Biomolecules

Class 12 Chemistry · 24 NEET MCQs with answers & explanations

Biomolecules in Chemistry covers carbohydrates (mono-, di-, polysaccharides), proteins (amino acids, peptide bond, structures), enzymes, vitamins and nucleic acids. NEET tests classification, structural differences (glucose vs fructose, DNA vs RNA), reducing vs non-reducing sugars and vitamin deficiency diseases.

Key Biomolecule Facts

Biomolecule	Key Fact
Glucose	Aldohexose ($C_6H_{12}O_6$); reducing sugar; exists as α and β anomers
Sucrose	Glucose + fructose; non-reducing sugar (glycosidic bond blocks both anomeric C)
Amino acids	Zwitter-ionic at isoelectric pH; 20 standard; peptide bond = CO−NH (amide)
Protein structure	1° (sequence) → 2° (α-helix, β-sheet) → 3° (3D fold) → 4° (subunits)
DNA vs RNA	DNA: deoxyribose + ATGC + double strand; RNA: ribose + AUGC + single strand
Vitamins	A (night blindness), B_1 (beriberi), C (scurvy), D (rickets), K (blood clotting)

Questions

Q1. Which of the following best defines carbohydrates according to NCERT?

(A) Polyhydroxy aldehydes only
(B) Polyhydroxy ketones only
(C) Polyhydroxy aldehydes or ketones or substances yielding them on hydrolysis
(D) Compounds with formula CnH2nOn only

Q2. Which of the following is classified as a monosaccharide?

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

Q3. Which of the following is a ketohexose and is a major sugar found in honey?

(A) D-Glucose
(B) D-Galactose
(C) D-Mannose
(D) D-Fructose

Q4. An enzyme is best described as which of the following?

(A) A polysaccharide acting as catalyst
(B) A nitrogen-containing carbohydrate
(C) A biological catalyst with high specificity
(D) A lipid lowering activation energy

Q5. Which statement best defines carbohydrates as per NCERT?

(A) Polyhydroxy acids only
(B) Nitrogenous organic compounds
(C) Polyhydroxy aldehydes or ketones
(D) Simple sugars only

Q6. Which of the following best describes the role of amylopectin in starch?

(A) Unbranched fraction responsible for blue-black colour with iodine
(B) Branched fraction (α-1,4 chains with α-1,6 branch points) forming the major part of starch
(C) Linear fraction with only beta 1,4 linkages
(D) Structural polysaccharide providing rigidity

Q7. Which of the following most accurately defines an amino acid?

(A) Organic compound with amino and carboxyl on alpha carbon
(B) Compound with only an amino group
(C) Compound with only a carboxyl group
(D) Compound with peptide linkage only

Q8. Which of the following best explains why amino acids exist as zwitterions in aqueous solution?

(A) Only an acidic group donates a proton to solvent
(B) Internal proton transfer from carboxyl to amino group forms a dipolar ion
(C) They lack polar groups entirely
(D) They form covalent bonds with water

Q9. Which of the following best defines nucleic acids?

(A) Polymers of nucleotides
(B) Polymers of amino acids
(C) Polymers of monosaccharides
(D) Polymers of fatty acids

Q10. Which set of components correctly makes up a nucleotide?

(A) Nitrogenous base, pentose sugar, phosphate
(B) Amino acid, sugar, lipid
(C) Base, protein, ion
(D) Sugar, lipid, ion

Q11. Which statement correctly distinguishes glucose from fructose?

(A) Glucose is an aldohexose; fructose is a ketohexose
(B) Both are ketohexoses
(C) Both are aldopentoses
(D) Glucose is a ketopentose; fructose is an aldohexose

Q12. Which option correctly identifies the glycosidic linkage in maltose?

(A) β-1,4 linkage between galactose and glucose
(B) α-1,4 linkage between two glucose units
(C) α-1,2 linkage between glucose and fructose
(D) β-1,6 linkage between two glucose units

Q13. Which of the following most comprehensively explains the nature of enzymes as described in NCERT?

(A) Biological catalysts, mostly proteins, not consumed in reaction
(B) Inorganic metal ions that activate chemical reactions
(C) Nucleic acids that replicate genetic information
(D) Polysaccharides that catalyse energy storage reactions

Q14. Which of the following best explains why enzymes are highly specific in their action?

(A) Flexible active site adapts to any substrate; hence non-specific
(B) Unique 3D active site is complementary to only one specific substrate
(C) Excess enzyme ensures all substrates bind simultaneously
(D) Non-specific random collisions determine substrate binding

Q15. Which statement best describes vitamins in human nutrition?

(A) Organic micronutrients needed in small amounts
(B) Energy-yielding macronutrients
(C) Structural polymers only
(D) Inorganic salts essential for bones

Q16. How are vitamins primarily classified based on solubility?

(A) Acidic and basic vitamins
(B) Fat-soluble and water-soluble
(C) Volatile and non-volatile
(D) Organic and inorganic vitamins

Q17. Which statement best explains why cellulose is not digested by humans?

(A) It lacks glucose units entirely
(B) It is a highly branched polysaccharide with alpha linkages
(C) It is completely insoluble and cannot enter cells
(D) Humans lack cellulase enzyme to hydrolyse beta 1,4-glycosidic bonds

Q18. Which amino acid is optically inactive due to the absence of a chiral carbon?

(A) Alanine
(B) Valine
(C) Glycine
(D) Leucine

Q19. Which of the following is NOT an oligosaccharide?

(A) Sucrose
(B) Maltose
(C) Lactose
(D) Cellulose

Q20. Which of the following is a polysaccharide?

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

Q21. Which of the following monosaccharides is a ketose?

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

Q22. Which carbohydrate yields exactly two monosaccharide units on hydrolysis?

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

Q23. Which of the following contains a glycosidic linkage?

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

Q24. Which of the following correctly distinguishes α-D-glucose from β-D-glucose?

(A) Position of –OH at C-2
(B) Position of –OH at C-1
(C) Number of carbon atoms
(D) Type of glycosidic bond formed

Answer key

1-C	**2-A**	**3-D**	**4-C**	**5-C**	**6-B**	**7-A**	**8-B**
9-A	**10-A**	**11-A**	**12-B**	**13-A**	**14-B**	**15-A**	**16-B**
17-D	**18-C**	**19-D**	**20-D**	**21-C**	**22-A**	**23-C**	**24-B**

Answers with explanations

Q1 — Answer: (C) Polyhydroxy aldehydes or ketones or substances yielding them on hydrolysis
NCERT defines carbohydrates as polyhydroxy aldehydes or ketones, or compounds yielding them on hydrolysis. Option D fails because deoxyribose (C5H10O4) does not fit CnH2nOn, so formula alone cannot define the class.

Q2 — Answer: (A) Glucose
Monosaccharides cannot be hydrolysed into simpler carbohydrates. Glucose is a monosaccharide; sucrose is a disaccharide, starch and cellulose are polysaccharides.

Q3 — Answer: (D) D-Fructose
Fructose is a ketohexose, meaning its carbonyl group is a ketone at C-2. Glucose, galactose and mannose are all aldohexoses, with the carbonyl at C-1. Fructose is the predominant sugar in honey alongside glucose.

Q4 — Answer: (C) A biological catalyst with high specificity
Enzymes are biological catalysts, almost all of which are proteins, and exhibit high specificity for their substrates and the reactions they catalyse. Ribozymes are the exception as catalytic RNA. Polysaccharides and lipids do not function as catalysts under normal cellular conditions.

Q5 — Answer: (C) Polyhydroxy aldehydes or ketones
Carbohydrates are defined as polyhydroxy aldehydes or ketones, or substances that yield them on hydrolysis. Option A is a trap — carbohydrates contain -OH groups but are not acids; they lack the -COOH group.

Q6 — Answer: (B) Branched fraction (α-1,4 chains with α-1,6 branch points) forming the major part of starch
Starch contains two components: amylose (about 15–20%), an unbranched α-1,4 chain that gives the blue-black colour with iodine, and amylopectin (about 80–85%), a branched polymer of α-1,4 chains with α-1,6 linkages at the branch points. Cellulose has β-1,4 linkages and is the structural polysaccharide.

Q7 — Answer: (A) Organic compound with amino and carboxyl on alpha carbon
Amino acids contain both an amino group and a carboxyl group attached to the same alpha carbon, along with a hydrogen atom and a variable R group. This alpha carbon arrangement is the defining structural feature of all standard amino acids.

Q8 — Answer: (B) Internal proton transfer from carboxyl to amino group forms a dipolar ion
Amino acids undergo internal acid-base reaction where the carboxyl group donates a proton to the amino group of the same molecule, forming a dipolar ion (zwitterion) bearing both a positive charge on nitrogen and a negative charge on oxygen. Option A is wrong because the transfer is internal, not to solvent.

Q9 — Answer: (A) Polymers of nucleotides
Nucleic acids are long-chain polymers of repeating nucleotide units responsible for storage and transfer of genetic information. Amino acids form proteins; monosaccharides form polysaccharides; fatty acids form lipids.

Q10 — Answer: (A) Nitrogenous base, pentose sugar, phosphate
A nucleotide consists of a nitrogenous base, a pentose sugar, and a phosphate group — these three together form the basic structural unit of nucleic acids. Option B describes components unrelated to nucleotides.

Q11 — Answer: (A) Glucose is an aldohexose; fructose is a ketohexose
Glucose has an aldehydic carbonyl group at C-1 making it an aldohexose. Fructose has a ketonic carbonyl group at C-2 making it a ketohexose. Options B and C misstate both structures. Option D reverses the classifications.

Q12 — Answer: (B) α-1,4 linkage between two glucose units
Maltose is formed from two glucose units connected by an α-1,4 glycosidic linkage. One anomeric carbon remains free, so maltose is a reducing sugar. Option C describes the linkage in sucrose. Option D describes the branch points in glycogen and amylopectin.

Q13 — Answer: (A) Biological catalysts, mostly proteins, not consumed in reaction
Enzymes are mostly proteinaceous biological catalysts that speed up biochemical reactions without being consumed. Some enzymes called ribozymes are RNA-based, but the vast majority are proteins as stated in NCERT. Option B confuses cofactors with enzymes; options C and D are categorically incorrect.

Q14 — Answer: (B) Unique 3D active site is complementary to only one specific substrate
Enzyme specificity arises from the precise 3D arrangement of amino acid residues at the active site, which is complementary only to a particular substrate — analogous to the lock-and-key mechanism. Option A incorrectly describes induced fit as causing non-specificity; induced fit still maintains specificity.

Q15 — Answer: (A) Organic micronutrients needed in small amounts
Vitamins are organic compounds required in minute quantities for normal metabolism, growth, and maintenance. They do not provide energy directly but regulate biochemical processes. Option D confuses vitamins with minerals — a frequent NEET-level mix-up.

Q16 — Answer: (B) Fat-soluble and water-soluble
Vitamins are classified as fat-soluble (A, D, E, K) — stored in liver and adipose tissue — and water-soluble (B complex, C) — not stored significantly and requiring regular dietary intake. Option A describes acids/bases, not vitamins.

Q17 — Answer: (D) Humans lack cellulase enzyme to hydrolyse beta 1,4-glycosidic bonds
Cellulose contains beta 1,4-glycosidic bonds and humans do not possess cellulase to hydrolyse them. Option B is a trap — cellulose is actually unbranched, not branched. Option C is partially true but not the biochemical reason.

Q18 — Answer: (C) Glycine
Glycine has two identical hydrogen substituents on its alpha carbon, so it lacks a chiral centre and shows no optical activity. All other standard amino acids have four different substituents on the alpha carbon and are optically active.

Q19 — Answer: (D) Cellulose
Cellulose is a polysaccharide with thousands of β-glucose units linked by β-1,4 glycosidic bonds — far beyond the 2–10 unit range of oligosaccharides. Sucrose, maltose, and lactose are all disaccharides (oligosaccharides).

Q20 — Answer: (D) Starch
Starch contains a large number of glucose units joined by glycosidic linkages, making it a polysaccharide. Maltose, lactose, and sucrose are disaccharides yielding only two monosaccharide units on hydrolysis.

Q21 — Answer: (C) Fructose
Fructose has a ketone functional group at C-2, making it a ketohexose. Glucose, galactose, and mannose all carry an aldehyde group at C-1 and are classified as aldoses.

Q22 — Answer: (A) Sucrose
Sucrose is a disaccharide that hydrolyses to give one glucose and one fructose molecule. Cellulose and starch are polysaccharides yielding hundreds to thousands of monosaccharide units.

Q23 — Answer: (C) Maltose
Glycosidic linkages connect monosaccharide units in di- and polysaccharides. Maltose has an α-1,4 glycosidic linkage between two glucose units. Glucose, fructose, and ribose are monosaccharides with no glycosidic bonds.

Q24 — Answer: (B) Position of –OH at C-1
α- and β-D-glucose are anomers differing only in the orientation of –OH at C-1 (anomeric carbon): axial in α, equatorial in β. This difference directly determines whether starch (α) or cellulose (β) linkages form.

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