

Qualitative Determination of Carbohydrates

Advanced Multiple Choice Questions

1. Which of the following statements BEST explains the biochemical basis of Molisch's test in qualitative carbohydrate analysis?

- A. Concentrated sulfuric acid oxidizes monosaccharides into carboxylic acids which subsequently react with α -naphthol to form a green precipitate.
 - B. Concentrated sulfuric acid dehydrates carbohydrates into furfural or hydroxymethylfurfural derivatives that condense with α -naphthol producing a purple or violet ring at the interface.
 - C. Diluted hydrochloric acid hydrolyzes polysaccharides into amino acids which react with iodine to produce a dark blue complex.
 - D. Cupric ions in alkaline medium reduce aldehyde groups into ketones while sulfuric acid stabilizes the final red precipitate.
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2. A carbohydrate sample produced a brick-red precipitate with Benedict's reagent after heating. This observation MOST likely indicates that the sample:

- A. Contains a reducing sugar capable of reducing cupric ions into cuprous oxide under alkaline conditions.
 - B. Contains only non-reducing polysaccharides that undergo oxidation in acidic medium.
 - C. Contains starch molecules that form unstable complexes with iodine in alkaline medium.
 - D. Contains ketohexoses incapable of participating in oxidation-reduction reactions.
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3. Which of the following carbohydrates would MOST likely give a NEGATIVE Benedict's test before hydrolysis?

- A. Glucose because it contains a free aldehyde functional group.
 - B. Maltose because it contains reducing monosaccharide residues.
 - C. Sucrose because its glycosidic linkage prevents a free reducing group.
 - D. Fructose because ketohexoses cannot reduce cupric ions.
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4. Barfoed's test is primarily used to differentiate between monosaccharides and disaccharides because:

- A. Monosaccharides react more rapidly with cupric ions in acidic medium forming a red precipitate within 1–2 minutes.
 - B. Disaccharides contain more aldehyde groups than monosaccharides and therefore react instantly.
 - C. Monosaccharides form stable blue complexes with iodine while disaccharides remain colorless.
 - D. Acidic hydrolysis completely prevents all disaccharides from participating in reduction reactions.
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5. In Seliwanoff's test, ketohexoses react faster than aldohexoses because ketohexoses:

- A. Undergo dehydration more rapidly in the presence of concentrated acid forming furfural derivatives that react with resorcinol.
 - B. Possess more hydroxyl groups capable of binding iodine molecules strongly.
 - C. Contain peptide bonds that accelerate condensation with α -naphthol.
 - D. Are resistant to hydrolysis and therefore accumulate rapidly during heating.
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6. Which of the following observations MOST strongly supports the presence of starch in an unknown solution?

- A. Formation of a deep cherry-red solution after heating with Seliwanoff reagent.
 - B. Development of a purple or violet ring after addition of Molisch reagent.
 - C. Appearance of a blue or blue-black complex after addition of iodine solution.
 - D. Formation of a brick-red precipitate after Benedict's reaction.
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7. Which carbohydrate would MOST likely give positive results in BOTH Benedict's and Barfoed's tests?

- A. Lactose because it is a reducing disaccharide reacting rapidly in acidic medium.
 - B. Glucose because it is a reducing monosaccharide capable of rapid reduction.
 - C. Sucrose because hydrolysis occurs immediately in Benedict's reagent.
 - D. Starch because polysaccharides are strongly reducing compounds.
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8. During Molisch's test, the appearance of a violet ring specifically occurs at the junction of the two liquids because:

- A. Sulfuric acid and α -naphthol immediately precipitate as insoluble crystals.

- B. Furfural derivatives formed by acid dehydration condense locally with α -naphthol at the interface.
 - C. Monosaccharides accumulate at the upper layer due to low molecular weight.
 - D. Iodine molecules diffuse preferentially toward the sulfuric acid layer.
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9. Which statement regarding reducing sugars is MOST accurate?

- A. All ketoses are permanently incapable of reducing cupric ions in Benedict's reagent.
 - B. Reducing sugars possess functional groups capable of participating in oxidation-reduction reactions.
 - C. Only polysaccharides can function as reducing sugars in acidic medium.
 - D. Non-reducing sugars rapidly produce red precipitates in Barfoed's test.
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10. Why should boiling in Barfoed's test NOT be prolonged beyond 1–2 minutes?

- A. Excessive heating may allow reducing disaccharides to hydrolyze and falsely produce positive results.
 - B. Prolonged heating destroys all monosaccharides before reduction occurs.
 - C. Cupric ions become permanently oxidized into elemental copper during extended heating.
 - D. Acetic acid converts monosaccharides into non-reducing polysaccharides.
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11. Which of the following carbohydrate classifications is CORRECT?

- A. Fructose is classified as an aldohexose because it contains six carbons and an aldehyde group.
 - B. Glucose is classified as a ketohexose because it contains a ketone functional group.
 - C. Glucose is classified as an aldohexose because it contains six carbon atoms and an aldehyde group.
 - D. Ribose is classified as a tetrose because it contains four carbon atoms.
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12. A sample gave positive Molisch and Benedict tests but negative iodine and Seliwanoff tests. The sample is MOST likely:

- A. Glucose because it is a reducing aldohexose monosaccharide.
- B. Fructose because it is a ketohexose producing a red Seliwanoff reaction.
- C. Starch because it forms a blue iodine complex.
- D. Sucrose because it is a non-reducing disaccharide.

13. Which reagent in Benedict's test directly undergoes reduction during the reaction?

- A. Sulfuric acid which is converted into sulfur dioxide.
 - B. Cupric ions which are reduced into cuprous oxide precipitate.
 - C. Resorcinol which is oxidized into furfural compounds.
 - D. α -Naphthol which precipitates as copper sulfate crystals.
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14. The positive iodine reaction with glycogen differs from starch because glycogen typically produces:

- A. A permanent bright green precipitate resistant to heating.
 - B. A purple-colored complex rather than a blue complex.
 - C. A deep cherry-red precipitate identical to fructose.
 - D. No visible reaction due to absence of glycosidic bonds.
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15. Which of the following carbohydrates is considered NON-reducing according to the laboratory experiment?

- A. Maltose because it contains glucose residues capable of reduction.
 - B. Lactose because it contains a free reducing group.
 - C. Sucrose because it lacks a free aldehyde or ketone group available for reduction.
 - D. Fructose because ketoses are biologically inactive in redox reactions.
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16. The main purpose of Seliwanoff's test is to:

- A. Distinguish polysaccharides from oligosaccharides using iodine complexes.
 - B. Differentiate aldoses from ketoses based on the rate of furfural formation.
 - C. Detect proteins through formation of peptide-copper complexes.
 - D. Hydrolyze starch into glucose molecules under alkaline conditions.
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17. Which statement BEST explains why Molisch's test is regarded as a general carbohydrate test?

- A. It produces positive reactions only with monosaccharides containing aldehyde groups.
 - B. All carbohydrates can be dehydrated into furfural derivatives under strong acidic conditions.
 - C. Only reducing sugars possess sufficient hydroxyl groups to react with α -naphthol.
 - D. Iodine complexes formed during the test are common to all carbohydrates.
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18. A student observed no color change in Benedict's test, but after hydrolysis the solution produced a brick-red precipitate. The unknown carbohydrate was MOST likely:

- A. Glucose because it already reacts before hydrolysis.
 - B. Fructose because ketohexoses rapidly reduce cupric ions.
 - C. Sucrose because hydrolysis releases reducing monosaccharides.
 - D. Starch because iodine positivity always accompanies Benedict positivity.
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19. Which statement regarding iodine complexes with polysaccharides is MOST accurate?

- A. The iodine complexes are highly stable and cannot be disrupted by heating.
 - B. Alcohol, sodium hydroxide, or heating can disrupt the weak iodine-polysaccharide interaction.
 - C. Iodine binds covalently to glucose residues forming irreversible products.
 - D. Glycogen produces a permanent blue-black complex stronger than starch.
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20. A carbohydrate sample produced positive Molisch, positive Benedict, positive Barfoed, and positive Seliwanoff tests. The MOST probable identity of the carbohydrate is:

- A. Lactose because it is a reducing disaccharide reacting slowly in acidic medium.
 - B. Fructose because it is a reducing ketohexose monosaccharide.
 - C. Sucrose because prolonged heating liberates fructose and glucose.
 - D. Starch because polysaccharides produce positive iodine reactions.
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Model Answers

Question 1:B

Question 2:A

Question 3:C

Question 4:A

Question 5:A

Question 6:C

Question 7:B

Question 8:B

Question 9:B

Question 10:A

Question 11:C

Question 12:A

Question 13:B

Question 14:B

Question 15:C

Question 16:B

Question 17:B

Question 18:C

Question 19:B

Question 20:B