

Elephant Toothpaste Student handout

Objective

To investigate the effect of the use of catalyst on reaction rate.

Background

“Elephant toothpaste” is a typical experiment to study catalyzed decomposition reaction. Soap solution is added to the hydrogen peroxide solution with the presence of catalyst. The rapid decomposition will produce thick foam.

Besides, a quantitative measurement can be performed by measuring the height of the foam rise at regular time intervals. Students can roughly estimate the change in rate of reaction by visual inspection.


Curriculum link

Topic IX Rate of Reaction (Chemistry)

Safety precautions

- Handle all chemicals with care. The experiment should be performed in a well-ventilated area.
- Wear eye protection and disposable nitrile gloves when handling the catalyst and hydrogen peroxide solution.

Materials and apparatus (per group)

6% H_2O_2 solution			50 cm^3
$\text{MnO}_2(\text{s})$ or suitable catalyst			0.5 g
Surfactant (soap) solution			3 – 5 cm^3
Spatula			x 1
10 cm^3 measuring cylinder		x 1	
50 cm^3 measuring cylinder		x 1	
500 cm^3 measuring cylinder		x 1	
Stop watch			x 1

Procedure

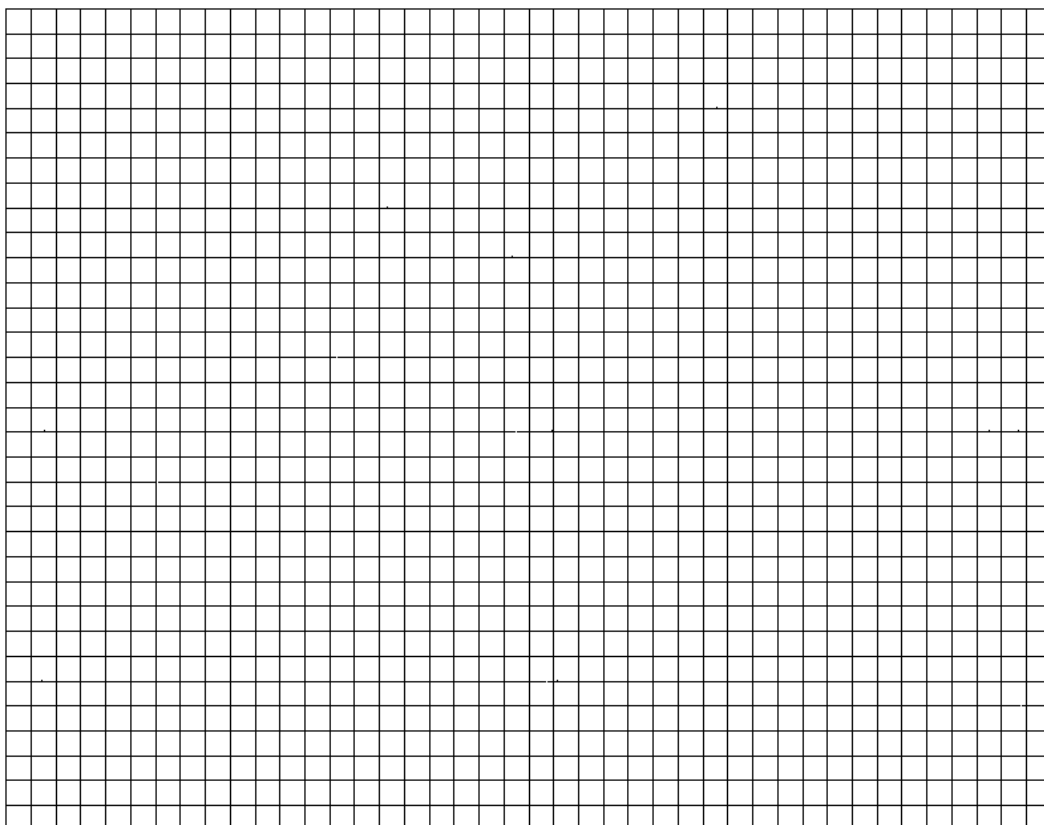
1. Transfer 50 cm^3 6% H_2O_2 solution to a 500 cm^3 measuring cylinder.
2. Add about 3 cm^3 of surfactant (soap solution) to the 500 cm^3 measuring cylinder.
3. Add about 0.5 g of the catalyst to the 500 cm^3 cylinder. Start the stopwatch immediately.
4. At regular time intervals (e.g. every 30 seconds), observe the foam rise as indicated by the measuring cylinder reading and record the results.

Results

Time after the addition of catalyst to the cylinder (seconds)	10	40	70	100	130	160	190	220
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Height of foam rise as indicated by the measuring cylinder reading (cm ³)								
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1. Plot a graph of height of foam rise as indicated by the measuring cylinder reading against time (seconds).



2. Rising of foam in the measuring cylinder is related to the gas produced during the decomposition of hydrogen peroxide. Estimate the volume of foam produced during:
 - (i) 10 to 40 seconds
 - (ii) 100 to 130 seconds
 - (iii) 190 to 220 seconds

3. What conclusion can be drawn from this experiment?

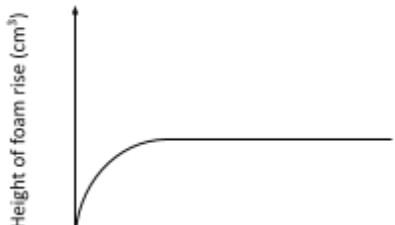

Discussion questions

1. Write down a balanced equation for the decomposition of hydrogen peroxide. Hence, suggest a chemical test to confirm the identity of the gas given off in the experiment.

2. Comment on the following statement concerning to the experiment:
“The decomposition reaction of hydrogen peroxide can be accurately followed by measuring the volume of foam produced in different period of time during the experiment.”

Assessment

Based on the following information, sketch the expected plot under different experimental condition:

	
<p>0.5 g MnO_2 is added to 50 cm^3 of 6% H_2O_2 solution at 20°C</p>	<p>0.5 g MnO_2 is added to 100 cm^3 of 6% H_2O_2 solution at 20°C</p>

