

CLASS 12

CHEMISTRY

EXTRA QUESTIONS

Class 12 Chemistry Chapter 10 Biomolecules – Extra Questions with Answers

These extra practice questions for Class 12 Chemistry Chapter 10 – Biomolecules go beyond the NCERT textbook exercises to reinforce carbohydrate chemistry, protein structure, vitamin deficiency diseases, and nucleic acid base-pairing. Useful for board exam revision and quick concept checks.

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Very Short Answer Type Questions (1 Mark)

Q1. Name the deficiency disease caused by a lack of vitamin B₁ and vitamin D.

Ans: Vitamin B₁ (thiamine) deficiency causes **beriberi**; vitamin D (calciferol) deficiency causes **rickets** in children (and osteomalacia in adults).

Q2. What is the anomeric carbon in glucose?

Ans: The anomeric carbon is **C1** of glucose — the carbon that becomes a new stereocentre when the open-chain structure cyclises into the pyranose (hemiacetal) ring, giving rise to the α and β anomers.

Q3. Name the two components of starch.

Ans: **Amylose** (unbranched, water-soluble, forms a helix) and **amylopectin** (branched, water-insoluble).

Q4. Which base is present in RNA but not in DNA, and which is present in DNA but not in RNA?

Ans: **Uracil** is present in RNA but not DNA; **thymine** is present in DNA but not RNA.

Short Answer Type Questions (2–3 Marks)

Q5. What is meant by mutarotation? Illustrate with reference to glucose.

Ans: Mutarotation is the spontaneous change in optical rotation of a freshly-prepared solution of a sugar's pure anomeric form towards a fixed equilibrium value, as the two anomers interconvert through the open-chain form. Freshly dissolved α -D-glucose (specific rotation $+11.1^\circ$) and freshly dissolved β -D-glucose (specific rotation $+19.2^\circ$) each gradually change, on standing, to the same equilibrium value of **$+52.5^\circ$** — corresponding to an equilibrium mixture of both anomeric forms via the open-chain aldehyde.

Q6. Explain why fibrous proteins are generally insoluble in water while globular proteins are usually soluble.

Ans: In fibrous proteins, long polypeptide chains lie parallel to one another and are cross-linked by hydrogen bonds and disulphide bonds into extended, rope-like or sheet-like structures with relatively little hydrophilic surface exposed to water, making them water-insoluble (e.g. keratin, collagen, myosin). In globular proteins, the chain folds up so that hydrophobic side chains are buried in the interior and polar/hydrophilic side chains face outward on the compact spherical surface, allowing extensive interaction with surrounding water molecules and making them water-soluble (e.g. insulin, haemoglobin, albumin).

Q7. Distinguish between a nucleoside and a nucleotide, and name the sugar and one purine base found in DNA.

Ans: A nucleoside is a base+sugar unit (no phosphate); a nucleotide is a base+sugar+phosphate unit, i.e. a phosphorylated nucleoside. DNA's sugar is β -D-2-deoxyribose, and one of its purine bases is **adenine** (the other purine base is guanine; DNA's pyrimidines are cytosine and thymine).

Higher Order Thinking Skills (HOTS)

Q8. A student argues: "Since DNA and RNA are both nucleic acids built from very similar nucleotide units, they should be equally stable and equally suited to long-term storage of genetic information." Evaluate this claim with reference to the structural differences between DNA and RNA.

Ans: The claim is **not correct**. Although DNA and RNA share the same basic nucleotide architecture, two

structural differences make DNA far better suited to long-term genetic storage. First, DNA's sugar is 2-deoxyribose (lacking the 2'-OH group that ribose has); RNA's extra 2'-OH makes its backbone chemically more reactive and more prone to hydrolytic cleavage, so RNA degrades faster than DNA. Second, DNA is normally double-stranded, with each strand's base sequence protected and "backed up" by its complementary partner strand (A-T, G-C base pairing) — damage to one strand can be repaired using the other as a template. RNA is usually single-stranded, with no such built-in redundancy. Together, these differences explain why DNA, not RNA, serves as the durable, error-correctable long-term store of hereditary information in most organisms, while RNA is generally used for shorter-lived, working copies of genetic instructions.

Q9. Two carbohydrate samples, both of molecular formula $C_{12}H_{22}O_{11}$, are tested with Fehling's solution. Sample X gives a positive test (red precipitate); Sample Y gives no reaction. Both hydrolyse under acid conditions to give monosaccharides. Identify a plausible identity for X and Y, and explain the difference in their Fehling's test behaviour in terms of their glycosidic linkages.

Ans: Sample X (Fehling's-positive, a reducing disaccharide) is plausibly **maltose** (glucose+glucose via an α -1,4 glycosidic link) or lactose (glucose+galactose via a β -1,4 link) — both leave one anomeric carbon free to open into a reactive aldehyde form. Sample Y (Fehling's-negative, a non-reducing disaccharide) is plausibly **sucrose** (glucose+fructose), whose glycosidic bond forms between the anomeric carbons of both monosaccharide units (C1 of glucose and C2 of fructose), leaving no free anomeric -OH on either unit. Since Fehling's test requires a free, openable aldehyde (or an α -hydroxy ketone that can isomerise to one), only X, with its unused anomeric centre, can reduce Cu^{2+} to the red Cu_2O precipitate; Y cannot.

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