# Biology PAG 2: Testing for Biological Molecules

# Suggested Activity 1: Basic food tests

## Instructions and answers for teachers& technicians

This practical activity is composed of two parts; a teacher/technician section and the learner activity which can be found on [page 15](#_Student_Activity). This Practical activity supports OCR GCSE Biology.

**When distributing the activity section to the learners either as a printed copy or as a Word file you will need to remove the teacher instructions section.**

|  |
| --- |
| This is a **suggested** practical activity that can be used as part of teaching the GCSE (9-1) Gateway Science (A) and Twenty First Century Science (B) specifications.  These are **not controlled assessment tasks**, and there is **no requirement to use these particular activities**.  You may modify these activities to suit your learners and centre. Alternative activities are available from, for example, [Royal Society of Biology](https://www.rsb.org.uk/education/teaching-resources/secondary-schools), [Royal Society of Chemistry](http://www.rsc.org/learn-chemistry), [Institute of Physics](http://www.iop.org/education/teacher/resources/index.html), [CLEAPSS](http://science.cleapss.org.uk/) and [publishing companies](https://global.oup.com/education/content/secondary/key-issues/gcse_science_2016/?region=uk), or of your own devising.  Further details are available in the [specifications](http://www.ocr.org.uk/science) (Practical Skills Topics), and in these [videos](https://www.youtube.com/playlist?list=PLBD9B84FF4BD54AA4). |

**OCR recommendations:**

**Before carrying out any experiment or demonstration based on this guidance, it is the responsibility of teachers to ensure that they have undertaken a risk assessment in accordance with their employer’s requirements, making use of up-to-date information and taking account of their own particular circumstances. Any local rules or restrictions issued by the employer must always be followed.**

**CLEAPSS resources are useful for carrying out risk-assessments: (**<http://science.cleapss.org.uk>**).**

**Centres should trial experiments in advance of giving them to learners. Centres may choose to make adaptations to this practical activity, but should be aware that this may affect the Apparatus and Techniques covered by the learner.**

### Introduction

As the list of biological molecules that can be tested for is extensive, there are a number of different experiments that GCSE learners could use to cover this Practical Activity Group (PAG). Numerous classic experiments could fall into this category including:

* The Jan Ingenhousz experiment - collecting and testing oxygen from submerged plants
* Testing leaves of plants for starch
* Food testing
* Blowing through a straw into lime water
* Testing *Scenedesmus* immobilized in alginate for O2 production
* Testing Yeast immobilized in alginate for CO2 production.

Learners will need to be fully prepared for the practical component of the exam. The best way to do this is to do as many experiments as is practically possible.

This teacher sheet describes methods used to test for the presence of biological molecules in a range of foods. This has been chosen as the experiments are technically easy, requiring very few items of specialist equipment and most biology teachers have done them at some time in their career.

Learners will need to be introduced to the food tests, how they are done and what a positive result looks like. The example foods listed below provide excellent results and they can be shown as a demonstration or discovered by the learners’ practical experience.

* Starch: potato, pasta or bread
* reducing sugar: lemonade/sugary drinks
* fat/lipid: oil or lard
* protein: egg albumen .

How to safely use the two methods to heat the reducing sugar test can also be demonstrated (kettle/thermostatic water bath and Bunsen burner).

Learners should then be allowed to use these tests on more complex foods e.g. a whole meal. These can be obtained from a school kitchen or from a fast food restaurant. A single meal typically provides enough material for a class to test. This allows learners to test for foods where the results are not already obvious before the experiment e.g. fat in oil; but may introduce some interesting results for example testing a burger bun for fat. Another advantage of using a meal is that the food is often more ‘colourful’ than the standard examples. Learners can therefore evaluate the results and use their problem-solving skills to try and find appropriate solutions to testing coloured food.

For separate science learners to fully cover the second DfE requirement for this PAG (see below). more complexity is required involving problem-solving and continuous sapling. The baby rice experiment can be used for this. Here the enzymatic breakdown of starch into reducing sugars is investigated. Learners could be given the equipment and asked to prove that the starch is broken down into reducing sugars. They will need to prove that the starch present at the start then disappears over time, concomitantly they will need to prove that the level of reducing sugars rise.

### DfE Apparatus and Techniques covered

The codes used below match the OCR Practical Activity Learner Record Sheet ([**Biology**](http://www.ocr.org.uk/Images/-295601-gcse-biology-learner-record-sheet.doc) / [*Combined Science*](http://www.ocr.org.uk/Images/304431-gcse-combined-science-learner-record-sheet.doc)) and Trackers ([**Biology**](http://www.ocr.org.uk/Images/323480-gcse-biology-practical-tracker.zip) / [*Combined Science*](http://www.ocr.org.uk/Images/323483-gcse-combined-science-practical-tracker.zip)) available online. **There is no requirement to use these resources.**

**1** *[1]***:** Use of appropriate apparatus to make and record a range of measurements accurately, including: **v**[*v*]) temperature**; vi**[*vi*]) volume of liquids

**2** *[2]*: Safe use of appropriate heating devices and techniques including use of: i) a Bunsen burner; ii) a water bath OR an electric heater

**3** *[3]*: Use of appropriate apparatus and techniques for the: i) observation of biological changes and/or processes; ii) measurement of biological changes and/or processes

**5** *[5]*: Measurement of rates of reaction by a variety of methods including: iii) colour change of indicator

**8**: Use of appropriate techniques and qualitative reagents to identify biological molecules and processes in more complex and problem-solving contexts including: i) continuous sampling in an investigation

### Aims

To introduce learners to the food tests by practical experience on simple foods [tests for starch (using iodine solution), for fat/lipid (using the emulsion test and paper test/grease spot test), for reducing sugar (using Benedict’s reagent) and for protein (using biuret reagent)].

To allow the learners to investigate the components of a meal using the above tests.

To investigate and monitor changes in biological molecues during the enzymatic digestion of starch by amylase.

### Supplementary practicals

DNA is a biological molecule. Extraction/isolation of a biological molecule can indicate its presence or absence. Extraction of DNA from a suitable food (e.g. leek) is a suitable example for this PAG and as such this is included as a supplementary practical.

### Intended class time

This activity will take 60 minutes.

### Links to Specifications:

### Twenty First Century

Describe the use of qualitative tests for biological molecules.

### Gateway

Explain the importance of sugars in the synthesis and breakdown of carbohydrates to include use of the terms monomer and polymer.

Describe that DNA is made from four different nucleotides; each nucleotide consisting of a common sugar and phosphate group with one of four different bases attached to the sugar to include the pairs of complementary bases (A-T and G-C).

Describe experiments that can be used to investigate enzymatic reactions.

Explain the mechanism of enzyme action to include the role of enzymes in metabolism, the role of the active site, enzyme specificity (lock and key hypothesis) and factors affecting the rate of enzyme controlled reactions (pH, temperature, substrate and enzyme concentration).

Compare the processes of aerobic respiration and anaerobic respiration to include in plants/fungi and animals the different conditions, substrates, products and relative yields of ATP.

### Mathematical Skills covered

Use ratios, fractions and percentages

Understand and use the symbols: =, <, <<, >>, >, ∝, ~

### Twenty First Century IaS references covered

Suggest appropriate apparatus, materials and techniques, justifying the choice with reference to the precision, accuracy and validity of the data that will be collected.

Identify factors that need to be controlled, and the ways in which they could be controlled.

Suggest an appropriate sample size and/or range of values to be measured and justify the suggestion.

Plan experiments or devise procedures by constructing clear and logically sequenced strategies to:

* make observations
* produce or characterise a substance
* test hypotheses
* collect and check data
* explore phenomena.

In a given context evaluate data in terms of accuracy, precision, repeatability and reproducibility, identify potential sources of random and systematic error, and discuss the decision to discard or retain an outlier.

Evaluate an experimental strategy, suggest improvements and explain why they would increase the quality (accuracy, precision, repeatability and reproducibility) of the data collected, and suggest further investigations.

In a given context interpret observations and other data (presented in diagrammatic, graphical, symbolic or numerical form) to make inferences and to draw reasoned conclusions, using appropriate scientific vocabulary and terminology to communicate the scientific rationale for findings and conclusions.

### Gateway Working scientifically references covered

Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.

Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment.

Evaluate methods and suggest possible improvements and further investigations.

Carry out experiments to include due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations, and following written instructions.

Make and record observations and measurements using a range of apparatus and methods to include keeping appropriate records.

Presenting observations using appropriate methods to include methods to include descriptive, tabular diagrammatic and graphically.

Communicating the scientific rationale for investigations, methods used, findings and reasoned conclusions to include presentations through paper-based and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms.

### Equipment (all equipment in this section is per group)

*Food tests*

For this experiment a range of foods to test will be needed. Care must be taken to avoid foods containing allergens associated with severe allergies e.g. nuts.

Starch test

* iodine solution [Lugol’s iodine reagent (I2KI)] in dropping bottle
* spotting tile.

Fat/lipid test

1. Grease spot test
   * Sugar paper.
2. Emulsion test
   * ethanol in dropping bottle
   * boiling/test tube
   * bung
   * Wash bottle filled with water.

Reducing sugars test

* Benedict’s reagent in dropping bottle
* beaker
* boiling/test tubes (one per food sample)
* heating device (e.g. kettle/thermostatic water bath or Bunsen burner tripod stand and gauze).

Protein test

* biuret reagent in dropping bottle
* boiling/test tube (one per food sample).

*Baby rice experiment*

* baby rice 10 g
* boiling tubes x2
* bungs to fit boiling tubes x2
* glass rods x2
* washer bottle
* plastic cup
* iodine solution [Lugol’s iodine reagent (I2KI)] in dropping bottle
* Benedict’s reagent in dropping bottle
* heating device (e.g. kettle/thermostatic water bath or Bunsen burner)
* test tubes x5.

*Supplementary practical*

DNA Extraction

* one leek
* 1 teaspoon salt
* tea spoons
* washing-up liquid
* pre-chilled alcohol (pre-chilled overnight to -20ºC then kept on ice)
* pestle
* mortar
* boiling tube
* pineapple juice
* inoculation loop
* heating device (e.g. kettle/thermostatic water bath or Bunsen burner).

### Health and Safety

Teachers will need to carry out a suitable risk assessment for each practical. The following may assist you in the preparation of your risk assessment:

Iodine solution CLEAPSS card 54B – Solutions stronger than 1 mol dm-3 should be labelled harmful. See also CLEAPSS card 39

Benedict’s reagent contain copper sulphate see CLEAPSS card 27C. See also CLEAPSS card 9.

Biuret reagent contain copper sulphate see CLEAPSS card 27C. See also CLEAPSS card 13.

Biuret solution contains NaOH. Solutions above 0.5 mol dm-3 should be labelled as corrosive, below 0.5 moldm-3 it should be labelled an irritant. 0.5 mol dm-3 equates to a 2% (w/v) solution, therefore the 1.5% (w/v) recipe stated above should be labelled as an IRRITANT.

Ethanol is highly flammable.

Enzyme powders are harmful and some solutions are irritant or allergenic. See CLEAPSS card 23.

Take care when using foods that may contain allergens – ensure you know whether any of the learners in the class have severe allergies before the lesson. It is not advisable to use any food with nut or traces of nuts.

### Method

***Food tests***

**Test for starch**

* Add a few drops of iodine solution onto the food. If the iodine turns blue-black then there is starch present.
* NOTE The reason for the reaction is that the iodine fits into the α(1,4) helix in starch causing the change in colour.

**Test for fat/lipid**

* Test 1. Rub the food onto sugar paper (beige works well). Allow the paper to dry. Hold it up to a suitable source of natural light (e.g. a window). The presence of a fat or lipid means that the paper remains translucent.
* Test 2. Add approx. 1 cm3 of the food to be tested into a boiling tube. Add 5 cm3 of water and shake. Add approximately 1 cm3 of alcohol (ethanol) to the mix. A white precipitate indicates the presence of fat/lipid.

**Test for reducing sugar**

* The food to be tested is placed into a boiling tube. Add approximately 3cm3 of Benedict’s reagent to the boiling tube. If using a solid food this may need to be homogenised prior to testing. Heat the tube – this can be done by placing the tube into a suitable beaker (e.g.250 cm3) and pouring boiling water into the beaker (e.g. from a kettle). A colour change from blue to green to orange to orange-red through to brick red indicates the presence of reducing sugars. This is a semi-quantitative test as the further along the colour change the more reducing sugar is present.
* NOTE The colour change is caused by the Cu2+ being reduced to Cu+ (precipitated Cu2O) by the reducing sugar.

**Test for protein**

* Add to one sample volume add five volumes of biuret reagent to the tube and mix. Leave to stand. Presence of protein results in a purple colour.
* NOTE The purple colour is formed by polypeptides with four or more peptide bonds reacting with the Copper. The Cu2+ reacting with the lone pair of electrons on the nitrogen.

***Baby rice experiment (30 minutes)***

Always consider combining tests. For example one learner can track the action of amylase on baby rice paste by looking at the disappearance of starch and the appearance of reducing sugars.

1. Prepare two samples of baby rice paste. These can be made in separate boiling tubes. Mix with water to a thick consistency using a glass rod.
2. Add a 2 cm3 of amylase either using a prepared solution – but salivary amylase works very, very well.
3. Add a similar volume of water to the other test tube as a control.
4. Stopper the tubes.
5. Shake/mixing the sample, taking care that the tubes are not hit against anything during this process.
6. Regularly remove an aliquot to test for starch can be done on a spotting tile and reducing sugars from both the test and control tubes. Every 2 minutes should be okay.
7. Pour out each tube after 10 minutes shaking – the experiment will be completed when the paste is liquefied by the enzyme.

***Extraction of DNA from leek (60 minutes)***

This process is very much ‘bucket chemistry’ – exact amounts are not required. The times stated are a minimum; if these are exceeded this will actually improve the extraction.

1. Using a teaspoon of salt and the pestle and mortar grind a leek leaf to a fine pulp. Do this until there is no discernible structure of leek leaf.
2. DNA is water soluble so add a small volume of water for the DNA to be extracted to solution (10 cm3 would be a good start but you want the mix to clearly contain some liquid when the pestle is tilted. If this has not been achieved then add more water).
3. Mix again with the mortar briefly for approximately 10 seconds.
4. Add a small volume of pineapple juice (10 cm3 would be sufficient), this contains bromelain a protease and will digest the protein. It is true that the addition of pineapple juice will add trace pineapple DNA to the sample – but as we are not doing any further analysis of the DNA this is not problematic here.
5. Mix the solution for approximately 10 seconds.
6. Add a good squirt of washing-up liquid.
7. Pour the liquid into a test tube (filter if required).
8. At this stage heat the solution to 60ºC for ten minutes. During this process you can explain the role of each step.
9. Cool the tube on ice for a few minutes.
10. Add pre-chilled alcohol you can use any here as long as it is of sufficient strength. I have used methylated spirits, IMS, 96% ethanol it even works well with Gin – but this is a very expensive way to do this and an appalling waste of Gin.
11. Over the next minute the DNA will be precipitating out of solution. Please note that the DNA cannot be seen as fluffy white precipitate here, but rather a collection of immobilized bubbles in solution.
12. Hook out the DNA using a metal loop/glass rod revealing what resembles mucus - this is the DNA.

### Notes

Please note that the sample obtained from leek is superior to that obtained from kiwi or other sources. Leek provides DNA of high quality and has the appearance of nucleic obtained from CsCl ultracentrifigation. It also has the advantage that a single leek can provide all the material required for an entire class.

### Technician Notes

For this practical the teacher will require for a class of 30:

NOTE many of these reagents are adapted from CLEAPSS. Please use the CLEAPSS cards for more detailed descriptions on how to make. The Biuret solution described here has been adapted from Gornall *et al.* (1949).

***Food tests***

* A selection of foods (bag of pasta, bag of potatos, bread, small bottle of cooking oil)
* A meal (school dinner/takeaway meal)
* Benedict’s reagent in dropping bottles (x15) [7.5% (w/v) anhydrous or 16% (w/v) hydrated sodium carbonate, 20% (w/v) trisodium citrate dihydrate, 12.5% potassium thiocyanate 1.8% (w/v) copper (II) sulphate (VI), 0.025% potassium hexacyanoferrate (II). Method:
* Dissolve the sodium carbonate, sodium citrate, and potassium thiocyanate in 700 cm3 of boiled distilled water.
* Dissolve the copper sulphate in 100 cm3 of boiled distilled water.
* Mix the two solutions together
* Pour over the potassium thiocyanate
* Make up to 1 litre with the boiled distilled water
* Biuret reagent in dropping bottles (x15) [1.5% (w/v) sodium hydroxide NaOH, 0.2% (w/v) copper sulphate CuSO4·5H2O, 0.6% (w/v) potassium sodium tartrate KNaC4H4O6·4H2O].This is an adapted solution from Gornall, A.G., Bardawill, C. J. and David, M. M. (1949) Determination of Serum Proteins by means of the Biuret Reaction. J. Biol. Chem. 177; 751. Note if preparing a stock addition of 0.1% (w/v) potassium iodine and keeping in the dark improves the storage time significantly.
* Iodine solution/[Lugol’s iodine reagent (I2KI)] in dropping bottles (x15) [potassium iodide 10% (w/v), iodine 5% (w/v)]
* Ethanol 150 cm3
* Sugar paper cut into 10cm squares
* Beakers (x15)
* Spotting tiles (x15)
* Test tubes x2 per food sample
* Kettle or thermostatic water bath
* Bunsen burner (x15)
* Heat proof mats (x15)
* Bunsen burner lighter
* Tripod (x15)
* Gauze (x15)

***Baby rice experiment***

* Baby rice 2 boxes
* Boiling tubes (x30)
* Bungs to fit boiling tubes (x30)
* Glass rods (x30)
* Washer bottle (x15)
* Plastic cup (x15)
* Iodine solution/[Lugol’s iodine reagent (I2KI)] in dropping bottles (x15) [potassium iodide 10% (w/v), iodine 5% (w/v)]
* Benedict’s reagent in dropping bottles (x15) [7.5% (w/v) anhydrous or 16% (w/v) hydrated sodium carbonate, 20% (w/v) trisodium citrate dihydrate, 12.5% potassium thiocyanate 1.8% (w/v) copper (II) sulphate (VI), 0.025% potassium hexacyanoferrate (II). Method:
* Dissolve the sodium carbonate, sodium citrate, and potassium thiocyanate in 700 cm3 of boiled distilled water.
* Dissolve the copper sulphate in 100 cm3 of boiled distilled water.
* Mix the two solutions together
* Pour over the potassium thiocyanate
* Make up to 1 litre with the boiled distilled water
* Kettle or thermostatic water bath
* Bunsen burner (x15)
* Heat proof mats (x15)
* Bunsen burner lighter
* Tripod (x15)
* Gauze (x15)
* Test tubes (x75)

***Extraction of DNA from leek***

* One leek
* Salt 1 cup
* Tea spoons (x15)
* Washing-up liquid 1 bottle
* Pre-chilled alcohol 250 cm3 (pre-chilled overnight to -20ºC then kept on ice)
* Pestle (x15)
* Mortar (x15)
* Boiling tubes (x15)
* Pineapple juice 200 cm3 carton
* Inoculation loop (x15)
* Kettle or thermostatic water bath
* Bunsen burner (x15)
* Heat proof mats (x15)
* Bunsen burner lighter
* Tripod (x15)
* Gauze (x15)

### Answers for quiz questions

|  |  |  |
| --- | --- | --- |
| **1.** | How would you test a food for starch? **[1 mark]** | |
|  |  | |
|  | **A** | Emulsion test |
|  | **B** | Benedict’s test |
|  | **C** | Grease spot test |
|  | **D** | Iodine solution  **D** |
|  | Your answer | |
|  |  | |
| **2.** | Using the biuret test what colour would indicate a positive test for protein?  **[1 mark]** | |
|  | **A** | Blue-black | |
|  | **B** | Purple | |
|  | **C** | White | |
|  | **D** | Brick red | |
|  | **B**  Your answer | | |
|  |  | | |

1. An experiment is done to test the fat content of a variety of milks. The scientists use the sudan red test rather than the emulsion test. Can you suggest why the scientists decided to use this test? **[2 marks]**

Milk is white ✓ the result for a positive emulsion test is white **accept** sudan red is red and can be detected in a white food/owtte ✓

### Document updates

v1 Published on the qualification pages

v1.1 January 2017 Consolidated labelling and formatting of activities

v1.2 June 2021 Update to meet digital accessibility standards



We’d like to know your view on the resources we produce. Click ‘[Like’](mailto:resources.feedback@ocr.org.uk?subject=I%20liked%20the%20Biology%20A%20and%20B%20PAG%20B2%20Activity%201%20Practical%20Activities%20resource) or ‘[Dislike’](mailto:resources.feedback@ocr.org.uk?subject=I%20disliked%20the%20Biology%20A%20and%20B%20PAG%20B2%20Activity%201%20Practical%20Activities%20resource) to send us an auto generated email about this resource. Add comments if you want to. Let us know how we can improve this resource or what else you need. Your email will not be used or shared for any marketing purposes.

Looking for another resource? There is now a quick and easy search [tool to help find free resources](http://www.ocr.org.uk/i-want-to/find-resources/) for your qualification.

OCR is part of Cambridge Assessment, a department of the University of Cambridge.

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored.   
Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered office   
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA. Registered company number 3484466. OCR is an exempt charity.

OCR operates academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed   
in their qualifications registers including A Levels, GCSEs, Cambridge Technicals and Cambridge Nationals.

OCR provides resources to help you deliver our qualifications. These resources do not represent any particular teaching method we expect you to use. We update our resources regularly and aim to make sure content is accurate but please check the OCR website so that you have the most up to date version. OCR cannot be held responsible for any errors or omissions in these resources.

Though we make every effort to check our resources, there may be contradictions between published support and the specification, so it is important that you always use information in the latest specification. We indicate any specification changes within the document itself, change the version number and provide a summary of the changes. If you do notice a discrepancy between the specification and a resource, please [contact us](mailto:resources.feedback@ocr.org.uk).

© OCR 2021 - You can copy and distribute this resource freely if you keep the OCR logo and this small print intact and you acknowledge OCR as the originator of the resource.

OCR acknowledges the use of the following content: N/A

Whether you already offer OCR qualifications, are new to OCR or are thinking about switching, you can request more information using our [Expression of Interest form](https://www.ocr.org.uk/qualifications/expression-of-interest/).

Please [get in touch](mailto:resources.feedback@ocr.org.uk) if you want to discuss the accessibility of resources we offer to support you in delivering our qualifications.

# Biology PAG 2: Testing for Biological Molecules

# Suggested Activity 1: Basic food tests

## Learner Activity

### Introduction

Any molecule produced in a cell, tissue or organism is classed as a biological molecule. This can include simple molecules like water and carbon dioxide, more complex molecules like glucose through to large complex polymers like DNA, proteins and carbohydrates.

In this activity you will have the chance to identify what biological molecules are found in a variety of foods.

### Aims

To use the diagnostic test for starch

To use the diagnostic test for protein

To use the diagnostic test for reducing sugars

To use the diagnostic tests for fats/lipids

### Equipment (per group)

Basic food test

* iodine solution in dropping bottle
* spotting tile.
* biuret reagent in dropping bottle
* boiling tubes/test tubes (three per food sample)
* Benedict’s reagent in dropping bottle
* Beaker
* heating device (e.g. kettle/thermostatic water bath or Bunsen burner).
* Sugar paper
* ethanol in a dropping bottle
* wash bottle filled with water
* bung.

DNA extraction

* one leek
* 1 teaspoon salt
* tea spoon
* washing-up liquid
* pre-chilled alcohol (pre-chilled overnight to -20ºC then kept on ice)
* pestle
* mortar
* boiling tube
* pineapple juice
* inoculation loop
* heating device (e.g. kettle/thermostatic water bath or Bunsen burner).

### Health and Safety

At some concentrations iodine solutions can be harmful – look at any labelling on the dropper bottle.

Biuret solution contains NaOH. Low concentrations NaOH it is an irritant but at higher concentrations it is corrosive – look at any labelling on the dropper bottle.

Ethanol is highly flammable. Do not use this near a naked flame (e.g. Bunsen burner).

If you are allergic to any foods let your teacher know before starting this practical.

### Method for simple food tests

*Test for starch*

* Add a few drops of iodine solution onto the food.

If the iodine turns blue-black then there is starch present.

*Test for fat/lipid*

* Test 1. Rub the food onto sugar paper (beige works well). Allow the paper to dry. Hold it up to a suitable source of natural light (e.g. a window).

The presence of a fat or lipid means that the paper remains translucent.

* Test 2. Add approx. 1 cm3 of the food to be tested into a boiling tube. Add 5 cm3 of water and shake. Add approximately 1 cm3 of alcohol (ethanol) to the mix.

A white precipitate indicates the presence of fat/lipid.

*Test for reducing sugar*

* The food to be tested is placed into a boiling tube.
* Add approximately 3 cm3 of Benedict’s reagent to the boiling tube.
* If using a solid food this may need to be broken up prior to testing.
* Heat the tube – this can be done by placing the tube into a suitable beaker (e.g.250 cm3) and pouring boiling water into the beaker (e.g. from a kettle).

A colour change from blue to green to orange to orange-red through to brick red indicates the presence of reducing sugars. Note this is a semi-quantitative test as the further along the colour change the more reducing sugar is present.

*Test for protein*

* Add to one sample volume add five volumes of biuret reagent to the tube.
* Add a clean bung to the tube.
* Mix vigorously.
* Leave to stand for a minute.

Presence of protein results in a purple colour.

*Baby rice experiment*

This activity will enable you to monitor a reaction during the experiment. Baby rice is essentially powdered rice (starch). Action of amylase will digest the starch into simple sugars. Design an experiment to monitor this process. During this experiment you will need to work out the ideal volumes and masses of materials required. You will also need to work out how to control the variables in the experiment.

In order to get you started here is the start of the practical.

1. In two separate boiling tubes add equal quantities of baby rice.
2. Mix the baby rice with water to a thick consistency using a glass rod.
3. Add a 2 cm3 of amylase either using a prepared solution – but salivary amylase works very, very well.
4. Put a bung into the tubes.
5. Shake/mixing the sample, taking care that the tubes are not hit against anything during this process.

*Supplementary practical - Extraction of DNA from leek (60 minutes)*

This process is very much ‘bucket chemistry’ – exact amounts are not required. The times stated are a minimum; if these are exceeded this will actually improve the extraction

1. Using a teaspoon of salt and the pestle and mortar grind a leek leaf to a fine pulp. Do this until there is no discernible structure of leek leaf.
2. DNA is water soluble so add a small volume of water for the DNA to be extracted to solution (10 cm3 would be a good start but you want the mix to clearly contain some liquid when the pestle is tilted. If this has not been achieved then add more water).
3. Mix again with the mortar briefly for approximately 10 seconds.
4. Add a small volume of pineapple juice (10 cm3 would be sufficient), this contains bromelain an enzyme that digests protein. Is this a good idea?
5. Mix the solution for approximately 10 seconds.
6. Add a good squirt of washing-up liquid.
7. Pour the liquid into a test tube.
8. At this stage heat the solution to 60 ºC for ten minutes. During this process you can explain the role of each step.
9. Cool the tube on ice for a few minutes.
10. Add pre-chilled alcohol you can use any here as long as it is of sufficient strength. I have used methylated spirits, IMS, 96% ethanol. It even works well with Gin.
11. Over the next minute the DNA will be precipitating out of solution. Please note that the DNA cannot be seen as fluffy white precipitate here, but rather a collection of immobilized bubbles in solution.

Hook out the DNA using a metal loop/glass rod revealing what resembles mucus - this is the DNA.

### Results

Record your results in a suitable table. Indicate what biological molecule the food contains and devise a method to indicate the relative amounts of each biological molecule.

### Quiz questions

|  |  |  |
| --- | --- | --- |
| **1.** | How would you test a food for starch? **[1 mark]** | |
|  |  | |
|  | **A** | Emulsion test |
|  | **B** | Benedict’s test |
|  | **C** | Grease spot test |
|  | **D** | Iodine solution |
|  | Your answer | | |
|  |  | | |
|  |  | |
| **2.** | Using the biuret test what colour would indicate a positive test for protein? **[1 mark]** | |
|  | **A** | Blue-black | |
|  | **B** | Purple | |
|  | **C** | White | |
|  | **D** | Brick red | |
|  | Your answer | | |
|  |  | | |

1. An experiment is done to test the fat content of a variety of milks. The scientists use the sudan red test rather than the emulsion test. Can you suggest why the scientists decided to use this test? **[2 marks]**

|  |
| --- |
|  |

### DfE Apparatus and Techniques covered

If you are using the OCR Practical Activity Learner Record Sheet ([**Biology**](http://www.ocr.org.uk/Images/-295601-gcse-biology-learner-record-sheet.doc) / [*Combined Science*](http://www.ocr.org.uk/Images/304431-gcse-combined-science-learner-record-sheet.doc)) you may be able to tick off the following skills:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Biology** | | | |  | ***Combined Science*** | | | |
| 1-v | 1-vi | 2-i/2-ii | 3-i |  | *1-v* | *1-vi* | *2-i/2-ii* | *3-i* |
| 3-ii | 5-iii | 8-i |  |  | *3-ii* | *5-iii* |  |  |