

## Essay {Paper03}

**[SBPtrial10-03]**

## (a) Problem statement

Rubric	Score
Able to state the problem statement correctly. Sample answer Does size of zinc affects the rate of reaction with sulphuric acid?	3
Able to state the problem statement less accurately. Sample answer Does size of zinc affects rate of reaction?// To investigate the effect of size of zinc on the rate of reaction with sulphuric acid.	2
Able to give an idea of problem statement. Sample answer. Size affects rate of reaction	1
Wrong or no response	0

## (b) Hypothesis

Rubric	Score
Able to make a hypothesis correctly. Sample answer When the size of zinc is smaller, the rate of reaction increases	3
Able to make a hypothesis less accurately. Sample answer Rate of reaction increases when size of zinc decreases.//Smaller zinc particles affects rate of reaction	2
Able to give an idea of making a hypothesis. Sample answer Size affects rate of reaction	1
Wrong or no response	0

## (c) All the variables

Rubric	Score
Able to state all the three variables correctly Manipulated variable: size of zinc //zinc granules and zinc powder Responding variable: rate of reaction// time taken to collect a fixed volume of hydrogen gas Fixed variable: volume /concentration of sulphuric acid//sulphuric acid	3
Able to state two variables correctly	2
Able to state one variable correctly	1
Wrong or no response	0

## (d) List of materials and apparatus

Rubric	Score
Able to list the apparatus and materials completely Apparatus: conical flask 250 ml, burette, basin, delivery tube with stopper, stop watch, triple beam balance, measuring cylinder Materials: zinc granules, zinc powder, [0.1- 1.0] mol dm <sup>-3</sup> sulphuric acid	3
Able to list the apparatus and materials less completely Apparatus: conical flask, burette, basin, stop watch Materials: zinc granules/powder, sulphuric acid	2
Able to list an idea of the apparatus and materials Sample answer Zinc, [any container], sulphuric acid, stop watch	1
Wrong or no response	0

## (e) Procedure

Rubric	Score
Able to list the steps of the procedures correctly Sample answers 1. 50 cm <sup>3</sup> of sulphuric acid is measured using a measuring cylinder and poured into a conical flask. 2. A burette filled with water is inverted over in a basin of water 3. Record the initial reading of the burette. 4. Put in 5 g of zinc granules into the conical flask 5. Attach the delivery tube with the end of the tube inserted into the burette. 6. Immediately start the stop watch. 7. Swirl the conical flask and record the burette reading at every 30 s intervals. 8. Repeat steps 1 – 6 by replacing the zinc granules with zinc powder	3
Able to list the steps of the procedures less accurately Sample answer Steps 1, 2,4,6,7,8	2
Able to list an idea of procedures Sample answer Steps 1 1. Sulphuric acid is poured into [any container] 2. Zinc is added into acid.	1
Wrong or no response	0

(f) Tabulation of data

Rubric	Score															
Able to tabulate data correctly with the following aspects: 1. Title with correct units 2. At least 4 time intervals  Sample answer  <table border="1"> <tr> <td>Time/s</td> <td>0</td> <td>30</td> <td>60</td> <td>90</td> </tr> <tr> <td>Initial burette reading/cm<sup>3</sup></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Volume of gas/cm<sup>3</sup></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Time/s	0	30	60	90	Initial burette reading/cm <sup>3</sup>					Volume of gas/cm <sup>3</sup>					2
Time/s	0	30	60	90												
Initial burette reading/cm <sup>3</sup>																
Volume of gas/cm <sup>3</sup>																
Able to tabulate data less accurately with the following aspects:  Sample answer  <table border="1"> <tr> <td>Time/s</td> <td>0</td> <td>30</td> <td>60</td> <td>90</td> </tr> <tr> <td>Volume of gas/cm<sup>3</sup></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Time/s	0	30	60	90	Volume of gas/cm <sup>3</sup>					1					
Time/s	0	30	60	90												
Volume of gas/cm <sup>3</sup>																
Wrong or no response	0															

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**[MRSMtrial08-02]**

(a) Does size of Calcium carbonate affects the rate of reaction?

(b) Manipulated variable: size of Calcium carbonate granules and Calcium carbonate powder

Responding variable: rate of reaction // time taken to collect a fixed volume of carbon dioxide

Fixed variable: volume /concentration of hydrochloric acid// hydrochloric acid

(c) When the size of Calcium carbonate is smaller, the total surface area per volume is higher, the rate of reaction increases

(d) List of substances and apparatus

Materials: Calcium carbonate granules and Calcium carbonate powder, 0.1 mol dm<sup>-3</sup> hydrochloric acidApparatus: conical flask 250 cm<sup>3</sup>, burette, basin, delivery tube with stopper, stop watch, triple beam balance, measuring cylinder(e) 1. 50 cm<sup>3</sup> of hydrochloric acid is measured using a measuring cylinder and poured into a conical flask.

2. A burette filled with water is inverted over in a basin of water

3. Record the initial reading of the burette.

4. Put in 5 g of Calcium carbonate granules into the conical flask

5. Attach the delivery tube with the end of the tube inserted into the burette.

6. Immediately start the stop watch.

7. Swirl the conical flask and record the burette reading at every 30s intervals.

8. Repeat steps 1 – 6 by replacing the zinc granules with Calcium carbonate powder

(f) For Calcium carbonate granules

Time/s	0	30	60	90	120	150	180
burette reading/cm <sup>3</sup>							
Volume of gas/cm <sup>3</sup>							

Calcium carbonate powder

Time/s	0	30	60	90	120	150	180
burette reading/cm <sup>3</sup>							
Volume of gas/cm <sup>3</sup>							

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**[SPM05-03-P3]**

(i)	<b>Statements of problem :</b> Does the increase in concentration of <b>acid</b> will increase the rate of reaction?						
(ii)	<b>All the variables :</b> Manipulated variable : concentration of acid Responding variable : rate of reaction Controlled variables : volume of acid, temperature.						
(iii)	<b>Lists of substances and apparatus :</b> Materials : hydrochloric acid with <b>concentration</b> 0.5 mol dm <sup>-3</sup> and 1.0 mol dm <sup>-3</sup> , zinc granule.  Apparatus : 100 cm <sup>3</sup> measuring cylinder, 10 cm <sup>3</sup> measuring cylinder, stopwatch.						
(iv)	<b>Procedure :</b>  1. Using a measuring cylinder, 50 cm <sup>3</sup> of 0.5 mol dm <sup>-3</sup> of hydrochloric and pour into a conical flask. 2. Weigh 2 g of zinc granule and drop into the conical flask. 3. Immediately close the conical flask with the stopper connected to a inverted burette filled with water. 4. At the same time start the stopwatch. 5. The time taken to collect 50cm <sup>3</sup> of hydrogen gas is recorded. 6. The time required for <b>all</b> the metal dissolved is recorded. 7. Step 1 to 5 is repeated by replacing 1.0 mol dm <sup>-3</sup> of hydrochloric acid.						
(v)	<b>Tabulation of data :</b>  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Concentration of acid/ mol dm<sup>-3</sup></th> <th>Time taken to collect 50 cm<sup>3</sup> of the hydrogen gas</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	Concentration of acid/ mol dm <sup>-3</sup>	Time taken to collect 50 cm <sup>3</sup> of the hydrogen gas				
Concentration of acid/ mol dm <sup>-3</sup>	Time taken to collect 50 cm <sup>3</sup> of the hydrogen gas						

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**[SBPtrial09-03-P3]**

(a)

Rubric	Score
Able to state the statement of the problem correctly	3
<u>Sample answer</u> How does temperature effect the rate of reaction between sulphuric acid and sodium thiosulphate solution ?	
Able to state the statement of the problem less accurately	2
<u>Sample answer</u> How does temperature effect the reaction between sulphuric acid and sodium thiosulphate solution ? // To investigate the effect of temperature on the rate of reaction between sulphuric acid and sodium thiosulphate solution	
Able to give an idea of the statement of the problem	1
<u>Sample answer</u> Temperature effect the rate of reaction	
No response or wrong response	0

(b)

Rubric	Score
Able to state the three variables correctly	3
<u>Sample answer</u> <b>Manipulated variable :</b> Temperature of sodium thiosulphate solution <b>Responding variable :</b> Time taken for the mark 'X' to disappear from sight// rate of reaction <b>Constant variable:</b> Volume and concentration of sulphuric acid/ sodium thiosulphate solution// volume of conical flask.	
Able to state any two variables correctly	2
Able to state any one variable correctly	1
No response or wrong response	0

(c)

Rubric	Score
Able to state the relationship correctly between the manipulated variable and the responding variable with direction	3
<u>Sample answer</u> The higher the temperature of sodium thiosulphate solution the higher the rate of reaction/time taken for the mark 'X' to disappear from sight	
Able to state the relationship between the manipulated variable and the responding variable with direction	2
<u>Sample answer</u> The higher the temperature the higher the rate of reaction	
Able to state the idea of hypothesis	1
<u>Sample answer</u> Different temperature different rate of reaction	
No response or wrong response	0

(d)

Rubric	Score
Able to give complete list of substances and apparatus <u>Sample answer</u> <b>Substances</b> Sodium thiosulphate solution [0.1 - 0.5] mol dm <sup>-3</sup> , sulphuric acid [0.2 - 1.0] mol dm <sup>-3</sup> <b>Apparatus</b> Conical flask [150 - 250] cm <sup>3</sup> , measuring cylinder, thermometer, Bunsen burner, filter paper/white paper, tripod stand, wire gauze, stopwatch	3
Able to give a list of substances and apparatus but less complete  <u>Sample answer</u> <b>Substances:</b> Sodium thiosulphate solution, sulphuric acid <b>Apparatus:</b> Conical flask, thermometer, stopwatch	2
Able to give at least one substance and at least one apparatus	1
No response or wrong response	0

(e)

Rubric	Score
Able to list all the steps correctly <u>Sample answer</u> 1. 50 cm <sup>3</sup> of sodium thiosulphate solution is poured into a conical flask. 2. The temperature of the solution is recorded. 3. The conical flask is placed on top of a piece of white paper with a mark 'X' at the centre. 4. 5 cm <sup>3</sup> of sulphuric acid is added into the conical flask and the stopwatch is started immediately. 5. Swirl the conical flask and record the time taken for the mark 'X' to disappear from sight. 6. Repeat steps 1 to 5 by heating the sodium thiosulphate solution at different temperatures.	3
Able to list down steps 1, 4, 5 and 6	2
Able to list steps 1, 4 and 5	1
No response or wrong response	0

(f)

Rubric	Score								
Able to tabulate the data with the following aspects 1. Correct titles 2. List of three temperature <u>Sample answer</u>	2								
<table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Temperature /°C</th> <th>Time / s</th> </tr> </thead> <tbody> <tr> <td>30</td> <td></td> </tr> <tr> <td>35</td> <td></td> </tr> <tr> <td>40</td> <td></td> </tr> </tbody> </table>	Temperature /°C	Time / s	30		35		40		
Temperature /°C	Time / s								
30									
35									
40									
Able to construct table with at least one title incomplete list of temperature <u>Sample answer</u>	1								
<table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> </tr> </tbody> </table>	Temperature	Time							
Temperature	Time								
No response or wrong response or empty table	0								

**[SPM2010-03]**

(a) To investigate the effect of a catalyst on the rate of reaction between metal (zinc) and acid (sulphuric acid)

(b) Manipulated variable : the presence of copper(II) sulphate solution

Responding variable : rate of reaction

Constant variable: Volume and concentration of sulphuric acid// mass of zinc

(c) The presence of copper(II) sulphate solution in the reaction between metal and acid, the higher the rate of reaction.

(d) Substances : Zinc strip, 0.1 mol dm<sup>-3</sup> of sulphuric acid

Apparatus: 250 cm<sup>3</sup> conical flask, sand paper, ruler, measuring cylinder, stopwatch

(e) 1. 5 cm of zinc strip is measured and is cleaned by using sand paper

2. zinc strip is then placed in a conical flask.

3. 25 cm<sup>3</sup> of 0.5 moldm<sup>-3</sup> sulphuric acid solution is measured with a measuring cylinder

4. The sulphuric acid is then poured into the conical flask and the stopwatch is started quickly.

5. The time taken for zinc strip to react completely with the acid is recorded

6. steps 1 to 5 is repeated by adding 20 cm<sup>3</sup> of 0.1 moldm<sup>-3</sup> copper(II) sulphate solution.

(f)

Experiment	Time taken/s
5 cm Zinc + 0.5 mol dm <sup>-3</sup> of sulphuric acid	
5 cm Zinc + 0.5 mol dm <sup>-3</sup> of sulphuric acid + Copper(II) sulphate	

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**[MRSMtrial09-03]**

(a) To investigate the effect of a catalyst on the rate of reaction between metal (zinc) and acid (sulphuric acid)

(b) Manipulated variable : the presence of copper(II) sulphate solution

Responding variable : rate of reaction

Constant variable: Volume and concentration of sulphuric acid// mass of zinc

(c) The presence of copper(II) sulphate solution in the reaction between metal and acid, the higher the rate of reaction.

(d) Substances : Zinc strip, 0.1 mol dm<sup>-3</sup> of sulphuric acid

Apparatus: 250 cm<sup>3</sup> conical flask, sand paper, ruler, measuring cylinder, stopwatch

- (e) 1. 5 cm of zinc strip is measured and is cleaned by using sand paper
2. zinc strip is then placed in a conical flask.
3. 25 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> sulphuric acid solution is measured with a measuring cylinder
4. The sulphuric acid is then poured into the conical flask and the stopwatch is started quickly.
5. The time taken for zinc strip to react completely with the acid is recorded
6. steps 1 to 5 is repeated by adding 20 cm<sup>3</sup> of 0.1 mol dm<sup>-3</sup> copper(II) sulphate solution.

(f) Tabulation of data

Experiment	Time taken/s
5 cm Zinc + 0.5 mol dm <sup>-3</sup> of sulphuric acid	
5 cm Zinc + 0.5 mol dm <sup>-3</sup> of sulphuric acid + Copper(II) sulphate	

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### [MRSMtrial03-03-P3]

(a) To investigate the effect of a catalyst, manganese(IV) oxide on the rate of reaction for decomposition of hydrogen peroxide

(b) Manipulated variable : the presence of manganese(IV) oxide powder

Responding variable : rate of reaction

Constant variable: hydrogen peroxide

(c) Substances : 10-volume hydrogen peroxide, manganese(IV) oxide powder

Apparatus: test tube, glowing splinter, match, spatula, measuring cylinder, stopwatch

(d).1. 3 cm<sup>3</sup> of 10-volume hydrogen peroxide is measured and poured into test tube.

2. by using match, burn the splinter and make it glowing.

3. place the glowing splinter into the test tube.

4. Observed the glowing splinter glow

5. steps 1 to 4 is repeated by adding 1 spatula of manganese(IV) oxide powder

(e)

Experiment	Observation
10-volume hydrogen peroxide	
10-volume hydrogen peroxide + manganese(IV) oxide	

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