

Chem!stry

Name: ()

Class:

Date: / /

Rate of Reaction – Assignment Two

Question 1.

A catalyst is best defined as a substance which increases the speed of a chemical reaction, and which:

- A Takes no part in the reaction.
- B May be recovered unchanged chemically after the reaction.
- C Is a complex molecule produced by plants and animals.
- D Is usually a metal or one of its compounds.

Question 2.

Which of the following statements best explains why coal dust forms an explosive mixture with air?

- A Powdering coal breaks chemical bonds.
- B Powdered coal catalyses the explosion.
- C Powdering coal releases hydrogen from compounds in the coal.
- D Powdering coal produces a large surface area.

Question 3.

Hydrogen peroxide decomposes to form oxygen and water. In two separate experiments, manganese(IV) oxide was added to 50 cm³ of aqueous hydrogen peroxide. The measurements taken are shown in the table below:

Experiment	Mass of MnO ₂ / g	Temperature Increase / °C	Total Volume of O ₂ Produced / cm ³
1	0.1	5.0	50
2	0.2	x	y

What are the values of x and y?

- A x = 2.5 y = 50
- B x = 5.0 y = 50
- C x = 5.0 y = 100
- D x = 10.0 y = 50

Question 4.

When an excess of calcium carbonate reacts with dilute hydrochloric acid, the reaction gradually becomes slower and finally stops. Which statement best explains why this happens?

- A The calcium carbonate is covered by bubbles of carbon dioxide.
- B An insoluble layer of calcium chloride is formed.
- C The calcium carbonate is all used up.
- D The hydrochloric acid is all used up.

Question 5.

In each of four different experiments, the same mass of magnesium reacts with the same volume of an excess of sulfuric acid. Which set of conditions will result in the magnesium being used up the fastest?

	Form of Magnesium	Concentration of Acid	Temperature
A	Ribbon	1 mol / dm ³	80 °C
B	Powder	0.5 mol / dm ³	20 °C
C	Ribbon	0.5 mol / dm ³	80 °C
D	Powder	1 mol / dm ³	80 °C

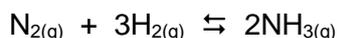
Question 6.

Magnesium reacts with hydrochloric acid. Which solution would give the fastest initial rate of reaction?

- A 40 g of HCl in 1000 cm³ of water.
- B 20 g of HCl in 1000 cm³ of water.
- C 15 g of HCl in 500 cm³ of water.
- D 10 g of HCl in 100 cm³ of water.

Question 7.

Nitrogen and hydrogen are reacted together in a closed vessel:

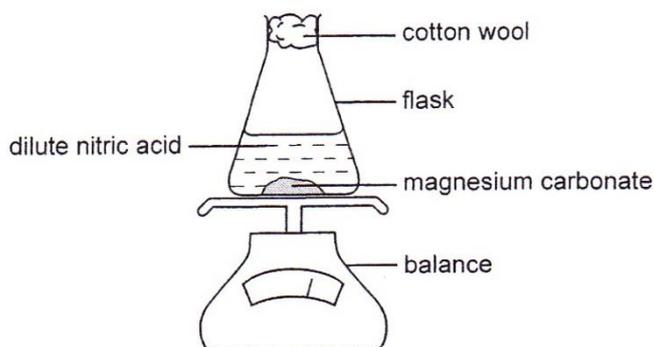


If the pressure of the vessel is increased, but the temperature is kept constant, how will the speeds of the forward and backward reactions be affected?

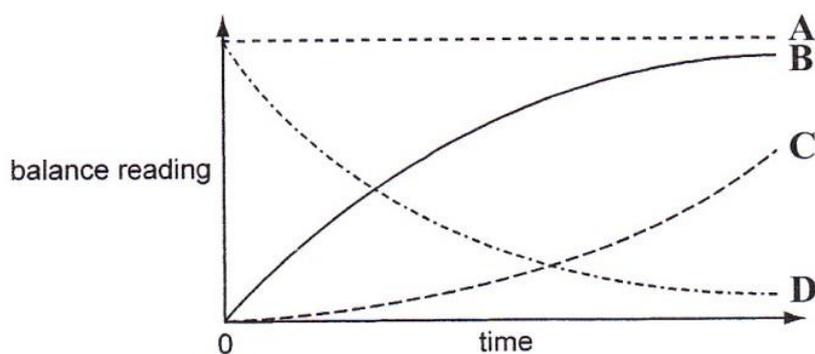
	Speed of Forward Reaction	Speed of Backward Reaction
A	Increases	Increases
B	Increases	Decreases
C	Does not change	Does not change
D	Decreases	Increases

Question 8.

The experiment shown in the diagram was set-up and the balance was read at intervals.



A graph of the balance readings against time was plotted. Which curve was obtained?



Question 9.

Calcium carbonate was reacted with an excess of dilute hydrochloric acid at room temperature.

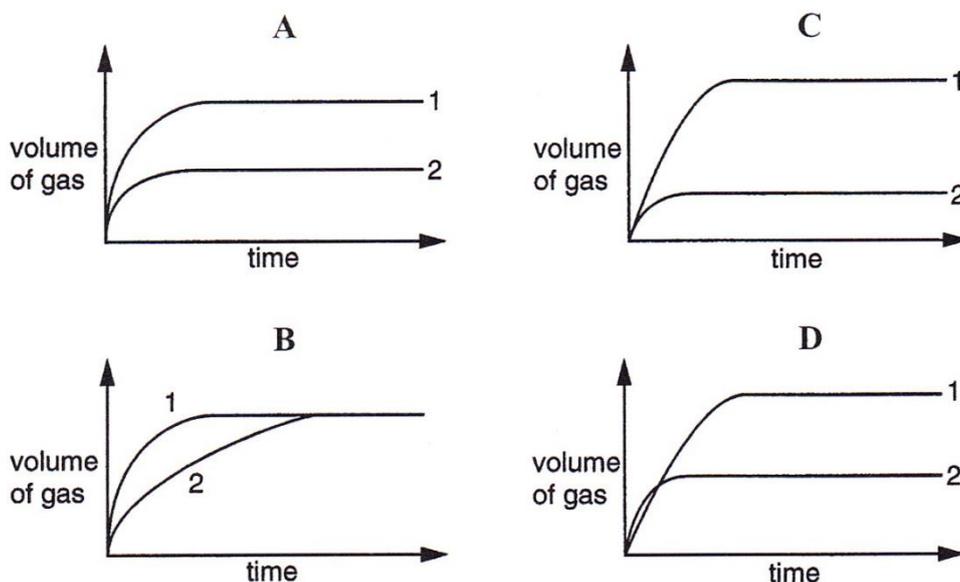


Two experiments were carried out:

Experiment 1 100 g of calcium carbonate lumps

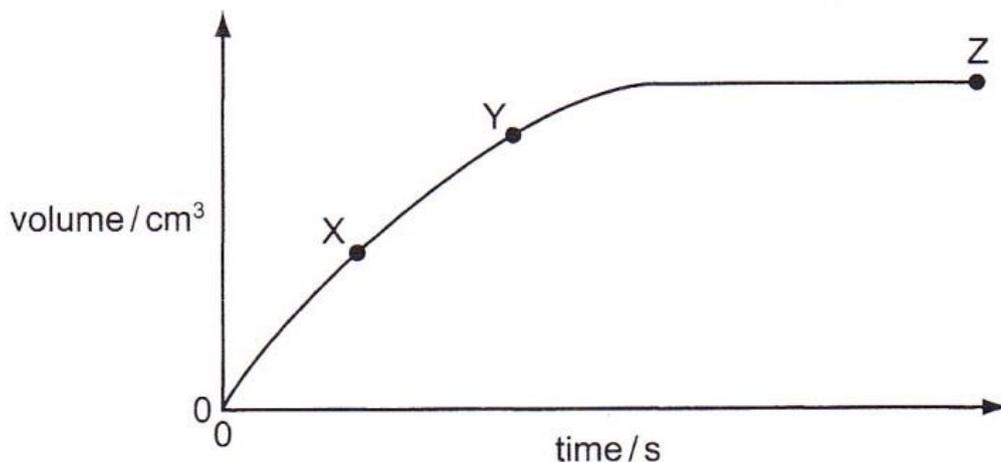
Experiment 2 50 g of calcium carbonate as a fine powder

Which of the graphs is correct?



Question 10.

The graph shows the volume of carbon dioxide evolved, plotted against time, when excess calcium carbonate reacts with 20 cm³ of 2 mol / dm³ hydrochloric acid.



Which statement is correct?

- A The reaction is faster at point Y than at point X.
- B The reaction first reaches completion at point Z.
- C The time taken to reach completion decreases if 10 cm³ of hydrochloric acid containing 4 mol / dm³ is used.
- D The total volume of carbon dioxide evolved is greater if a greater mass of calcium carbonate is used.

Question 11.

In which reaction is the pressure **least** likely to affect the rate of reaction?

- A $C_{(s)} + CO_{2(g)} \rightarrow 2CO_{(g)}$
- B $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{2(g)}$
- C $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$
- D $NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$

• Write your answers to the multiple-choice questions in the table below:

1.	2.	3.	4.
5.	6.	7.	8.
9.	10.	11.	

Question 12.

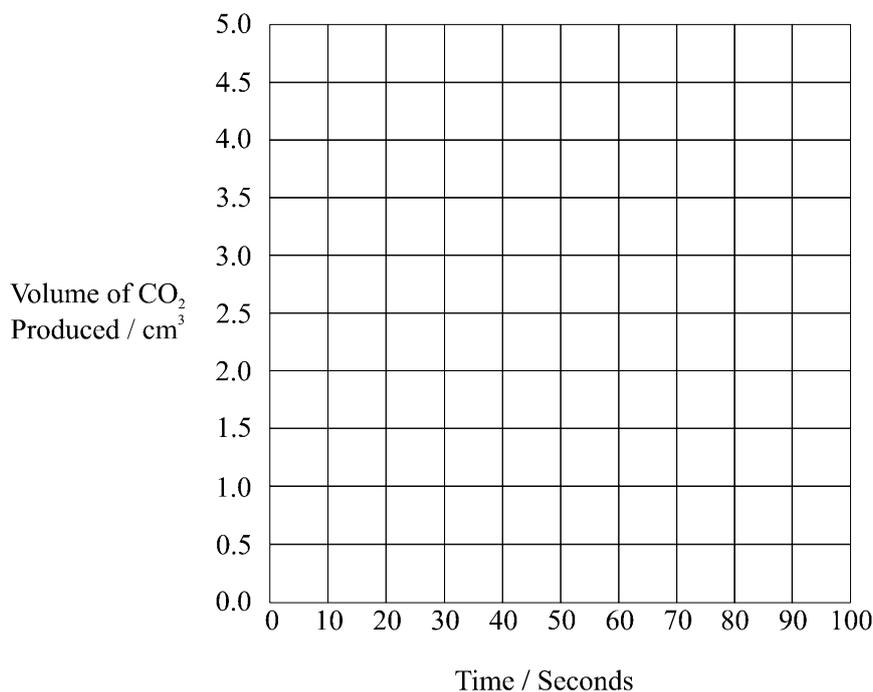
A student reacted 5.00 g of calcium carbonate *chips* (excess reagent) with 20.0 cm³ of 1.00 mol / dm³ hydrochloric acid (limiting reagent). To determine the rate of reaction, the student measured the volume of carbon dioxide gas produced every 20 seconds. The following results were obtained:

Time / Seconds	Volume of CO ₂ Produced / cm ³
0	0.00
20	1.50
40	2.75
60	3.50
80	3.75
100	3.75

- a) Plot the data obtained from the experiment on the graph paper below. Draw the best *curve* through the points. Clearly label this graph with the letter **A**.

[2 marks]

Graph of Volume Against Time for the Reaction
Between Calcium Carbonate and Hydrochloric Acid



- b) i) Write the balanced chemical equation, including state symbols, for the reaction between calcium carbonate and hydrochloric acid:

.....

[1 mark]

- ii) Calculate the number of moles of calcium carbonate and hydrochloric acid used in the reaction and hence prove that the hydrochloric acid is the limiting reagent:

[3 marks]

- c) The student repeated the experiment using 5.00 g of powdered calcium carbonate with the same volume and concentration of hydrochloric acid. On the graph paper, sketch the graph that you expect the student to obtain as a result of this experiment. Label this graph with the letter **B**.

[2 marks]

- d) Finally, the student repeated the experiment using 5.00 g of calcium carbonate chips with 20.0 cm³ of 0.50 mol / dm³ hydrochloric acid. On the graph paper, sketch the graph that you expect the student to obtain as a result of this experiment. Label this graph with the letter **C**.

[2 marks]

- e) What effect *increasing the temperature* would have on the *rate* of this chemical reaction? Explain your answer.

.....
.....
.....
.....
.....

[3 marks]

f) State *two* other methods by which the student could have measured the rate of this chemical reaction. In each case, state the trend that the student would observe in their results:

Method #1:

.....

Observed Trend:

.....

Method #2:

.....

Observed Trend:

.....

[4 marks]

Question 13.

Two experiments were carried out in which hydrochloric acid was added to aqueous solutions of sodium thiosulfate:

Experiment 1:	400 cm ³ of 1.00 mol / dm ³ hydrochloric acid
	400 cm ³ of 1.00 mol / dm ³ sodium thiosulfate
Experiment 2:	100 cm ³ of 4.00 mol / dm ³ hydrochloric acid
	100 cm ³ of 4.00 mol / dm ³ sodium thiosulfate

The initial rate of formation of sulfur and the total mass of sulfur were measured in each experiment. Four different options are given below:

	Rate of Formation of Sulfur	Total Mass of Sulfur Formed
A	Faster in 1	Smaller in 1
B	The same in 1 and 2	Greater in 1
C	The same in 1 and 2	The same in 1 and 2
D	Slower in 1	The same in 1 and 2

a) Which option; **A**, **B**, **C** or **D** is correct?

b) Explain your choice of answer:

.....

- Scan the QR code below for the answers to this assignment.



http://www.chemist.sg/rate_of_reaction/rate_two_ans.pdf