

Practical investigation

Syllabus Inquiry question: What affects the rate of a chemical reaction?

Aim

The aim of this experiment is to investigate the effect of different catalysts on the decomposition rate of hydrogen peroxide (H_2O_2).

Safety Information

SUBSTANCE	GHS SIGNAL WORD	HAZARDS AND PRECAUTIONS
10% v/v hydrogen peroxide		
Manganese dioxide		
Iron (III) oxide		

Which of the substances listed above are corrosive?

Which of the substances listed above are flammable?

Hypothesis

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Variables

Independent variable:

Dependent variable:

Controlled variables:

Materials

Apparatus

- 4 Plastic measuring cylinders (250 mL)
- Large plastic tray to contain spills
- Stopwatch
- Plastic spatula
- 4 beakers (100 mL)

Chemicals

- Hydrogen peroxide solution (60 mL, 10% v/v)
- Powdered manganese(IV) oxide (MnO_2), 0.5 g
- Iron(III) oxide (Fe_2O_3), 0.5 g
- Potato, 1 cm^3 piece
- Liver, 1 cm^3 piece



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Additional Items

- Washing up liquid (detergent), approximately 1 mL per cylinder
- Glowing splint (for testing the presence of oxygen gas)

Method

1. Line up four 250 mL plastic measuring cylinders in a large plastic tray to contain any spills.
2. Label each of the four plastic measuring cylinders with the name of the catalyst to be used:
MnO₂, Fe₂O₃, Potato, and Liver.
3. Place about 1 cm³ of washing up liquid into each measuring cylinder. This helps to produce foam, making the reaction more visible.
4. Add catalysts in plastic measuring cylinders in the amounts given below.
MnO₂: 0.5 g
Fe₂O₃: 0.5 g
Potato: 1 cm³ piece
Liver: 1 cm³ piece
5. Each student will take a 25 mL of the 10% hydrogen peroxide solution to pour into each of the cylinders and note the time using the stopwatch. (The addition of the H₂O₂ to each cylinder should be done as nearly simultaneously as possible)
6. Observe and record the time taken for the foam to cover every 50 mL (at 50 mL, 100 mL, 150 mL, 200 mL, 250 mL) on the measuring cylinder. Record these times in the table provided in the report Performa.
7. To confirm the presence of oxygen, place a glowing splint into the foam. The splint should re-light if oxygen is present.



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Clean-Up

Dispose of Chemical Waste:

- Carefully pour the contents of each cylinder into a designated waste container.

Clean Equipment:

- Rinse all plasticware with water and clean with detergent if necessary. Ensure the equipment is dried and stored properly.

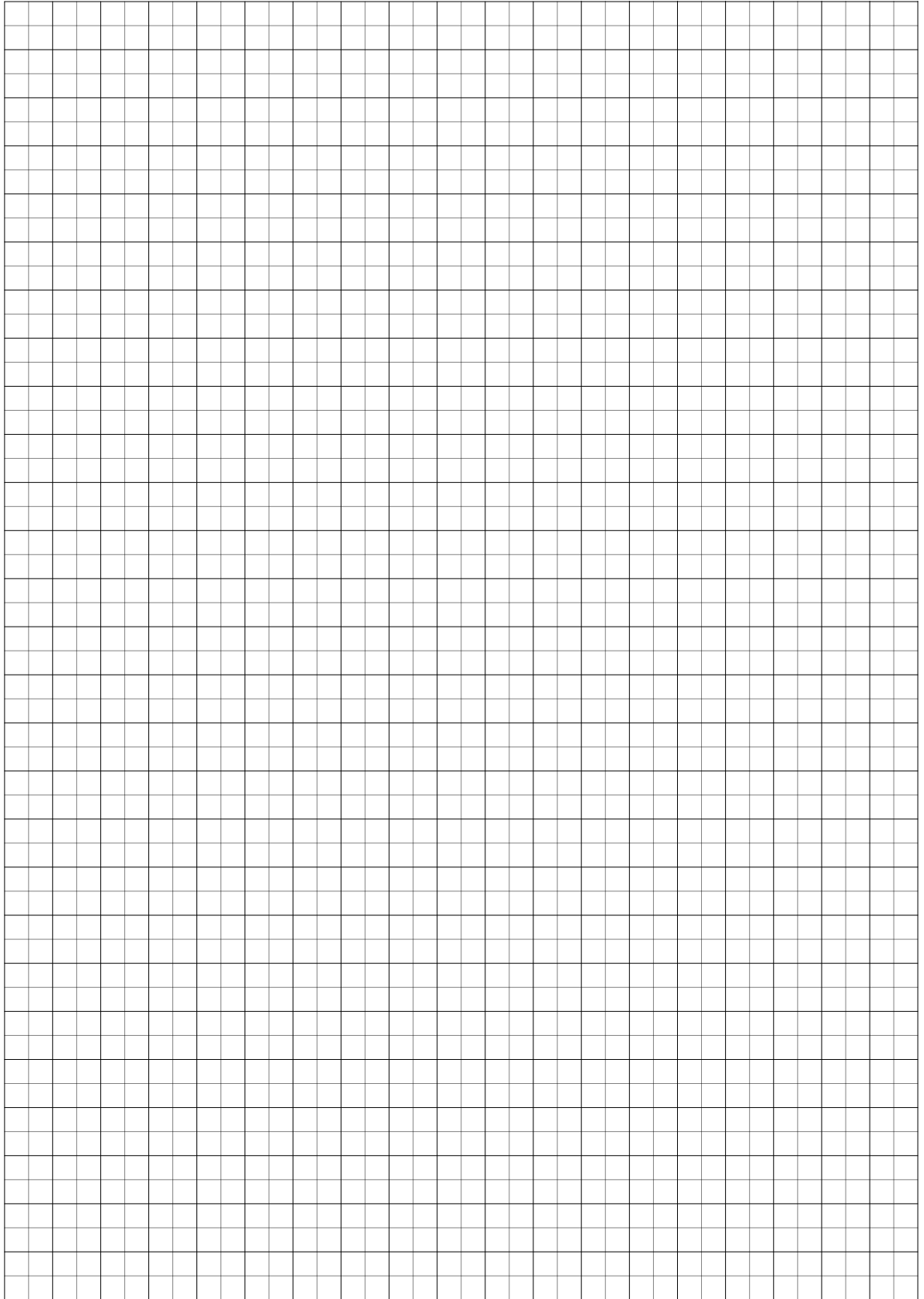
Safety and Hygiene:

- Wash your hands thoroughly after handling chemicals and cleaning equipment.

Results

Catalyst	Time (sec)				
	at 50 mL	at 100 mL	at 150 mL	at 200 mL	at 250 mL
MnO ₂					
Fe ₂ O ₃					
Potato					
Liver					





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Using the results obtained from this experiment, list the catalysts in order of increasing effectiveness.

Using the results obtained from this experiment, list the catalysts in order of increasing activation energy (E_a).

Write the balanced chemical equation for the decomposition of H_2O_2 using the most effective catalyst.
(Use correct states of matter.)



Conclusion