

High Demand Questions

QUESTIONSHEET 1

Calcium carbonate reacts with dilute hydrochloric acid to produce the gas carbon dioxide.

The table below gives the results from a reaction when 40 cm³ dilute hydrochloric acid was added to one marble chip (calcium carbonate) at room temperature of 20°C. The calcium carbonate was in excess.

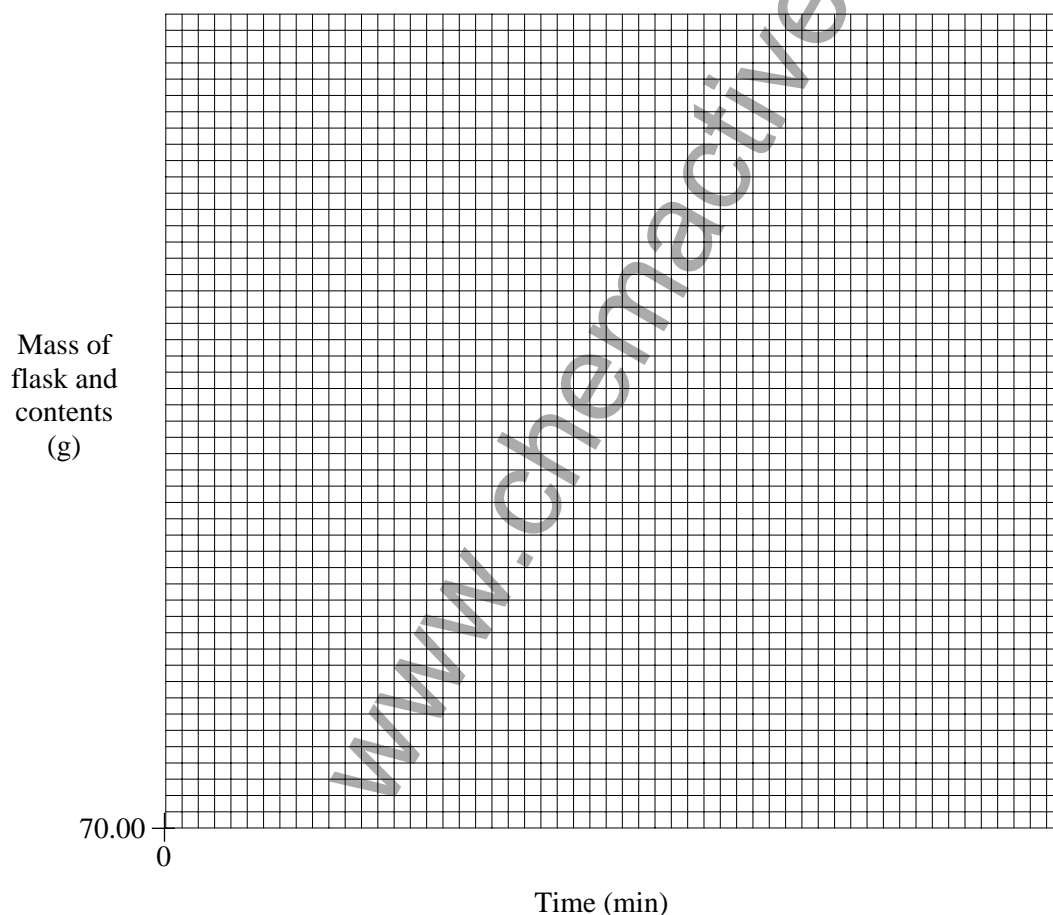
One of the results in the table is unreliable.

Mass of flask and contents (g)	71.00	70.74	70.54	70.40	70.30	70.24	70.26	70.20	70.20	70.20
time (min)	0	1	2	3	4	5	6	7	8	9

- (i) On the grid below plot a graph of the results shown in the table above.

Draw a smooth curve through the **reliable** points and label it **A**.

[3]



(Continued...)

QUESTIONSHEET 1 CONTINUED

(ii) Sketch carefully on the grid the graph that would be obtained if:

I. the same reaction was carried out at a temperature of 50°C. Label this graph **B**. [2]

II. when an identical piece of calcium carbonate was reacted with only 20 cm³ of the dilute acid. Label this graph **C**. [2]

(iii) Explain your answer to part (ii) I, in terms of **particle collision**.

.....

.....

..... [3]

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Some chemical reactions may take place twice as quickly if their temperature is raised by 10°C .

- (a) If a particular reaction takes 32 minutes at 20°C , how long will it take if the temperature is raised to 50°C ?

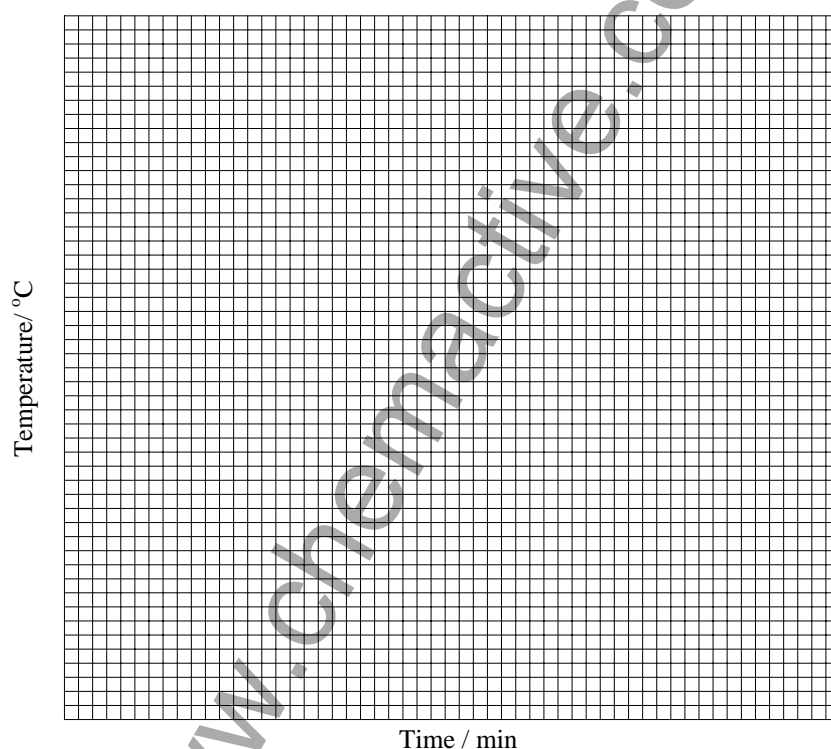
.....

.....

.....

..... [2]

- (b) Plot a graph of temperature against time taken to complete the reaction. [3]



- (c) Explain why the line on your graph does not meet either axis.

.....

.....

..... [2]

High Demand Questions

QUESTIONSHEET 3

Carbonates react with acids to produce a salt, carbon dioxide and water.

- (a) The equation describes the reaction between calcium carbonate and hydrochloric acid.



- (i) Add state symbols to complete the equation. [1]

- (ii) Name the salt produced in this reaction.

..... [1]

- (iii) Use the relative atomic masses C = 12, Ca = 40 and O = 16 to calculate the relative formula mass of calcium carbonate. Show your working.

.....

..... [1]

- (iv) How much carbon dioxide can be produced from:

A 100 g calcium carbonate?

.....

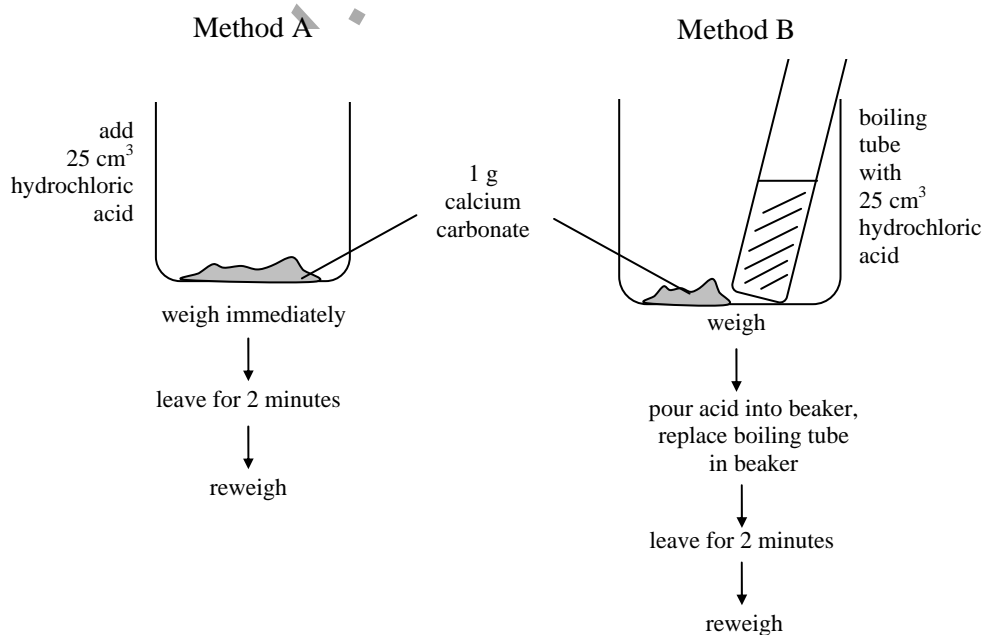
..... [2]

B 1 g calcium carbonate?

.....

..... [1]

- (b) A student wished to measure the production of carbon dioxide in the above reaction. She considered the two methods outlined in the diagram.



(Continued...)

QUESTIONSHEET 3 CONTINUED

- (i) Before carrying out the experiment, she performed the calculation in part (a) (iv) **B** of this question. Suggest how this information could be of use to her.

.....
.....
.....
..... [2]

- (ii) Explain why, of the two methods shown, method B would provide a more reliable estimate of the amount of carbon dioxide produced during the reaction.

.....
.....
.....
..... [2]

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High Demand Questions

QUESTIONSHEET 4

Raj's chemistry teacher puts a beaker of sodium thiosulphate on the windowsill.

Raj can clearly see a tree on the school field through the beaker. The teacher adds hydrochloric acid to the beaker. After 120 seconds Raj cannot see the tree although he is looking carefully.

- (a) Explain why.

.....
 [2]

The teacher repeats the experiment with three other classes. The tree disappears from view at different times.

Class	Time for tree to disappear in seconds
9X	120
9Y	200
9Z	150

The three experiments were identical except for the day on which they were done.

- (b) Which class did the experiment: -

- (i) on a warm spring day?

..... [1]

- (ii) during a summer heat wave?

..... [1]

- (iii) on a January day when the school heating was not working well?

..... [1]

The following year the local group of schools agree to do the same experiment on the same day under exactly the same conditions using the same chemicals. They look at objects that are the same distance away.

The results are: -

School	Time for tree to disappear in seconds
St Peter's	110
St Paul's	100
St Mary's	150

The teachers tested the chemicals used. They found that the sodium thiosulphate was of different concentration in each school.

- (c)(i) Which school had the strongest solution?

..... [1]

(Continued...)

QUESTIONSHEET 4 CONTINUED

(ii) Give reasons for your answer.

.....
..... [2]

Hanif decides to use an ultraviolet lamp and an electric motor powered by a photoelectric cell.

(d) How could he use this equipment to measure the cloudiness of the liquid in a more objective way?
Draw a diagram of how the equipment might be set up.

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

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[4]

High Demand Questions

QUESTIONSHEET 5

Cotton is starched to make it easier to weave into denim cloth. Before the cloth is made up into clothing the starch is removed so that it can be more easily sewn.

Denim from a newly woven roll is tested to find out the best conditions for the removal of starch using the biological catalyst amylase. A solution of amylase is made up and five equal pieces are cut from the roll of denim. Equal quantities of amylase are added to four of the five pieces in separate beakers. The beakers are kept at temperatures of 20°C, 40°C, 60°C and 80°C respectively for 15 minutes. Afterwards all five pieces are tested for starch.

(a) (i) What is a catalyst?

..... [2]

(ii) What is the name given to biological catalysts?

..... [1]

(b) (i) Which of the cotton samples would you expect to contain the most starch?

..... [1]

(ii) Explain your answer.

.....
.....
..... [3]

(iii) Which sample would you expect to contain the least starch?

..... [1]

(iv) Explain your answer.

.....
..... [2]

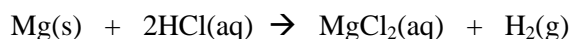
(v) What chemical is most often used to detect starch?

..... [1]

High Demand Questions

QUESTIONSHEET 6

The following equation shows what happens when magnesium ribbon reacts with hydrochloric acid.



- (a) What would you see happening to the magnesium ?

..... [1]

- (b) 40 cm³ of gas is collected in 10 seconds. What is the rate of reaction?

..... [1]

- (c) How would the rate compare if you used very dilute hydrochloric acid?
Explain why.

..... [2]

- (d) State **two** ways in which the reaction could be speeded up besides changing the concentration of hydrochloric acid.

..... [2]

- (e) Calculate how many moles of hydrogen gas are collected.

..... [2]

[24 dm³ is the volume of 1 mole of gas at room temperature]

High Demand Questions

QUESTIONSHEET 7

When 0.15 M sodium thiosulphate solution ($\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$) is added to hydrochloric acid, sulphur is formed.

(a) What would you observe during the reaction?

..... [1]

(b) What other products are formed?

..... [2]

(c) Apart from heating it, how else could you speed up the reaction?
How would this work?

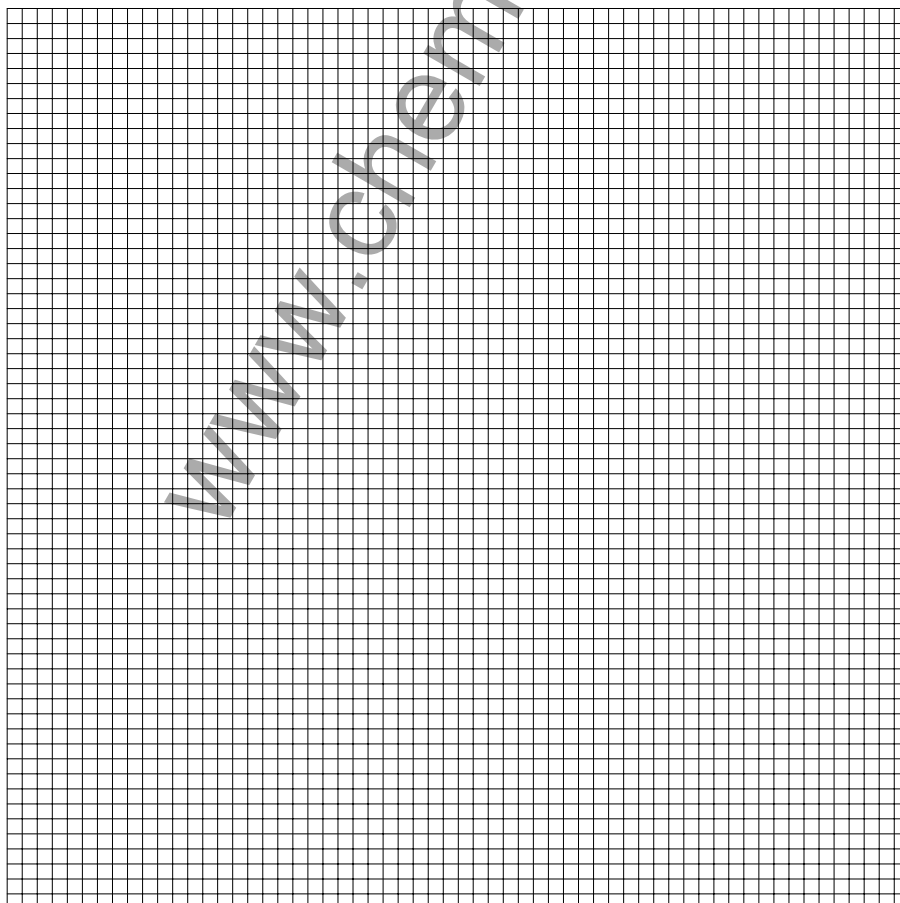
..... [2]

The following results table was obtained by mixing various amounts of sodium thiosulphate solution, water and 1 M hydrochloric acid.

Volume (cm^3)	$\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$	50	40	30	20	10
	$\text{H}_2\text{O}(\text{l})$	0	10	20	30	40
	$\text{HCl}(\text{aq})$	5	5	5	5	5
Reaction Time (s)		5	13	27	56	3 min

(d)(i) Plot a graph of the results

[3]



(Continued...)

QUESTIONSHEET 7 CONTINUED

(ii) Which variable are you testing?

..... [1]

(iii) Why is the volume of acid kept the same?

..... [1]

(iv) What would you observe during the reaction?

..... [1]

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High Demand Questions

QUESTIONSHEET 8

Yoghurt is made from milk. Yoghurt contains lactic acid formed from lactose, the sugar present in milk. Recently a new type of yoghurt has appeared in the shops in which bacteria from Russian cosmonauts has been used in the process.

- (a) Describe a test to show that an acid is formed when milk is turned into yoghurt. State the result of the test.

.....
..... [2]

- (b) For all practical purposes, a solution of lactose does not change into lactic acid. Adding bacteria increases the rate of reaction. What is meant by the phrase 'rate of reaction'?

.....
..... [2]

- (c) Why does the addition of bacteria have this effect?

..... [1]

- (d) Describe or draw diagrams to show what is happening to individual molecules of lactose in the reaction to form lactic acid molecules in yoghurt.

.....
.....

[3]

- (e) After a while the rate of formation of lactic acid decreases. Why is this?

..... [1]

- (f) The yoghurt – milk mixture is heated to about 70°C. What effect does this have on the rate of the production of lactic acid? Explain your answer.

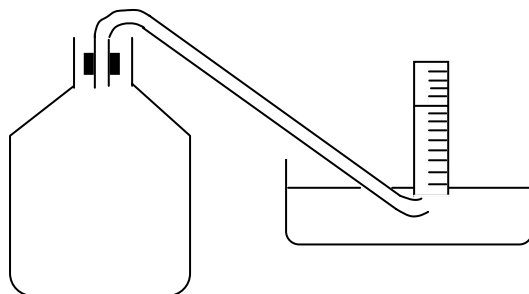
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..... [2]

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Medium Demand Questions

QUESTIONSHEET 9

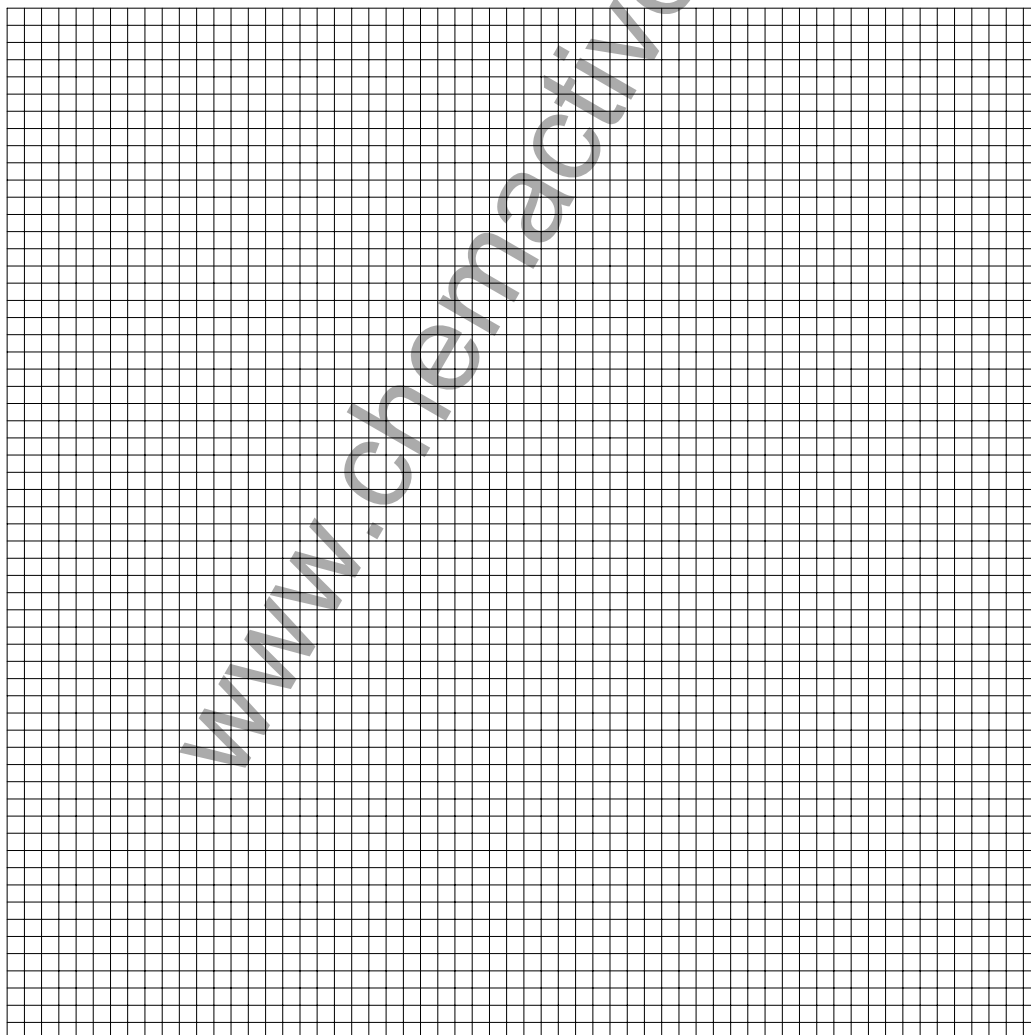
The apparatus shown can be used to collect gas formed by reacting magnesium and sulphuric acid. The following table of data was collected.



Time (s)	0	2	4	6	8	10
Volume (cm ³)	0	10	16	20	22	22

(a) Plot a graph of the results.

[3]



(Continued...)

QUESTIONSHEET 9 CONTINUED

(b) One experimental result was missed.

(i) What value could it have?

..... [1]

(ii) Why is it easy to miss results like this during experiments?

..... [1]

(c) (i) Which gas is formed in the reaction ?

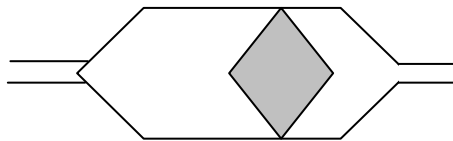
..... [1]

(ii) How could you test for this gas?

..... [2]

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Some cars are fitted with catalytic converters to remove harmful substances from exhaust gases.



The platinum catalyst is coated onto a honeycombed ceramic support.

It works best when the engine has warmed up.

- (a)(i) Explain why a honeycombed support is better than a solid one.

..... [1]

- (ii) Explain why the catalyst works better when the engine is warm.

.....
..... [2]

- (b) Heavy metals may stick to the catalyst and prevent it from working.
The catalyst is said to be poisoned.

- (i) Explain how catalysts work and how poisoning with heavy metals prevents this.

.....
.....
..... [3]

- (ii) Why should the owners of cars with catalytic converters always use unleaded petrol?

.....
..... [2]

Hydrogen peroxide (H_2O_2) breaks down slowly to form water and oxygen.

- (a) Write a balanced symbol equation for the reaction.

..... [2]

- (b) The reaction can be greatly speeded up by a catalyst.

- (i) Name a possible catalyst.

..... [1]

- (ii) How does the catalyst work?

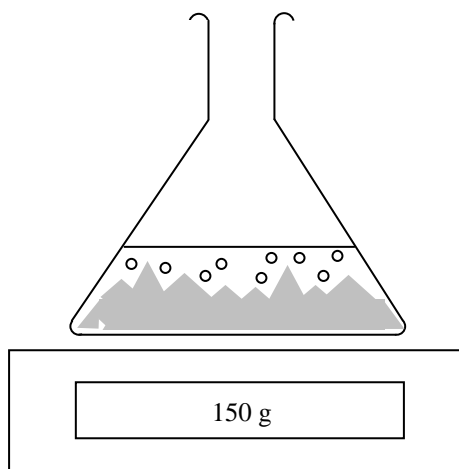
..... [2]

- (iii) How could you show that the catalyst was unchanged at the end of the reaction?

..... [2]

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The diagram shows a flask of zinc metal reacting with hydrochloric acid on a chemical balance.



- (a) How could this apparatus be used to measure the speed of the reaction?

.....
..... [2]

- (b) (i) What is the gas being produced?

..... [1]

- (ii) How would you test the gas to identify it?

.....
..... [2]

- (iii) Write an equation for the reaction which is taking place.

..... [2]

- (c) How would you expect the results to change if:

- (i) the temperature was increased?

..... [1]

- (ii) the zinc was ground into a fine powder?

..... [1]

- (iii) the concentration of the hydrochloric acid was increased?

..... [1]

Medium Demand Questions

QUESTIONSHEET 13

Chemical reactions are caused when molecules of different chemicals collide.

- (a) Describe the effect of increasing the pressure of two gases on the rate of reaction using this collision theory.

.....
..... [2]

- (b) Cornflour is used on the production line in some sweet factories. It is carried in the air. Special precautions have to be taken to remove the cornflour from the air as a fire hazard. Why is this fine powder a fire hazard?

.....
..... [2]

- (c) 10 g of magnesium ribbon burns up in 1 minute.
How fast would you expect 10 g of magnesium powder to burn?

..... [1]

- (d) Why is heat often provided as a means of speeding up chemical reactions?

.....
..... [2]

- (e) Why does food not keep for ever in a freezer?

.....
..... [2]

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Medium Demand Questions

QUESTIONSHEET 14

A research laboratory is investigating the effectiveness of various catalysts for the reduction of pollution in petrol powered car exhausts.

They obtain the following results using their own 'pollution units', P.
[10 P = 10 pollution units.]

Catalyst	Petrol P	Carbon monoxide P	Oxides of nitrogen P
None	100	700	500
A	30	150	150
B	50	250	300
C	10	75	90

In his lab notebook the scientist uses the abbreviations 'CO', 'NO_x' and 'CH'.

- (a) What do these abbreviations stand for?

.....
.....
..... [3]

- (b)(i) Which catalyst is most effective at reducing total pollution?

..... [1]

- (ii) Which is the largest pollutant in the exhaust before a catalyst is used?

..... [1]

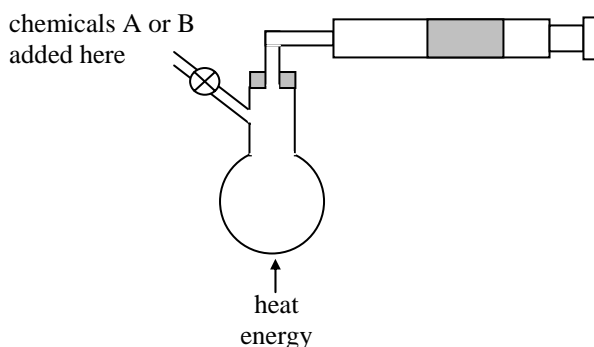
- (iii) Which is the largest pollutant in the exhaust from the most effective catalyst?

..... [1]

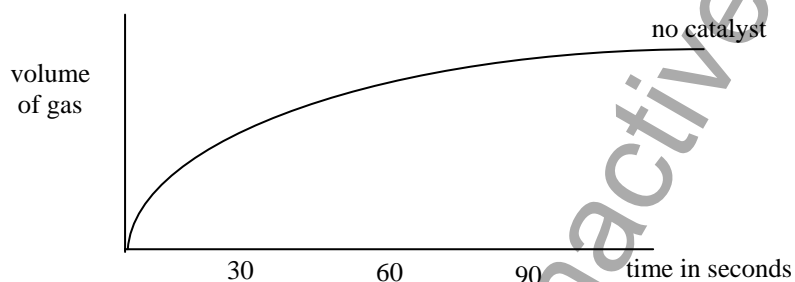
Medium Demand Questions

QUESTIONSHEET 15

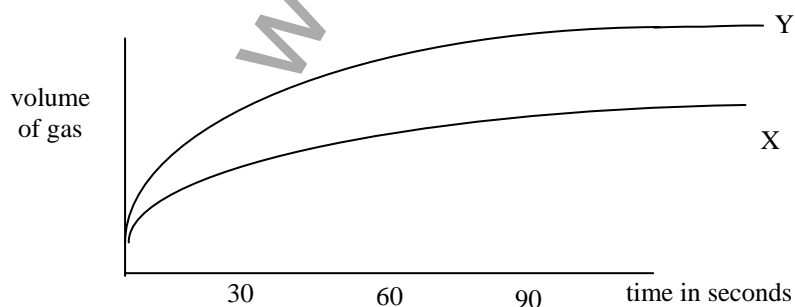
Hydrogen peroxide and a catalyst are mixed in the apparatus below. The hydrogen peroxide decomposes into water and oxygen.



The results obtained are represented on the graph below



- (a) (i) On the same axes, draw a line to represent the volume of oxygen produced when the reaction is repeated with 5 g of a granulated catalyst in the flask. Label this (i). [1]
- (ii) On the same axes, draw a line to represent the volume of oxygen produced when the reaction is repeated with 5 g of a powdered catalyst in the flask. Label this (ii). [1]
- (b) John measures the volume of gas produced when 5 g of two chemicals X and Y are added to hydrogen peroxide under identical conditions. His results for this experiment look like this.



He claims that they show that Y is a better catalyst than X. John's partner Steven does not agree.

(Continued...)

QUESTIONSHEET 15 CONTINUED

What does Steven find wrong with the results?

.....
..... [2]

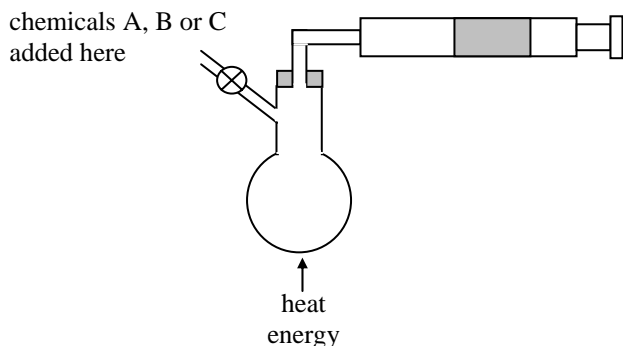
- (c) After the experiment Steven recovers 5 g of X and 1 g of Y from the two experiments. He claims that this shows that John is wrong.

Why might he think this?

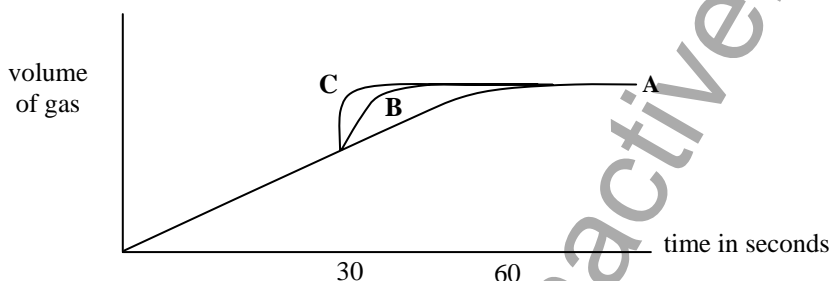
.....
..... [2]

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200 cm³ of hydrogen peroxide solution are warmed in a flask. The volume of gas produced is measured using a syringe. After 30 seconds 5 g of a chemical A is added to the hydrogen peroxide and the volume of gas continues to be measured. The experiment is then repeated but this time another chemical, B, replaces A. A third experiment has chemical B replaced by chemical C.



The graph below shows the volume of gas produced over time when the chemicals A, B and C are added.



- (a) What is the formula of hydrogen peroxide?
 [1]
- (b) What is the gas produced?
 [1]
- (c) (i) What is a catalyst?
 [2]
- (ii) Which of the three chemicals A, B and C is not a catalyst? (Give a reason for your choice)
 [2]
- (iii) Which of the three chemicals is the best catalyst? (Give a reason for your answer)
 [2]
- (d) How much of the compounds B and C should be recovered from the flasks after the experiment?
 [1]

- (a) List **three** ways of increasing the rate of a chemical reaction.

.....
.....
..... [3]

- (b) Explain why it is not possible to light a dead tree with a match.

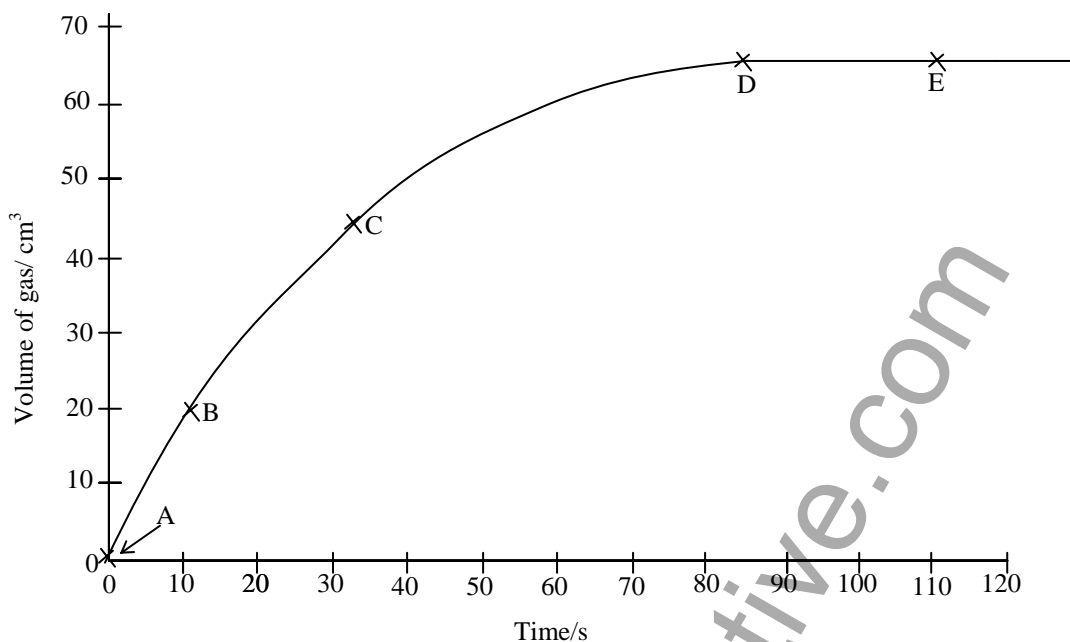
.....
.....
..... [2]

- (c) Why is it difficult to light coal, but coal dust in mines can cause explosions?

.....
..... [2]

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The graph below shows the volume of gas produced in an experiment over a period of time.



(a) Write down the letter which represents:

(i) the point at which the reaction has first stopped.

..... [1]

(ii) the point at which the reaction is going at its fastest.

..... [1]

(b) Use the graph to estimate:

(i) the volume of gas produced after 60 seconds.

..... [1]

(ii) the time taken for 30 cm³ of gas to be collected.

..... [1]

(c) If the experiment was repeated with a catalyst present, how much gas would you expect to collect in total?

..... [1]

(d) (i) If the experiment in (c) was repeated with twice as much catalyst, how much gas would you expect to collect in total?

..... [1]

(ii) Would the speed of collection of the gas be faster, slower or the same as in experiment (c)?

..... [1]

TOTAL / 7

Rates of reactions can be measured in a number of ways.

- (a) Name two pieces of apparatus which could be used to measure volumes of gases.

.....
..... [2]

- (b)(i) If you were timing how long magnesium took to dissolve in different concentrations of acid, what controls would you use to make sure the experiment was fair?

.....
.....
..... [3]

- (ii) Which of the following would be best for timing the reactions? (Underline the correct answer)

Stop clock kitchen clock alarm clock egg timer [1]

- (c) Which of the following pieces of apparatus would be most suitable for weighing a marble chip? (Underline the correct answer)

spring balance

balance reading to 4 decimal places

balance reading to 2 decimal places

balance reading in whole grams [1]

Low Demand Questions

QUESTIONSHEET 20

Complete the following sentences.

- (i) Heat energy is measured in _____.
- (ii) One thousand of these is called a _____.
- (iii) A reaction which gives out heat is described as _____.
- (iv) A reaction which takes in heat is described as _____.
- (v) A _____ will speed up a chemical reaction without being permanently used up.
- (vi) Reactions involving gases can be speeded up using _____ pressure.
- (vii) Powders have a greater _____ than lumps of a solid.
- (viii) Curtains fading and _____ are examples of reactions which
- (ix) are triggered by _____.

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