Structure, Function and Identification of Macromolecules

The foods we eat are a combination of the major groups of nutrients our cells require.

Q1. Identify the 4 main categories of macromolecules and state why each is important for cells.

Carbohydrates are composed of carbon, hydrogen and oxygen in a 1:2:1 ratio. They can easily be divided into three main groups, each of which have some general characteristics.

- Monosaccharides – These are crystalline compounds, soluble in water, sweet to taste, and do not need digestion in order to be absorbed into the blood stream. They may contain either 5 carbons (pentose) or six carbons (hexose).
- Disaccharides -These are crystalline, water-soluble, sweet to the taste, and must be digested to monosaccharides before they can be absorbed and used for energy. These are a combination of two monosaccharides.
- Polysaccharides -These are not water soluble and are not crystalline. They form colloidal suspensions instead of solutions. They are not sweet and must be digested before being absorbed. These are made up of many monosaccharides joined together.

Q2. Name an example of each of the three categories of carbohydrates.

Q3. Describe how carbohydrates are stored in your body and how they are removed from storage when needed.

Q4. Some students are using the Lugol's iodine test and Benedict's test to detect the presence of certain macromolecules in foods. Predict their results by completing the data table below:

Table 1: Lugol's and Benedict's test results for a variety of foods

Food tested	Lugol's iodine test result	Benedict's test result
	purple	blue
Table sugar		
	yellow	red precipitate
Untreated starch		
Starch exposed to amylase		
Distilled water		

Q5. Another student predicts that her lollipop will give a positive Benedict's test. What would you say?

Q6. One group of students gets a positive Lugol's test for their distilled water. Suggest an explanation for this.

Students are trying to investigate the effects of amylase on starch. They set up a series of test tubes as outlined below and then subject the contents of each tube to the Benedict's test.

Table 2: Preparation of test tubes for Lugol's and Benedict's tests

Test tube	amylase	starch	HCl	Lugol's test	Benedict's test
1	-	10 mL	-	purple	blue
2	2 mL	10 mL	-	yellow	red
3	2 mL	10 mL	1 drop	purple	blue
4	distilled water			yellow	blue

Q7. State the purpose of each tube.

Q8. a) What molecule disappears from the starch/amylase mixture?
b) What new molecule appears in the starch/amylase mixture?
c) From these data, what can we say about the effect of amylase on starch?

Q9 Tube 3 contained amylase yet showed a positive Lugol test and negative Benedict test. Explain.

Q10. Design a simple experiment to determine if the amylase is used up during starch digestion.

Q11. Suggest a reason why the saliva of carnivores generally contains a much lower concentration of salivary amylase than does that of herbivores and omnivores.

Q12. Would you expect plants to produce amylase?

Peptide bonds can be detected using the biuret test. In the presence of peptides bonds, the reagent changes from blue to pink or lavender. Because there is one peptide bond between each pair of amino acids, the intensity of the color change is directly proportional to the concentration of proteins in a sample.

Q13. Complete the data table.

Table 3: Biuret results for treated and untreated egg white

Treatment group	Biuret result
Egg white	
Egg white treated with proteases	

Q14. Design a procedure to allow you to rank a series of solutions from highest protein concentration to lowest.

Ninhydrin (2,2-dihydroxyindane-1,3-dione) is a chemical used to detect primary and secondary amines. When reacting with these amines, a deep blue or purple color is produced.

Q15. Suggest a reason why ninhydrin treatment is still the most common method for detecting fingerprints on porous surfaces where dusting would be inappropriate.