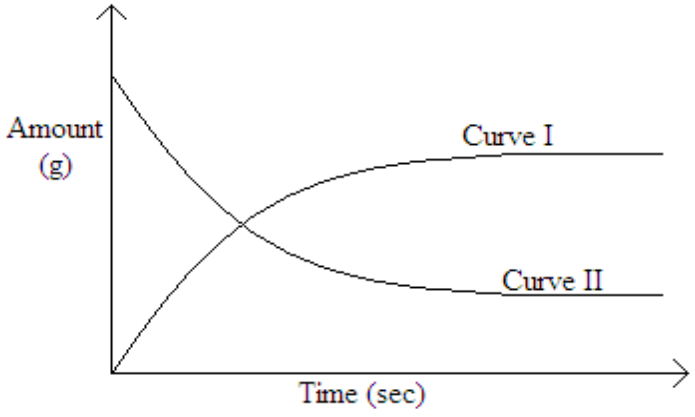
RATE OF REACTION

(i) The graph below shows the amount of calcium carbonate and calcium chloride varying with time in the reaction:

$$CaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + H_2O_{(L)} + CO_{2(g)}$$



1. **Which** curve shows the amount of calcium chloride varying with time (1mark)

.....

(b) **Explain** why the two curves become horizontal after a given period of time. (1mark)

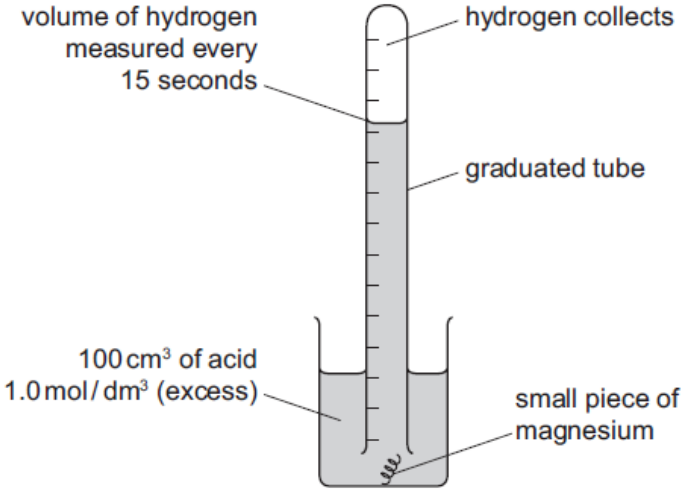
.....

.....

.....

(a) **Sketch** on the graph how curve II would appear if the experiment was repeated using a more dilute hydrochloric acid solution. (1mark)

2. A diagram of the apparatus which could be used to investigate the rate of reaction between magnesium and an excess of an acid is drawn below.



(a) The magnesium kept rising to the surface. In one experiment, this was prevented by twisting the magnesium around a piece of copper. In a second experiment, the magnesium was held down by a plastic net fastened to the beaker.
(i) Suggest a reason why magnesium, which is denser than water, floated to the surface.

.....

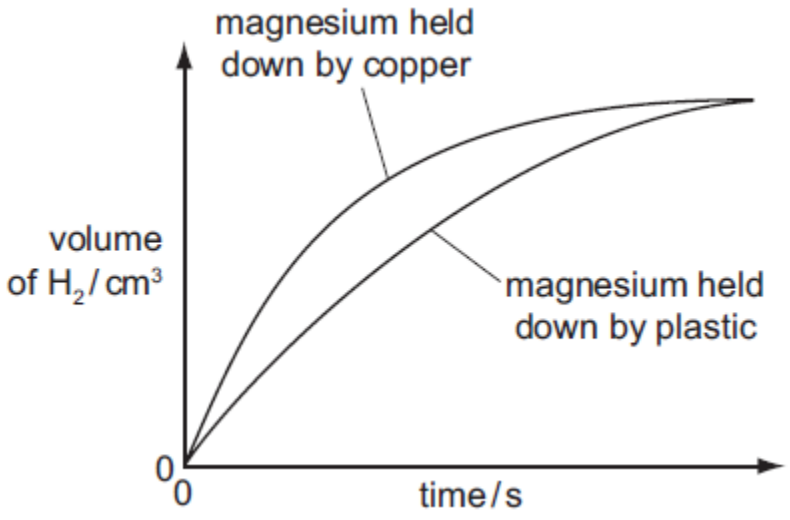
..... [1]

(ii) Iron, zinc and copper have similar densities. Why was copper a better choice than iron or zinc to weigh down the magnesium?

.....

..... [1]

(b) The only difference in the two experiments was the method used to hold down the magnesium. The results are shown below.



(c) In which experiment did the magnesium react faster?

..... [1]

(d) Suggest a reason why the experiment chosen in **(i)** had the faster rate.

..... [1]

(c) The experiment was repeated using 1.0 mol / dm3 propanoic acid instead of 1.0 mol / dm3 hydrochloric acid. Propanoic acid is a weak acid.

(i) How would the graph for propanoic acid **differ** from the graph for hydrochloric acid?

..... [1]

(ii) How would the graph for propanoic acid be the **same** as the graph for hydrochloric acid?

..... [1]

(d) Give **two** factors which would alter the rate of this reaction.
For each factor explain why it alters the rate.

Factor.....

Explanation.....

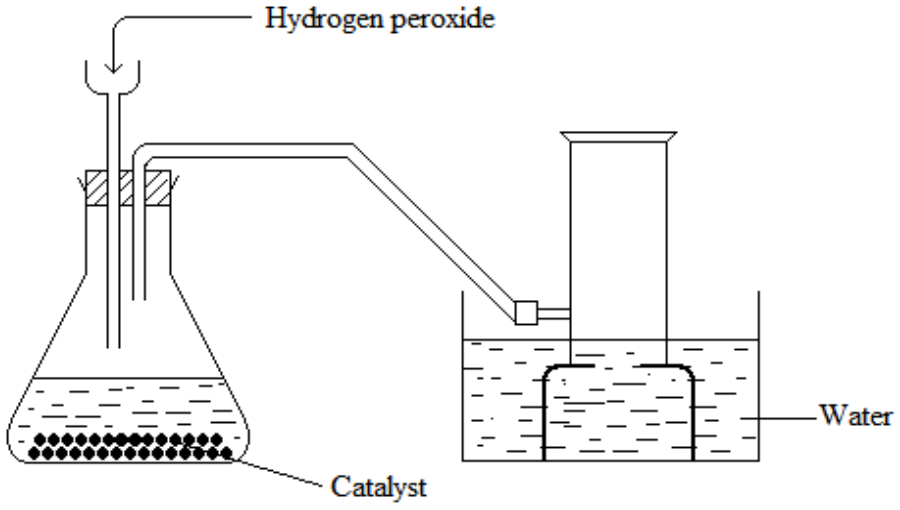
.....

Factor.....

Explanation.....

..... [4]
[Total: 10]

3. (a) The diagram below shows a set – up used by a student in an attempt to prepare and collect oxygen gas.



a) **Complete** the diagram by correcting the mistakes on it. (2mks)

b) **Name** the catalyst used. (1mk)

.....

c) **Write** the equation for the production of oxygen gas. (1mk)

.....

(b) A piece of phosphorus was burnt in excess air. The product obtained was shaken with a small amount of hot water to make it a solution.

b) **Write** an equation for the burning of phosphorus in air. (1mk)

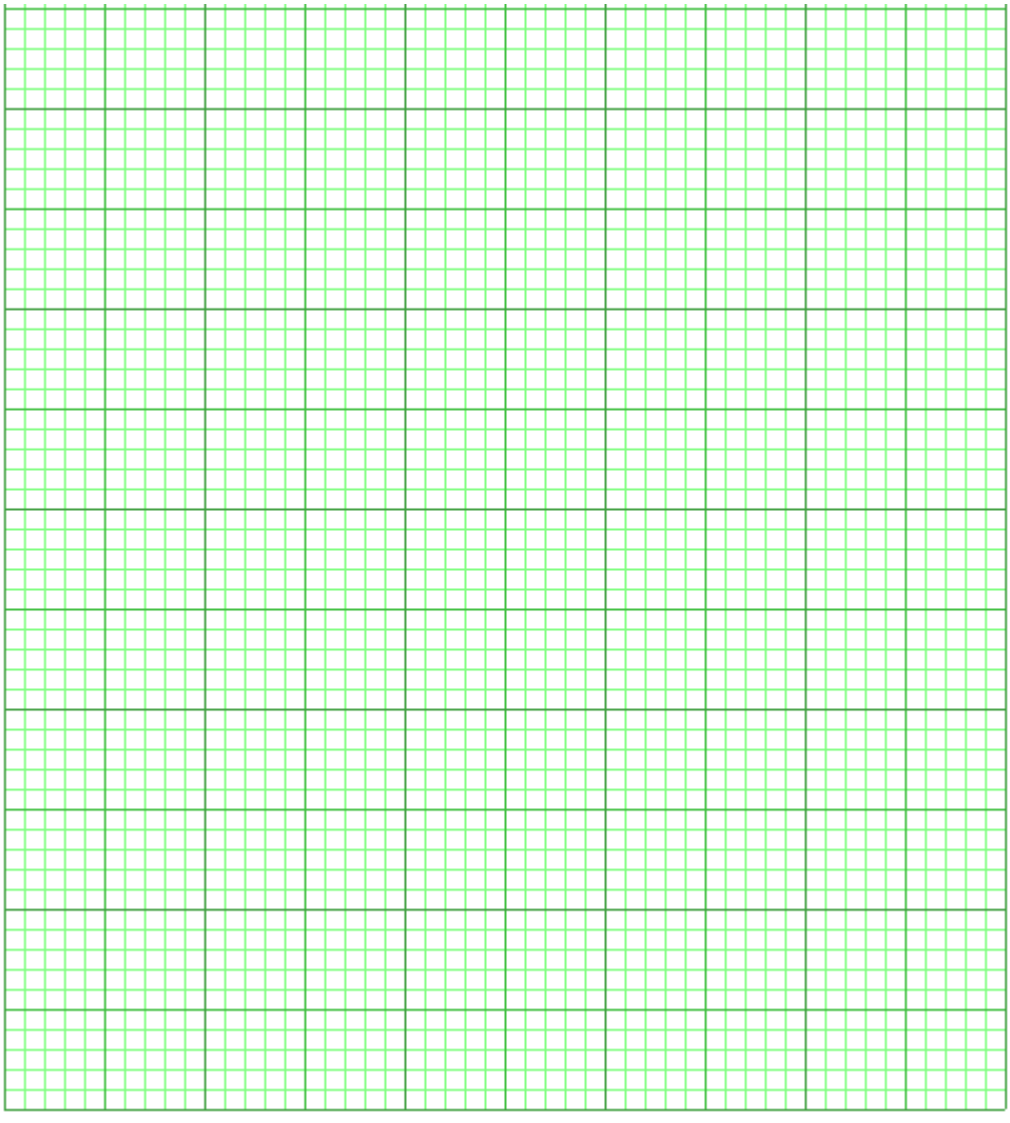
.....

c) The solution obtained in (b) above was found to have a Ph of 2. **Give reasons** for this observation. (1mk)

.....

(c) **Sketch** graph on the grid given below showing how the volume of oxygen (vertical axis) varies with time when:-

(i) 0.5g of the catalyst is mixed with 100cm^3 of 0.2Mhydrogn peroxide solution at 20^{0}C, label the curve R. (1mk)



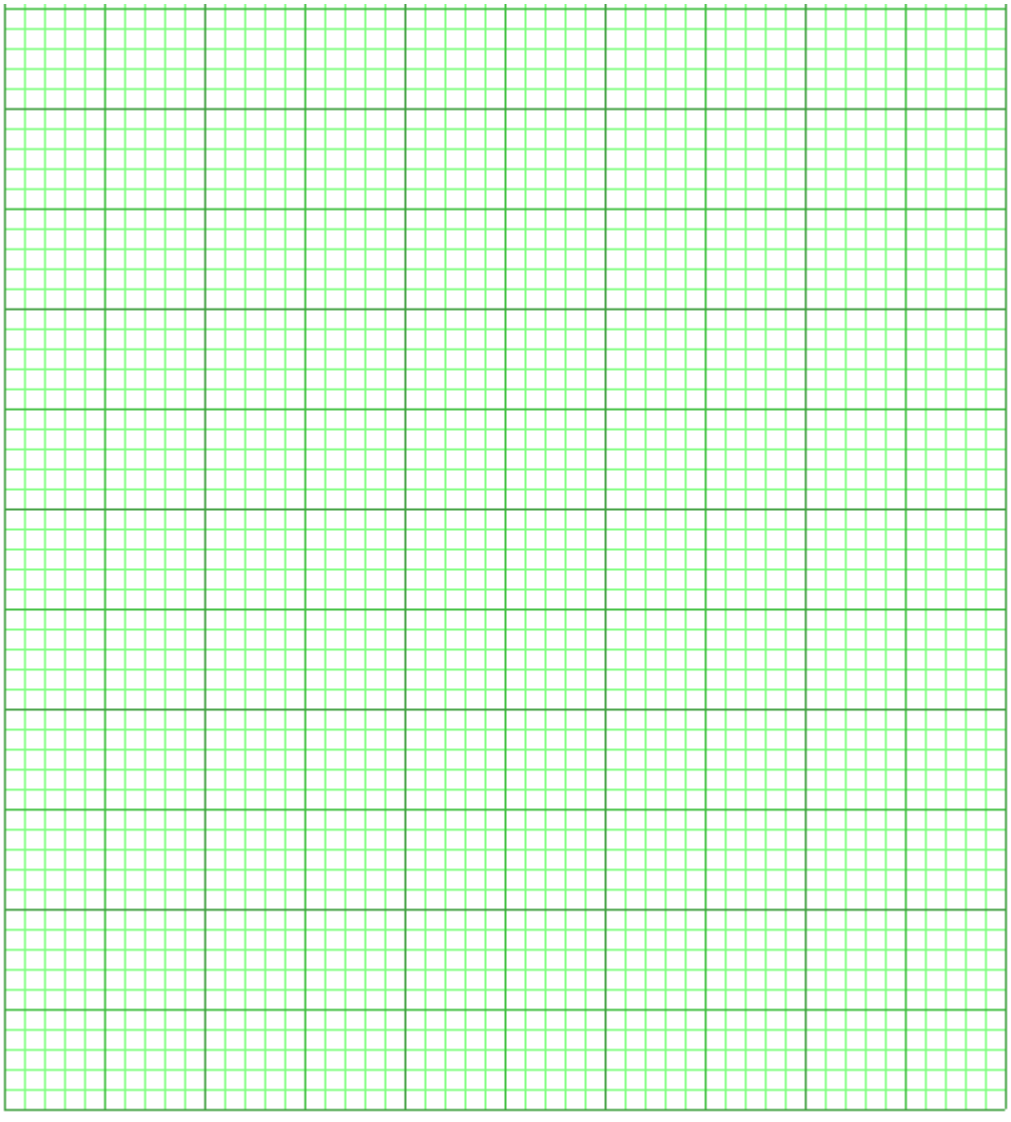
(ii) The same experiment is repeated at 30^0C, label the curve S. (1mk)

(iii) The same experiment is repeated at 40^0C, label the curve T. (1mk)

4. The reaction between 0.65g of zinc granules and excess of 0.5M hydrochloric acid was followed by measuring the amount of gas produced. The following results were obtained

Time (sec)	0	30	60	90	120	150	180	210	240	270
Total volume of gas at r.t.p (cm^3)	0	80	140	190	220	230	240	240	240	240

a) Plot a graph of volume of gas produced against time.



4mks

b) (i) Write an equation for the reaction taking place. 1mk

(ii) How would the gas produced be identified? 1mk

(iii) Why is an excess of an acid used? 1mk

c) From the graph:

i) What is the volume of the gas evolved at 75 seconds? 1mk

ii) At what time is the reaction complete? 1mk

(a) On the same graph, sketch the curves that you expect if the experiment was repeated under the same conditions but using:

(i) 0.4M hydrochloric acid, instead of 0.5M hydrochloric acid. Label the graph X. 1mk

(ii) Zinc powder (same quantity) was used in place of granulated zinc. Label the graph Y. 1mk

(b) Calculate the volume of the gas that would be produced at r.t.p from 13g of zinc. (Zn = 65.0, molar gas volume at r.t.p. = 24.0dm^3)