Four tests, four targets

Use a separate portion of the sample for each test. Record the observed colour or cloudiness first, then state which biological molecule was detected.

1. BENEDICT'S — Reducing sugars

Add Benedict's solution to the aqueous sample; heat in a hot water bath.

Blue remains: negative.

Green, yellow, orange or brick-red precipitate: positive.

2. IODINE — Starch

Add iodine in potassium iodide solution to the sample. No heating is required.

Orange-brown remains: negative.

Blue-black colour: positive.

3. EMULSION — Lipids

Mix the sample with ethanol; then add the clear ethanolic extract to water. Do not heat.

No white cloudiness: negative.

Milky-white emulsion: positive.

4. BIURET — Proteins

Add biuret reagent and mix. Alternatively, add alkali then a few drops of dilute copper(II) sulfate.

Blue remains: negative.

Lilac or purple colour: positive.

Only Benedict's test requires heating here. The colour swatches are reminders, not calibrated concentration standards.

Scope: Cambridge Biology 9700 syllabus, section 2.1, outcome 1, p. 17.

What the results actually mean

These are qualitative tests: they detect a target under the test conditions. A positive result is not a complete analysis of everything in a food sample.

1. REDUCING SUGAR IS NOT THE SAME AS ALL SUGAR

Glucose, fructose and maltose give positive Benedict's tests. Sucrose does not give a positive result directly. A blue result therefore does not prove that the sample contains no carbohydrate. Standardised concentration comparisons and the non-reducing sugar test are covered in Lessons 2.1.2 and 2.1.3.

2. IODINE DETECTS STARCH, NOT EVERY CARBOHYDRATE

Iodine forms a blue-black complex with starch. Glucose is a carbohydrate but does not produce this starch result. A sample can contain both starch and a reducing sugar, so the iodine and Benedict's tests may both be positive.

3. WHY THE EMULSION LOOKS WHITE

ETHANOL	→ ADD WATER	→ EMULSION
Lipid dissolves.	Lipid is poorly soluble.	Tiny droplets scatter light.

The white appearance comes from dispersed lipid droplets, not a new white pigment. Use a clear extract so undissolved food does not imitate a positive result.

4. BIURET DETECTS PEPTIDE BONDS

In alkaline conditions, copper(II) ions form a violet complex with peptide bonds in polypeptides. Free amino acids do not give the usual positive protein result. This test indicates protein or polypeptide material; it does not identify a particular protein.

Syllabus context: Cambridge Biology 9700, sections 2.1-2.3.

Make the evidence trustworthy

Good technique separates a real result from contamination, poor preparation or a failed reagent. Follow your teacher's approved procedure and risk assessment.

1. PREPARE AND CONTROL

Label clean tubes and use fresh portions for all four tests. Prepare a suitable aqueous sample for Benedict's, iodine and biuret; use an ethanolic extract for the emulsion test. Keep sample and reagent volumes consistent. For Benedict's comparisons, also control bath temperature and heating time.

2. CHECK THAT THE TEST WORKS

Run a known positive alongside the unknown: glucose, starch, oil or protein as appropriate. Use a matching negative control without the target, such as water with the reagent, or ethanol and water for the emulsion test. If controls fail, repeat before interpreting the unknown.

3. OBSERVATION AND CONCLUSION ARE DIFFERENT

OBSERVATION		SUPPORTED CONCLUSION
After heating with Benedict's solution, an orange precipitate forms.	→	Reducing sugar was detected in the tested sample.

Do not infer an exact concentration from colour alone. A negative result means not detected under these conditions, not necessarily completely absent.

4. WORK SAFELY

Wear eye protection; do not taste samples or reagents. Keep ethanol away from flames and other ignition sources and never heat it for the emulsion test. Handle hot water and tubes with suitable holders. Avoid skin and eye contact with iodine, copper-containing reagents and alkaline biuret reagent; follow the local disposal instructions.

Practical support: AQA Biology handbook, food tests (methods and safety).