PEARSON EDEXCEL INTERNATIONAL GCSE (9–1)

BIOLOGY LAB BOOK

Pearson

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BIOLOGY

Lab Book

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CONTENTS

CORE PRACTICAL 1: FOOD TESTS
INVESTIGATE FOOD SAMPLES FOR THE PRESENCE OF GLUCOSE, STARCH, PROTEIN AND FAT

SPECIFICATION REFERENCE
2.9
(2.7, 2.8, 2.24, 2.25, 2.26)

Introduction

You will be given a range of foods. Some are powdered, some solid and some liquid. Use the tests below to identify whether each food contains starch, glucose, protein or fat. Use the reagents and tests described.

Learning tip

- Use a different spatula for each food or wash and carefully wipe the spatula in between foods to avoid cross-contamination (i.e. transferring one food to another).

Your teacher may watch to see if you can:

- follow instructions carefully
- work safely, reducing the risk of harm from hazards.

Method

Learning tip

- Volumes of liquids are measured in millilitres (mL) or litres (L). You will notice that all glassware is calibrated in mL. There are 1000 mL in 1 litre.

Iodine solution test for starch	Benedict's reagent test for glucose
Iodine solution stains starch blue/black. If the iodine solution remains yellow/brown, then the food does not contain starch. **1** Place one spatula of each food on a white tile or plate. **2** Use a dropper pipette to add 2 or 3 drops of iodine in potassium iodide solution onto each food. **3** Record the results. Which foods stain blue/black and which foods are yellow/brown?	*When glucose (and some other sugars) are heated with Benedict's reagent, the colour of the reagent changes from blue to red. If there are only small amounts of glucose present, the reagent becomes green or yellow. If the reagent remains blue then there is no glucose present.* **1** Place two spatulas of each food into separate, clean test tubes. Label the test tubes so you know which food each contains. **2** Use a syringe to add 5 mL of distilled water to each test tube. **3** Use a syringe to add 5 mL of Benedict's solution to each test tube, and shake the tubes to mix the contents. **4** Place each labelled tube into a water bath, heated to 80 °C for 10 minutes. **5** Record the colour of the solution for each food tested.

Objectives

- To identify starch, glucose, proteins and fat in foods

Equipment

- eye protection
- 5 mL test tubes, racks and bungs
- Benedict's reagent
- water bath set at 80 °C
- marker pen
- spatulas
- test tubes and rack
- biuret reagent
- iodine in potassium iodide solution in a dropping bottle
- dimple tile
- pipette
- distilled water
- ethanol
- paper towels

Safety notes

- Wear eye protection.
- Wash any splashes quickly from skin.
- Do not taste any of the food.
- Biurets reagent can be harmful to skin and eyes. Take care as it is corrosive.
- Take care with hot water in the water bath.
- Benedict's solution can be harmful to skin and eyes.

Biuret test for protein

When dilute potassium or sodium hydroxide solution and copper sulfate solution, combined in biuret reagent, are added to protein the colour changes from blue to deep mauve/purple.

1. Place two spatulas of each food into separate, clean test tubes. Label each tube so you know which food is in it.
2. Use a syringe to add 5 mL of distilled water to each food in its tube and shake to mix.
3. Use another syringe to add 5 mL of biuret reagent to each tube and gently move the tube to mix the contents.
4. After about 2 minutes, note and record the colour of the solution for each food.

Ethanol emulsion test for fats

Fats do not dissolve in water but they do dissolve in ethanol. If ethanol containing dissolved fat is poured into water, the fat comes out of solution and forms an emulsion (droplets of one liquid suspended in another liquid). This emulsion looks white and cloudy.

1. Place two spatulas of each food into separate, clean test tubes.
2. Use a syringe to add 3 mL of ethanol to each tube and shake the contents vigorously to dissolve any fat that is in the food into the ethanol.
3. Allow the tubes to stand for 2–3 minutes so that the contents settle.
4. Carefully pour the ethanol from each tube into another test tube that is half-filled with distilled water.
5. Observe the water in the second tube, near the top and see if there is a white cloudy layer.
6. Record your results for each food.

Learning tip

- Some of the foods you are testing may contain more than one food type.

Results

1 Record your results in a table.

Food	Colour at end of test			
	Iodine solution test	Benedict's test	Biuret test	Ethanol emulsion test

Analysis

1 For each food you tested, fill in the table to show which food types – starch, glucose, protein or fat – it contained. Use a tick (✓) if the food type is present or a cross (✗) if the food type is not present.

Food	Food types			
	Starch	Glucose	Protein	Fat

2 Did any of the tests show you how much of the food type the food contained?

Give a reason for your answer.

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Evaluation

1 Identify any problems you had with this investigation and explain how the method could be improved to reduce or avoid these problems.

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Extension

1 Describe how you could adapt the Benedict's test to show how much glucose is present in foods such as milk, potatoes and cooked rice.

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INVESTIGATE HOW ENZYME ACTIVITY CAN BE AFFECTED BY CHANGES IN TEMPERATURE

SPECIFICATION REFERENCE

2.12

(2.10, 2.11)

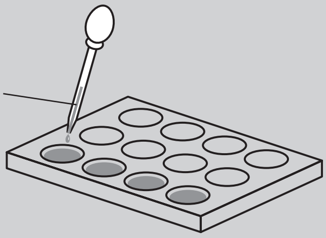
Introduction

Amylase is an enzyme made in salivary glands under your tongue, near and under your jaw and in your mouth. Amylase digests (breaks down) starch into smaller sugar molecules.

Each group will investigate the action of amylase at one or two temperatures. You can then share your results with the others in your class. Temperatures investigated will be 0 °C, 10 °C, 20 °C, 30 °C, 40 °C, 50 °C, 60 °C, 70 °C and 80 °C.

Your teacher may watch to see if you can:

- work safely
- collect accurate data.



Method

1 Using the dropper pipette, drop one drop of iodine in potassium iodide solution into each well on a dimple tile.

Learning tip

- Remember: Volumes of liquids are measured in millilitres (mL) or litres (L). You will notice that all glassware is calibrated in mL. There are 1000 mL in 1 litre. The volume of solids is measured in cm^3 and m^3 but liquids do not form cubes.

2 Use a syringe to place 5 mL 0.5% starch solution into a test tube. Label the tube with your initials.

3 Place the test tube into a water bath at your specified temperature. Leave it there for 5 minutes so that it reaches that temperature.

4 Use a pipette to take a little of the starch solution from the test tube and add 1 drop of it to the iodine in potassium iodide solution in the first well of the dimple tile. Take care NOT to touch the pipette tip onto the iodine solution in the wells. Return the rest of the mixture to the test tube. Rinse the pipette with distilled water.

5 Use another syringe to place 2 mL 0.05% amylase solution into the test tube; stir to mix the contents and start the timer.

Learning tip

- In an enzyme-controlled reaction, always add the enzyme last so that you know when the reaction starts.

6 After 20 seconds, take a little of the mixture from the test tube using a pipette and add 1 drop of it to the second well of the dimple tile. Return the rest of the mixture to the test tube. Rinse the pipette with distilled water.

7 Repeat step **6** at 20-second intervals, using a different well in the dimple tile each time. Do **not** stop the timer when you take the samples.

8 Note the time when the iodine in the potassium iodide solution stays yellow/brown, indicating that there is no starch in the mixture in the test tube.

Objectives

- To investigate the effect of temperature on the rate of digestion of starch by the enzyme amylase

Equipment

- eye protection
- iodine in potassium iodide solution in a dropping bottle
- dimple tile
- 5 mL syringes
- 0.5% solution soluble starch
- test tubes
- marker pen
- test tube rack
- water baths set at 0 °C, 10 °C, 20 °C, 30 °C, 40 °C, 50 °C, 60 °C, 70 °C and 80 °C
- crushed ice for 0 °C and 10 °C water baths
- thermometer to check temperatures of water baths
- pipette
- distilled water
- 0.05% amylase solution
- timer

Safety notes

- Wear eye protection.
- Do not drink any of the solutions.
- Wash any splashes quickly from skin. (Enzymes/amylase can cause allergic reactions or asthma symptoms.)
- Take care with the enzyme solutions.

9 Carry out a Benedict's test (see CP1) to see if the mixture in the tube now contains sugar.

10 If you have time, carry out this investigation two more times and find the average time taken for the starch to be broken down.

11 Share your results with others in your class and complete the tables below.

Learning tips

- If you do not have time to set up a test tube at each of the temperatures, you may carry out 3 or 4 investigations at different temperatures. Others in your class may carry out investigations at other temperatures and you can share your results.
- When carrying out a reaction at a specific temperature, we place the reactants separately in a water bath at that temperature for 5–10 minutes so they reach the required temperature, before mixing the reactants.

Results

1 Complete the table for your own data.

Trial number	Temperature (°C)	Time taken for amylase to digest the starch (s)
1		
2		
3		
Mean time taken for amylase to digest starch (s)		

2 Complete the table using data from the other groups in your class.

Temperature (°C)	Mean time taken for amylase to digest starch (s)

Analysis

1 Plot a bar graph to show the time taken for amylase to digest starch at the different temperatures.

2 Look at your graph and describe how temperature affects the time taken for amylase to digest starch.

3 A bar graph is a good way to display these data because they are discrete.
Suggest what further investigations you would need to carry out in order to get data suitable for a line graph.

4 Study the data produced by your class. In which range of temperatures is the optimum temperature (temperature at which the enzyme works fastest) for amylase?

Give reasons for your answer.

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Evaluation

1 Suggest further investigations you could carry out to find more precisely/accurately the optimum temperature for amylase.

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2 Describe any problems you had with carrying out the investigation.

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3 Suggest reasons for the problems and suggest how the method could be changed to help reduce these problems.

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