology Grade 11 — Chapter 2

Molecular Biology

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Independent practice MCQs from the supplied Class 11 Biology notes pack. Total: 50 questions.

A. Important / Main Topics

1. Which of the following is the study of the chemical processes taking place within living organisms?

(A) Biochemistry
(B) Cell biology
(C) Histology
(D) Physiology

Correct Answer: A

Explanation: Biochemistry is defined as the study of the composition and structure of chemical compounds in living organisms and the chemical processes taking place within them.

2. Which bond is formed by the mutual sharing of electrons between two atoms?

(A) Ionic bond
(B) Covalent bond
(C) Hydrogen bond
(D) Hydrophobic interaction

Correct Answer: B

Explanation: A covalent bond is formed by the mutual sharing of electrons between two atoms to achieve a s.

3. What is the general formula for carbohydrates?

(A) C_nH□nO_n
(B) C_nH_nO□n
(C) C_n(H□O)_n
(D) (CH□)_nO_n

Correct Answer: C

Explanation: According to the classic concept, carbohydrates have the generalized formula C_n(H□O)_n, where n is the number of carbon atoms.

4. Which of the following is a monosaccharide?

(A) Sucrose
(B) Maltose
(C) Starch
(D) Glucose

Correct Answer: D

Explanation: Glucose is a single saccharide unit (monosaccharide) with the formula C□H□□O□.

5. What is the bond that links two monosaccharides to form a disaccharide?

(A) Glycosidic bond
(B) Peptide bond
(C) Ester bond
(D) Phosphodiester bond

Correct Answer: A

Explanation: A glycosidic bond is a covalent bond formed by a condensation reaction between two sugar molecules.

6. Which polysaccharide is the major structural component of plant cell walls?

(A) Starch
(B) Cellulose
(C) Glycogen

(D) Chitin

Correct Answer: B

Explanation: Cellulose is the structural carbohydrate of plants and the major constituent of the plant cell wall.

7. What are the building blocks (monomers) of proteins?

(A) Nucleotides
(B) Fatty acids
(C) Amino acids
(D) Monosaccharides

Correct Answer: C

Explanation: Amino acids are the building blocks of proteins. There are 20 commonly found in proteins.

8. How many essential amino acids must be obtained from the diet?

(A) 5
(B) 11
(C) 20
(D) 9

Correct Answer: D

Explanation: There are nine essential amino acids that cannot be produced by the body and must be acquired through diet.

9. Which bond forms between the carboxylic acid group of one amino acid and the amino group of another?

(A) Peptide bond
(B) Glycosidic bond
(C) Ester bond
(D) Phosphodiester bond

Correct Answer: A

Explanation: A peptide bond is established between the C of the carboxylic acid group and the N of the amino group of two amino acids.

10. Which of the following is the defining characteristic of lipids?

(A) They are highly soluble in water.
(B) They are insoluble in water but soluble in organic solvents.
(C) They are made of nucleotides.
(D) They always contain phosphorus.

Correct Answer: B

Explanation: Lipids are a heterogeneous group of organic compounds that are hydrophobic (insoluble in water) but soluble in organic solvents.

11. What is the most common type of phospholipid found in cell membranes?

(A) Phosphatidylserine
(B) Phosphatidylethanolamine
(C) Phosphatidylcholine (lecithin)
(D) Phosphatidylinositol

Correct Answer: C

Explanation: Phosphatidylcholine, also called lecithin, is the most common phospholipid, where choline is attached to the phosphate group.

12. Which of the following is the energy currency of the cell?

(A) NAD
(B) FAD
(C) DNA
(D) ATP

Correct Answer: D

Explanation: ATP (Adenosine Triphosphate) is a mononucleotide known as the energy currency of cells.

13. Which nitrogenous base is found only in RNA and not in DNA?

(A) Uracil
(B) Thymine
(C) Adenine
(D) Guanine

Correct Answer: A

Explanation: Uracil is found only in RNA, whereas thymine is found only in DNA.

14. According to the Watson and Crick model, how many hydrogen bonds form between Guanine and Cytosine?

(A) 1
(B) 3
(C) 2
(D) 4

Correct Answer: B

Explanation: There are three hydrogen bonds between Guanine and Cytosine, while there are two between Adenine and Thymine.

15. What is the process of synthesizing mRNA from a DNA template called?

(A) Translation
(B) Replication
(C) Transcription
(D) Transformation

Correct Answer: C

Explanation: Transcription is the first step of gene expression, where a single strand of mRNA is synthesized from the DNA template.

16. Why is water considered the "universal solvent"?

(A) It has a high specific heat capacity.
(B) It has a high heat of vaporization.
(C) It is less dense as a solid than as a liquid.
(D) It is a polar molecule, allowing it to dissolve ionic and polar substances.

Correct Answer: D

Explanation: The polarity of water molecules makes it an excellent solvent for polar substances and ionic compounds.

17. A molecule has the formula C□H□□O□ but contains a ketone group instead of an aldehyde group. This molecule is:

(A) Fructose
(B) Glucose
(C) Galactose
(D) Ribose

Correct Answer: A

Explanation: Both glucose and fructose are hexoses (C□H□□O□), but glucose is an aldo sugar and fructose is a keto sugar.

18. In a DNA molecule, if the percentage of Adenine is 20%, what is the percentage of Guanine?

(A) 20%
(B) 30%
(C) 40%
(D) 60%

Correct Answer: B

Explanation: According to Chargaff's rule, A = T (20% + 20% = 40%). The remaining 60% is divided equally between G and C, so G = 30%.

19. Which of the following is a major function of cholesterol in the plasma membrane?

(A) It acts as a channel for ions.
(B) It serves as a receptor for hormones.
(C) It stabilizes the lipid bilayer and restricts the entry/exit of polar molecules.
(D) It acts as an antigen for cell recognition.

Correct Answer: C

Explanation: It stabilizes the lipid bilayer and restricts the entry/exit of polar molecules. — this correctly answers the question.

20. Which level of protein structure is stabilized by hydrogen bonds between the C=O and N-H groups of the polypeptide backbone?

(A) Primary structure
(B) Tertiary structure
(C) Quaternary structure
(D) Secondary structure

Correct Answer: D

Explanation: Secondary structures (α-helix or β-pleated sheets) are established by hydrogen bonding between opposite charge-bearing groups of different amino acids.

21. Sickle cell anemia is caused by a single amino acid substitution. What is this change in the β-chain of hemoglobin?

(A) Glutamic acid is replaced by Valine.
(B) Valine is replaced by Glutamic acid.
(C) Glycine is replaced by Alanine.
(D) Alanine is replaced by Glycine.

Correct Answer: A

Explanation: Sickle cell hemoglobin shows one difference from normal: glutamic acid is replaced by valine at position number six in the β-chain.

22. Which of the following is a fibrous protein?

(A) Enzymes
(B) Collagen
(C) Hormones
(D) Antibodies

Correct Answer: B

Explanation: Fibrous proteins have a fibre-like shape, are insoluble, and are structural. Collagen is a fibrous protein.

23. Which type of fatty acid has a higher melting point?

(A) Unsaturated and short-chain
(B) Unsaturated and long-chain
(C) Saturated and long-chain
(D) Saturated and short-chain

Correct Answer: C

Explanation: Saturated and long-chain — this correctly answers the question.

24. In the formation of a nucleotide, the nitrogenous base is linked to which carbon of the pentose sugar?

(A) 2' carbon
(B) 3' carbon
(C) 5' carbon
(D) 1' carbon

Correct Answer: D

Explanation: During nucleotide formation, the nitrogenous base is linked with the 1' carbon of the pentose sugar, forming a nucleoside.

25. Which enzyme is responsible for transcribing viral RNA into DNA in retroviruses like HIV?

(A) Reverse transcriptase

(B) DNA polymerase
(C) RNA polymerase
(D) Protease

Correct Answer: A

Explanation: Reverse transcriptase — this correctly answers the question.

B. Less Important / Secondary Topics

26. What is the primary role of mRNA in the cell?

(A) It carries the genetic message from the nucleus to the ribosome.
(B) It forms part of the ribosome.
(C) It transports amino acids to the ribosome.
(D) It acts as a catalytic molecule.

Correct Answer: A

Explanation: mRNA takes the genetic message from the nucleus to the ribosome in the cytoplasm to form a particular protein (translation).

27. What is the sequence of the Central Dogma of Life?

(A) RNA → DNA → Protein
(B) DNA → RNA → Protein
(C) DNA → Protein → RNA
(D) Protein → RNA → DNA

Correct Answer: B

Explanation: The flow of biological information from DNA to RNA and from RNA to protein is known as the central dogma of life.

28. Which of the following is formed when a protein is covalently attached to a carbohydrate?

(A) Glycolipid
(B) Lipoprotein
(C) Glycoprotein
(D) Nucleoprotein

Correct Answer: C

Explanation: Glycoproteins are formed when proteins are covalently attached to carbohydrates.

29. In a DNA molecule, which of the following is true regarding the two polynucleotide chains?

(A) They are parallel and identical in direction.
(B) They are parallel but have identical base sequences.
(C) They are antiparallel but not complementary.
(D) They are antiparallel and complementary to each other.

Correct Answer: D

Explanation: According to the Watson and Crick model, the two chains are opposite in direction (antiparallel) and complementary to each other.

30. What is the function of the 2' hydroxyl (-OH) group in RNA?

(A) It can participate in reactions that cleave the phosphodiester bond, making RNA less stable.
(B) It makes RNA more stable than DNA.
(C) It allows RNA to form a double helix.
(D) It binds to the phosphate group.

Correct Answer: A

Explanation: The hydroxyl group at the 2' position can participate in reactions that cleave the phosphodiester bond, making RNA less s.

31. Which type of bond is formed during the polymerization of nucleotides in DNA and RNA?

(A) Peptide bond
(B) Phosphodiester bond
(C) Glycosidic bond

(D) Hydrogen bond

Correct Answer: B

Explanation: Nucleotides are linked by phosphodiester bonds between the 5' phosphate of one nucleotide and the 3' hydroxyl of the next.

32. When a protein signal (first messenger) binds to a cell surface receptor, what is typically generated inside the cell?

(A) A steroid hormone
(B) A new DNA strand
(C) A second messenger like cAMP
(D) A polysaccharide

Correct Answer: C

Explanation: Protein signaling involves the generation of a second messenger, such as cAMP, which triggers changes in the cell.

33. Which of the following is an example of a conjugated molecule consisting of a lipid and a carbohydrate?

(A) Glycoprotein
(B) Lipoprotein
(C) Nucleoprotein
(D) Glycolipid

Correct Answer: D

Explanation: Glycolipids are complex lipids containing one or more simple sugars in connection with long fatty acids or alcohol.

34. Which structural feature of water allows it to absorb a large amount of heat with a minimal change in temperature?

(A) High specific heat capacity due to hydrogen bonding
(B) High polarity
(C) Lower density of ice
(D) Ionization

Correct Answer: A

Explanation: Much of the heat absorbed by water is used to break hydrogen bonds, so a large amount of heat causes very little increase in temperature.

35. Which of the following is a stereoisomer of glucose that is a non-superimposable mirror image?

(A) Anomer
(B) Enantiomer
(C) Epimer
(D) Diastereoisomer

Correct Answer: B

Explanation: Enantiomers are stereoisomers that are non-superimposable mirror images of one another, like D-glucose and L-glucose.

36. If a protein is treated with a chemical that breaks disulfide bridges, which level(s) of protein structure would be most directly affected?

(A) Primary structure
(B) Secondary structure
(C) Tertiary structure
(D) Quaternary structure

Correct Answer: C

Explanation: Disulfide bridges are important for stabilizing the tertiary structure of proteins.

37. A molecule of DNA has the sequence 5'-ATGC-3' on one strand. What is the sequence of the complementary strand?

(A) 5'-TACG-3'

(B) 5'-GCAT-3'
(C) 3'-ATGC-5'
(D) 3'-TACG-5'

Correct Answer: D

Explanation: The complementary strand is antiparallel and pairs A with T and G with C. The complementary sequence to 5'-ATGC-3' is 3'-TACG-5'.

38. Which of the following explains why water is less dense as a solid (ice) than as a liquid?

(A) Ice has a giant lattice structure with maximum hydrogen bonding, creating more space between molecules.
(B) Ice has a more compact structure.
(C) Water molecules in ice have less kinetic energy.
(D) Ice contains fewer hydrogen bonds than liquid water.

Correct Answer: A

Explanation: Ice has a lattice-like arrangement due to maximum hydrogen bonding, which creates empty spaces, making it less dense than liquid water.

39. In a DNA double helix, if the total number of purines is 40%, what is the percentage of pyrimidines?

(A) 20%
(B) 40%
(C) 60%
(D) 80%

Correct Answer: B

Explanation: According to Chargaff's rule, the total purines and total pyrimidines are in a 1:1 ratio, so if purines are 40%, pyrimidines are also 40%.

40. Which of the following best describes the structural difference between a nucleoside and a nucleotide?

(A) A nucleoside contains a phosphate group, while a nucleotide does not.
(B) A nucleoside contains only a phosphate group and a base.
(C) A nucleoside consists of a sugar and a base, while a nucleotide consists of a sugar, a base, and a phosphate group.
(D) A nucleotide lacks a pentose sugar.

Correct Answer: C

Explanation: A nucleoside is a base linked to a sugar. When a phosphate is added to the 5' carbon, it becomes a nucleotide.

41. During the formation of a phosphodiester bond between two nucleotides, what is released?

(A) Water
(B) Carbon dioxide
(C) Ammonia
(D) Pyrophosphate

Correct Answer: D

Explanation: Pyrophosphate — this correctly answers the question.

42. A mutation changes a single nucleotide in a gene, resulting in the substitution of one amino acid in the protein. What is this type of mutation called?

(A) Point mutation
(B) Frameshift mutation
(C) Deletion
(D) Insertion

Correct Answer: A

Explanation: Sickle cell anemia is an example of a point mutation where a single nucleotide change results in the substitution of glutamic acid with valine.

43. Which of the following is the primary function of glycolipids and glycoproteins on the cell surface?

(A) Transport of ions
(B) Cell-to-cell recognition and sticking cells together in tissues
(C) Synthesis of ATP
(D) DNA replication

Correct Answer: B

Explanation: Glycolipids and glycoproteins act as cell surface markers involved in cell-to-cell recognition.

44. In a steroid signaling pathway, where is the receptor for the steroid hormone typically located?

(A) On the cell surface
(B) In the cell membrane
(C) Inside the cell (cytoplasm or nucleus)
(D) On the mitochondrial membrane

Correct Answer: C

Explanation: Steroids are lipid-soluble and can freely diffuse across the plasma membrane to bind to receptors inside the cell.

45. What is the role of the R group in an amino acid?

(A) It forms the peptide bond.
(B) It binds to the phosphate group.
(C) It forms the backbone of the protein.
(D) It determines the individual chemical properties of the amino acid.

Correct Answer: D

Explanation: It determines the individual chemical properties of the amino acid. — this correctly answers the question.

46. In a molecule of ATP, what is the significance of the two covalent bonds linking the three phosphates?

(A) They are high-energy bonds.
(B) They are low-energy bonds.
(C) They are hydrogen bonds.
(D) They are glycosidic bonds.

Correct Answer: A

Explanation: The two covalent bonds linking the three phosphates together are called high-energy bonds and can be broken by hydrolysis to release energy.

47. Why does a protein lose its function if its tertiary structure is disrupted?

(A) The primary sequence changes.
(B) The active site loses its specific 3D shape, preventing substrate binding.
(C) The peptide bonds break.
(D) The protein becomes a carbohydrate.

Correct Answer: B

Explanation: The active site loses its specific 3D shape, preventing substrate binding. — this correctly answers the question.

48. If a cell is placed in a solution with a high concentration of solutes, what will happen to the water potential?

(A) Water potential will increase.
(B) Water potential will remain unchanged.
(C) Water potential will decrease.
(D) Water potential becomes zero.

Correct Answer: C

Explanation: Adding solutes lowers the water potential, making it more negative. Water moves from high water potential (low solute) to low water potential (high solute).

49. Which of the following statements about enzymes is supported by their protein nature?

(A) They can be crystallized.

(B) They are unaffected by temperature.

(C) They are always fibrous.

(D) They are highly specific and catalyze biochemical reactions.

Correct Answer: D

Explanation: Enzymes are mostly proteins, and their specific 3D structure allows them to catalyze specific biochemical reactions.

50. A student states that DNA is more stable than RNA because it lacks a 2'-OH group. Is this correct?

(A) Yes, the absence of a 2'-OH group makes DNA more stable because it cannot participate in reactions that cleave the phosphodiester bond.

(B) No, DNA is less stable than RNA.

(C) No, both have the same stability.

(D) No, RNA is more stable because it has a 2'-OH group.

Correct Answer: A

Explanation: The notes state that DNA can act as a s.