

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE



S25-3400U30-1A

MONDAY, 6 JANUARY – FRIDAY, 21 FEBRUARY 2025

BIOLOGY – Unit 3 (3400U30)

PRACTICAL ASSESSMENT

INVESTIGATING THE EFFECT OF SUBSTRATE
CONCENTRATION ON THE RATE OF ENZYME ACTION

SECTION A

1 hour

For Examiner's use only		
	Maximum Mark	Mark Awarded
Section A	6	

ADDITIONAL MATERIALS

A calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The total number of marks available for this section of the task is 6.

The number of marks is given in brackets at the end of each question or part-question.

This task is in 2 sections, **A** and **B**. You will complete Section **A** in one lesson and Section **B** in the next science lesson.

JUN253400U301A01

Introduction

The enzyme catalase is found in germinated mung beans. It catalyses the breakdown of toxic hydrogen peroxide solution into harmless water and oxygen.

Your task is to investigate the effect of increasing the concentration of the substrate hydrogen peroxide solution on the rate of enzyme action.

Apparatus Required

The following apparatus is required for each group: (each group should consist of no more than three candidates).

eye protection

1 × 10 cm³ measuring cylinder

5 × 10 cm³ syringe

1 × forceps

5 × test tube

15 × filter paper disc

1 × stopwatch

2 × germinated mung beans

1 × pestle and mortar

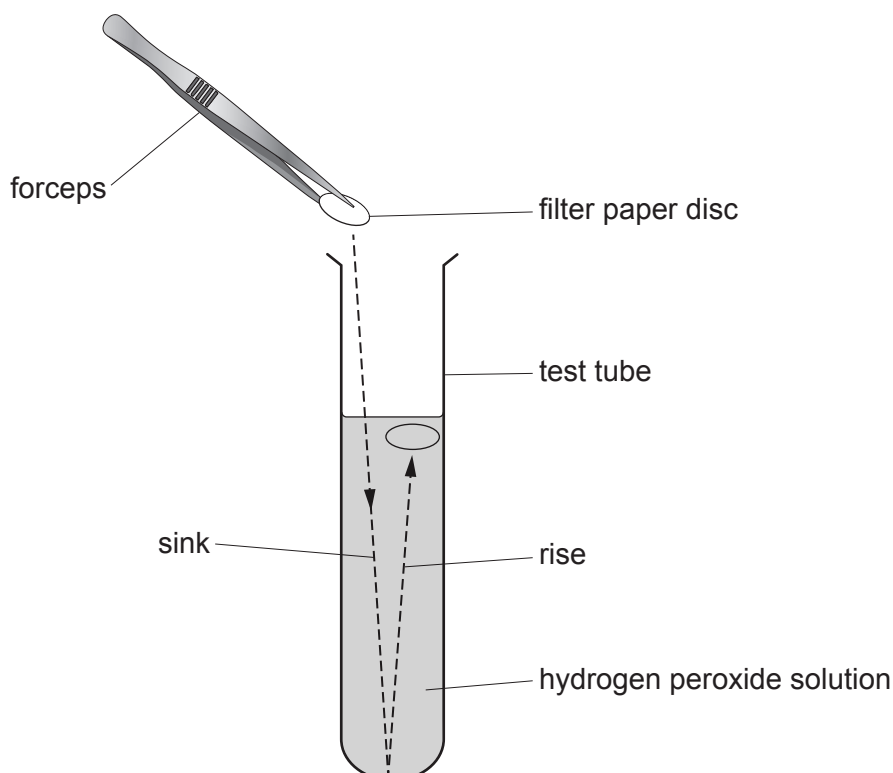
20 cm³ of hydrogen peroxide solution at concentrations of 2, 4, 6, 8 and 10 vol

1 × 100 cm³ beaker of deionised water

paper towels

CLEAPSS student safety sheet: 57 – Hydrogen peroxide. This is provided on page 6 of this examination paper.

Diagram



Read the method and answer questions 1.(a) and 1.(b) before carrying out the experiment and recording your results.

Method

1. Wear eye protection.
2. Measure 5 cm^3 of deionised water using the measuring cylinder.
3. Use the pestle and mortar to grind two germinated mung beans with the 5 cm^3 of deionised water to produce an enzyme solution.
4. Use a syringe to measure 10 cm^3 of 2 vol hydrogen peroxide solution and place into a test tube.
5. Use forceps to dip a filter paper disc into the enzyme solution. Wipe off the excess on a paper towel.
6. Drop the filter paper disc into the 2 vol hydrogen peroxide solution and immediately start the stopwatch. If the disc sticks to the side of the test tube, then gently push it with the forceps into the hydrogen peroxide solution.
7. Record the time taken, **in seconds**, for the filter paper disc to sink and rise to the top again.
8. Remove the disc using forceps and discard.
9. Repeat steps 5–8 two more times to get a total of three results. Use the same test tube of 2 vol hydrogen peroxide solution each time.
10. Repeat steps 4–9 for concentrations of 4 vol, 6 vol, 8 vol and 10 vol hydrogen peroxide solution.



SECTION A

Answer **all** questions.

1. (a) State a hypothesis for this experiment. [1]

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- (b) Explain why the hydrogen peroxide used in this experiment is not considered hazardous. [1]
Use the student safety sheet on page **6** of this examination paper.

.....

.....

You may record raw results in the space below.



(c) Present your results in a table. Include all of your results.

[4]

Examiner
only

END OF PAPER

6



Substance	Hazard	Comment
Concentrated hydrogen peroxide solution (if less than 8.3 mol/dm ³ but 2.3 mol/dm ³ or more) or (if 100 vol or less but over 28 vol) or (if 30% w/v or less but over 8%)	 CORROSIVE	DANGER: causes serious eye damage and may be harmful if swallowed. This is the most-concentrated solution found in schools. Take care to avoid skin contact. It decomposes slowly to produce oxygen gas; pressure may build up and care needs to be taken when opening a bottle. It should be stored in the dark. Decomposition is speeded up by catalysts such as some metal oxides and some enzymes. The oxygen formed will assist fires.
Dilute hydrogen peroxide solution (if less than 2.3 mol/dm ³ but 1.5 mol/dm ³ or more) or (if less than 28 vol but 18 vol or more) or (if less than 8% w/v but 5% or more)	 IRRITANT	WARNING: irritating to the eyes (and to the skin, although not officially classified as such). The typical concentration used in school science practical work. It decomposes slowly to produce oxygen gas; pressure may build up and care needs to be taken when opening a bottle. It should be stored in the dark. Decomposition is speeded up by catalysts such as some metal oxides and some enzymes.
Very dilute hydrogen peroxide solution (if less than 1.5 mol/dm ³) or (if less than 18 vol) or (if less than 5% w/v)	Currently not classified as hazardous	It is used for bleaching hair. It decomposes slowly to produce oxygen gas; pressure may build up and care needs to be taken when opening a bottle. It should be stored in the dark. Decomposition is speeded up by catalysts such as some metal oxides and some enzymes. Old stock may have insufficient peroxide molecules for the intended activity.
Additional information: Concentration of hydrogen peroxide solutions may be expressed in several different ways: • Molarity: as with any chemical, the concentration may be given as x mol/dm³, or x M, i.e. x mol in 1 dm³ of solution • Percentage, w/v: a y % w/v solution will contain y g hydrogen peroxide in 100 cm³ of solution • Vol: 1 cm³ of z volume strength will give z cm³ of oxygen when it decomposes.		

Typical control measures to reduce risk

- Use the lowest concentration and smallest volume possible.
- Wear eye protection for all but the most-dilute solutions.
- Store concentrated solutions away from heat and light, in bottles with special vented caps. Beware of a rapid release of pressure when opening a bottle.
- Avoid accidental contamination of solutions which may speed up the formation of oxygen and pressure build-up.

Assessing the risks

- What are the details of the activity to be undertaken? What are the hazards?
- What is the chance of something going wrong?
e.g. Could an impurity / catalyst cause rapid decomposition and frothing?
- How serious would it be if something did go wrong?
e.g. If the solution splashes onto the skin, is it sufficiently concentrated to cause burns?
- How can the risk(s) be controlled for this activity?
e.g. Can it be done safely? Does the procedure need to be altered? Should goggles or safety spectacles be worn?

Emergency action

- **In the eye** Irrigate the eye with gently-running tap water for at least 20 minutes. Call 999/111.
- **In the mouth/swallowed** Do no more than rinse and spit with drinking water. Do **not** induce vomiting. Call 999/111.
- **Spilt on the skin or clothing** Remove and soak contaminated clothing. Irrigate the skin-affected area with gently-running tap water for at least 20 minutes. Call 999/111 as appropriate.
- **Spilt on the floor, bench, etc.** For large spills, and especially for (moderately) concentrated solutions, cover with mineral absorbent (e.g. cat litter) and scoop into a bucket. Dilute with at least ten times its own volume of water. Rinse the floor etc. with plenty of water.
Wipe up small amounts with a damp cloth and rinse it well.



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