

Aim: To test food samples for the presence of glucose (reducing sugar), starch, protein and lipid.

### Background Theory

- Food molecules include carbohydrates (starch, glucose), proteins and lipids.
- Each macromolecule can be identified using a specific chemical test.
- A positive result is a specific colour change. A negative result keeps the reagent colour.

### Equipment

- Test tubes and test tube rack
- Water bath at 80°C
- Benedict's solution (blue)
- Biuret reagent (NaOH + copper sulfate solution)
- Iodine solution (orange-brown)
- Ethanol (industrial)
- Distilled water
- Food samples to test (e.g. glucose solution, starch solution, egg white, cooking oil)

### The Four Tests

Test	Method	Positive result	Negative result
<b>Reducing sugar (glucose)</b>	Add 2 cm <sup>3</sup> of food sample + 2 cm <sup>3</sup> Benedict's solution. Heat in water bath at 80°C for 5 minutes.	<b>Brick red/orange precipitate</b>	Solution stays blue
<b>Starch</b>	Add 2 drops of iodine solution to the food sample on a white tile.	<b>Blue-black colour</b>	Remains orange-brown
<b>Protein</b>	Add 2 cm <sup>3</sup> food sample + 2 cm <sup>3</sup> dilute NaOH. Add 2 drops copper sulfate solution. Mix gently.	<b>Purple/violet colour</b>	Remains blue
<b>Lipid</b>	Add 2 cm <sup>3</sup> food sample to 2 cm <sup>3</sup> ethanol. Shake to dissolve. Pour into 2 cm <sup>3</sup> distilled water.	<b>Milky white emulsion forms</b>	Solution remains clear

### Results Table

Food sample	Benedict's result	Iodine result	Biuret result	Ethanol result

## Analysis

- For each food sample, identify which molecules are present based on your results.
- Explain each positive result using the appropriate test name and colour change.
- ★ Explain why heating is required for Benedict's test — the copper ions need energy to react with the reducing sugar.
- ★ Describe why a food might test positive for both starch and reducing sugar (starch is being broken down by amylase in saliva during the test).

**Exam Tip:** Learn the EXACT positive colour for each test. Benedict's = brick red (not just "red"). Iodine = blue-black (not "black"). Biuret = purple/violet (not "blue"). Wrong colour = wrong mark.

**Common Mistake:** The biuret test reagents must be added in the right order — NaOH first, then copper sulfate. Adding them the wrong way round gives an incorrect result.