# Food tests

**Specification reference:** **1.1**

**Chemical elements are joined together to form biological compounds**

## Introduction

The chemical composition of different foods can be determined by performing chemical tests. There are five tests which you need to know and understand how to use.

- Reducing sugars
- Non-reducing sugars
- Proteins
- Starch
- Fats and oils

These tests can be used on pure chemicals to demonstrate the positive results from each and then used to investigate the composition of different foods.

## Apparatus and reagents

5 boiling tubes
2 test tubes
1 beaker
3 dropping pipettes
Benedict's reagent
Dilute hydrochloric acid
Dilute sodium hydroxide/ sodium bicarbonate
Biuret reagent
Iodine- potassium iodide solution
Absolute alcohol
Glucose solution
Sucrose solution
Albumen solution
Starch solution
Oil
Water bath

## Method

### Reducing sugars

1. Mix 2 $cm^3$ of the test solution with an equal volume of Benedict's reagent.
2. Heat the mixture in a water bath to between 70 $^oC$ and 90 $^oC$ for 5 minutes
3. If the blue Benedict's has changed colour to an orange / red precipitate the test solution is a reducing sugar.

**Non-reducing sugars**

1. Mix 2 $cm^3$ of the test solution with an equal volume of Benedict's reagent.
2. Heat the mixture in a water bath to between 70 $^oC$ and 90 $^oC$.
3. Observe and record colour change. If it is not a reducing sugar there will be no colour change and the solution will remain blue.
4. Put another 2 $cm^3$ of the test solution into a boiling tube, add 2 drops of hydrochloric acid and heat in a water bath to 70 $^oC$ and 90 $^oC$ for 2 minutes.
5. Add 2 drops of sodium hydroxide.
6. Add 2 $cm^3$ Benedict's reagent.
7. Heat the mixture in a water bath to between 70 $^oC$ and 90 $^oC$ for 5 minutes.
8. If the blue Benedict's has changed colour to orange / red precipitate, the test solution is a non – reducing sugar.

**Proteins**

1. Mix 2 $cm^3$ of the test solution with 2 $cm^3$ of Biuret reagent in a test tube.
2. Cover the top of the boiling tube and invert it once. If the solution turns purple the test is positive.

**Starch**

1. Mix 2$cm^3$ of the test solution with 2 drops of iodine in potassium- iodide solution.
2. If starch is present the solution will change colour to blue/ black.

**Fats and oils**

1. Mix the fat or oil with 5 $cm^3$ of absolute alcohol in a boiling tube.
2. Shake the tube.
3. Pour the mixture into another boiling tube half full of cold water.
4. If lipids are present a cloudy white emulsion will form.

## Risk Assessment

| Hazard | Risk | Control measure |
|---|---|---|
| Biuret is an irritant | Could splash onto hands or into eyes when transferring biuret to test tube | Wear gloves/ eye protection |
| Ethanol is flammable | Could catch fire if used near a Bunsen burner | Ensure all Bunsen burners are turned off before ethanol is used |

Benedict's reagent and Iodine solution are classed as low hazard by CLEAPSS at these concentrations

## Teacher/ Technicians notes

**Starch**
Iodine is only sparingly soluble in water (0.3 g per litre); it is usual to dissolve it in potassium iodide solution (KI) to make a 0.01 M solution (by tenfold dilution of a 0.1 M solution) to use as a starch test reagent. Refer to CLEAPSS Recipe card 33.

**Reducing/ non reducing sugar**
Benedicts reagent can be purchased from a laboratory supplier or can be made
1 $dm^3$ of Benedicts reagent contains:
100 grams anhydrous sodium carbonate
173 grams sodium citrate
17.3 grams copper (II) sulphate pentahydrate

**Protein**
Biuret reagent can be purchased from a laboratory supplier or potassium hydroxide and dilute copper(II)sulphate solution can be used as an alternative

**Fats and oils**
Absolute alcohol should be used because if it has been diluted an emulsion of fats will be produced in the alcohol before it is poured into the water.

## Further work

- Testing a variety of foods.
- The Benedict's test is semi-quantitative, 0.5g % concentration reducing sugar gives a green precipitate, 1g% concentration a yellow precipitate, 1.5g % an orange precipitate and above 2 g% a red precipitate. Students could assess the % concentration of reducing sugar by comparing the colour to standard solutions of reducing sugars. They would need to plan which variables needed to be controlled to carry out such a semi-quantitative study.
- The Biuret test is also semi-quantitative. The deeper the violet colour the more peptide bonds (hence protein) which is present.

## Practical techniques

- Use of qualitative reagents to identify biological molecules.