Exercise 1_1C Rates

Write the date in the margin of your homework jotter.
Write the title of this Exercise as a heading: Exercise 1_1C Reaction Rates

For general revision of this area of the Unit, the **BBC Bitesize website** provides the basics and the **Chemguide website** will give an in depth understanding – often beyond the scope of the syllabus!

1.

   Two identical samples of zinc were added to an excess of two solutions of sulphuric acid, concentrations 2 mol l^{-1} and 1 mol l^{-1} respectively.
   Which of the following would have been the same for the two samples?

   A The total mass lost
   B The total time for the reaction
   C The initial reaction rate
   D The average rate of evolution of the gas

2.

Which of the following graphs could represent the change in the rate of reaction when magnesium ribbon reacts with dilute hydrochloric acid?

A
Rate
Time

C
Rate
Time

B
Rate
Time

D
Rate
Time
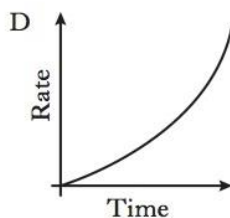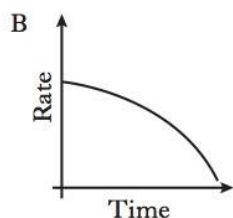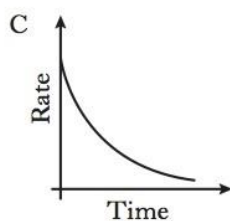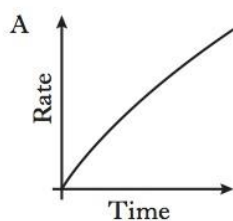
6.

   Dilute hydrochloric acid, concentration 2mol.l-1 is added to a mixture of copper metal and copper (II) carbonate.

Which of the following happens?

   A   The only gas produced is carbon dioxide
   B   The only gas produced is hydrogen
   C   A mixture of carbon dioxide and hydrogen is produced
   D   There is no production of gas

7.

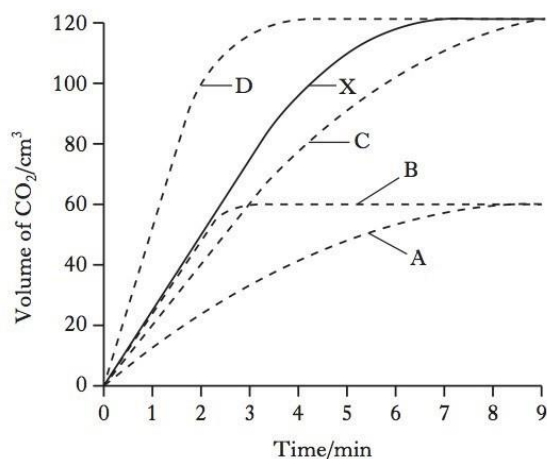Hydrochloric acid reacts with magnesium according to the following equation.

$$Mg(s) + 2H^{+}(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$$
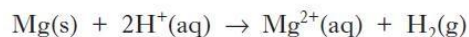
What is the least volume of $4\,mol\,l^{-1}$ hydrochloric acid that would be required to completely react with $0\cdot1\,mol$ of magnesium?

A $25\,cm^3$
B $50\,cm^3$
C $100\,cm^3$
D $200\,cm^3$

3.

Graph **X** was obtained when 1 g of calcium carbonate powder reacted with excess dilute hydrochloric acid at 20 °C.

Which curve would best represent the reaction of 0·5 g lump calcium carbonate with excess of the same dilute hydrochloric acid?

4.

A mixture of sodium chloride and sodium sulphate is known to contain 0·6 mol of chloride ions and 0·2 mol of sulphate ions.

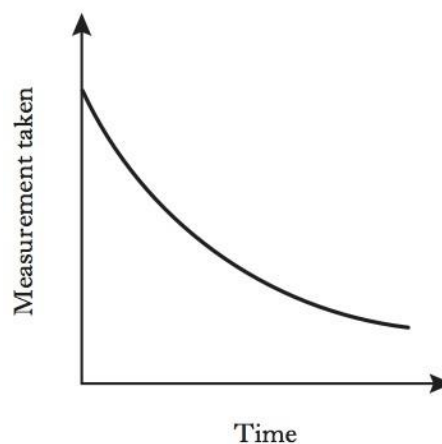How many moles of sodium ions are present?

A 0·4

B 0·5

C 0·8

D 1·0

5.

Which of the following gases could be described as monatomic?

A Bromine

B Methane

C Hydrogen

D Helium

8.

Excess marble chips (calcium carbonate) were added to 25 cm^3 of hydrochloric acid, concentration 2 mol l^{-1}.

Which of the following measurements, taken at regular intervals and plotted against time, would give the graph shown above?

A Temperature

B Volume of gas produced

C pH of solution

D Mass of the beaker and contents

9.

0·5 mol of copper(II) chloride and 0·5 mol of copper(II) sulphate are dissolved together in water and made up to 500 cm^3 of solution.

What is the concentration of Cu^{2+}(aq) ions in the solution in mol l^{-1}?

A 0·5

B 1·0

C 2·0

D 4·0

10.

Different isotopes of the same element have identical

A electron arrangements
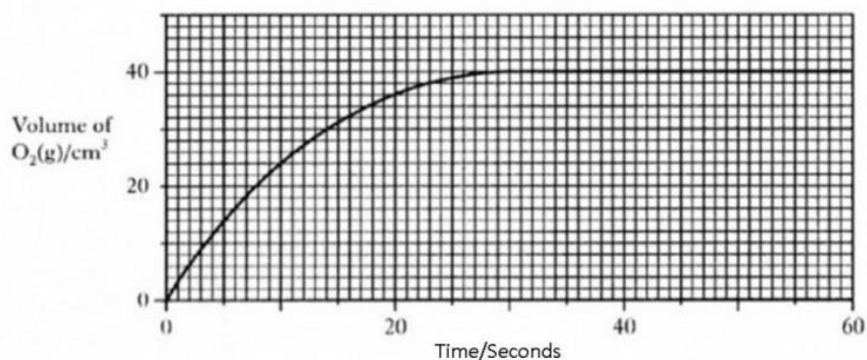
B nuclei

C numbers of neutrons

D mass numbers.

11.

Hydrogen peroxide, H_2O_2, decomposes very slowly to produce water and oxygen.

The balanced equation for the reaction is:

$$2H_2O_2(aq) \ 2H_2O(l) + O_2(g)$$

The following graph is obtained for the volume of oxygen released over time.

a) Calculate the average rate of reaction between 10 and 20 s.
b) Using information from the above graph, calculate the mass of hydrogen peroxide used in the reaction, assuming all the hydrogen peroxide decomposed.
(Take the molar volume of oxygen to be 24 litres mol^{-1})
**In your jotter, show your working clearly**

12.

A student heated a compound which gave of carbond dioxide and water vapour.
Lumps of calcium chloride were used to absorb the water vapour first and the carbon dioxide was then collecte din such a way that iyts volume could be measured.

Copy and complete the diagram below to show the absorption of water and collection of carbon dioxide.
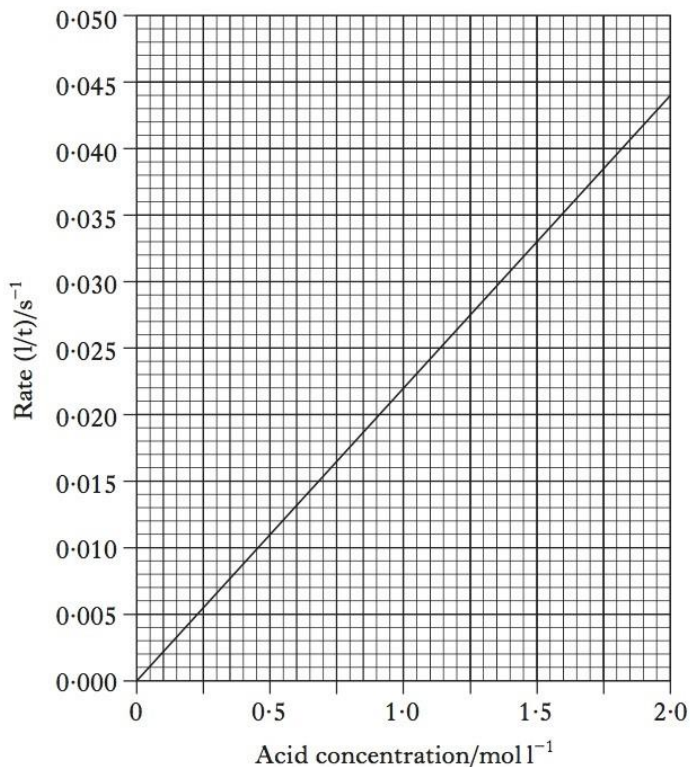Labe the diagram clearly.
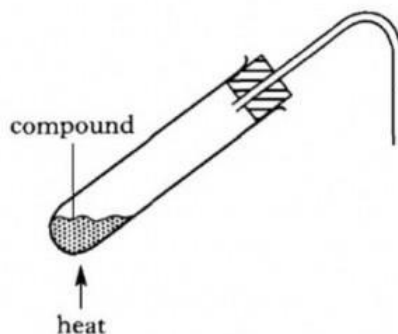
13.

(a) A student investigated the effect of changing acid concentration on reaction rate. Identical strips of magnesium ribbon were dropped into different concentrations of excess hydrochloric acid and the time taken for the magnesium to completely react, recorded.

A graph of the student's results is shown below.

Use information from the graph to calculate the reaction time, in seconds, when the concentration of the acid was $1 \cdot 0 \, mol \, l^{-1}$.

(b) The rate of a reaction can also be altered by changing the temperature or using a catalyst.

(i) Graph 1 shows the distribution of kinetic energies of molecules in a gas at $100\,°C$.
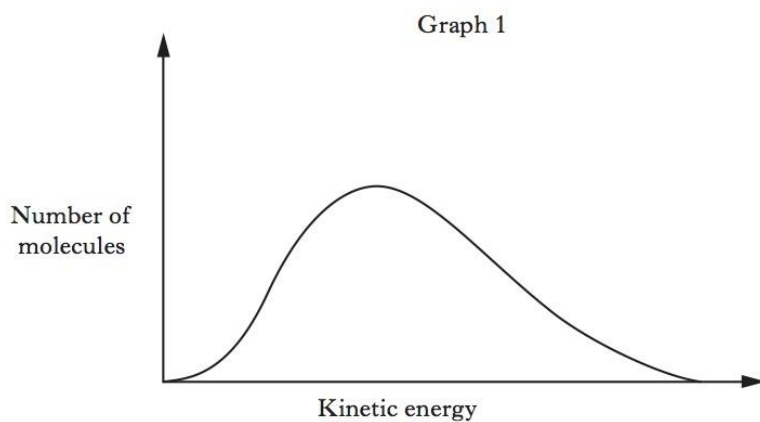
Graph 1

Add a second curve to Graph 1 to show the distribution of kinetic energies at $50\,°C$.

1

14.

Marble chips, calcium carbonate, reacted with excess dilute hydrochloric acid. The rate of reaction was followed by recording the mass of the container and the reaction mixture over a period of time.

The results of an experiment are shown in the following graph.
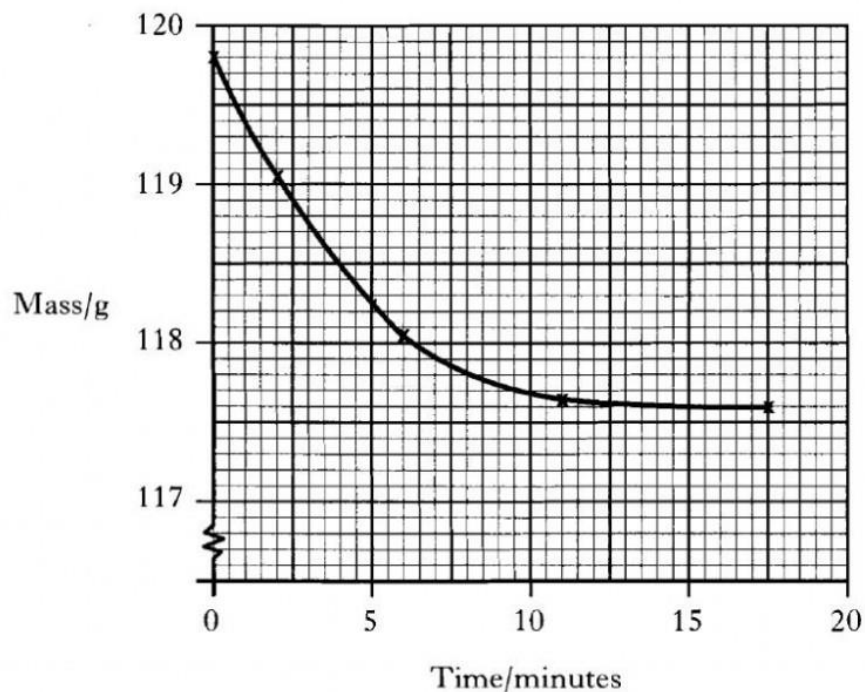
(a) Write a balanced equation for the reaction.

(b) Calculate the average rate of reaction over the first five minutes.

(c) Why does the average rate of reaction decrease as the reaction proceeds?

(d) The half-life of the reaction is the time taken for half of the calcium carbonate to be used up.

Calculate the half-life for this reaction.

(e) Use the axes below to sketch a curve showing how the volume of gas produced changes over the same period of time.
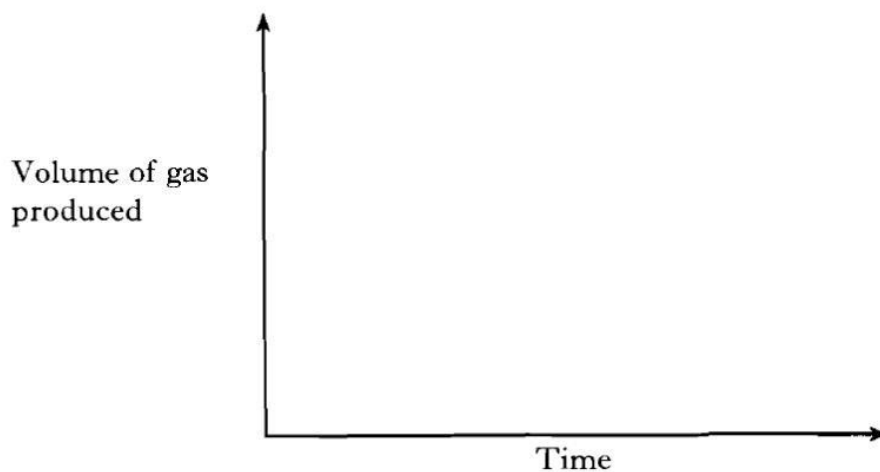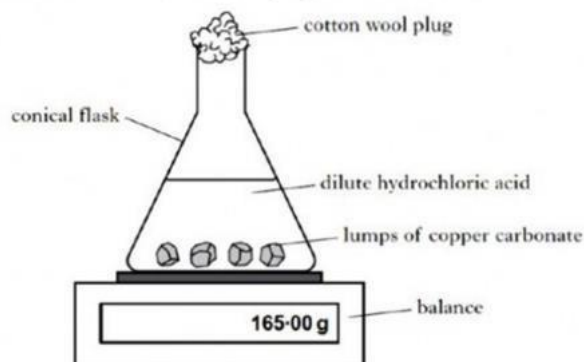
15.

Copper(II) carbonate reacts with dilute hydrochloric acid as shown.

$$CuCO_3(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l) + CO_2(g)$$

A student used the apparatus shown below to follow the progress of the reaction.

a) Suggest why a cotton wool plug is placed in the mouth of the conical flask.

The experiment was carried out using 0·50 g samples of both pure and impure copper(II) carbonate. The graph below shows the results obtained.
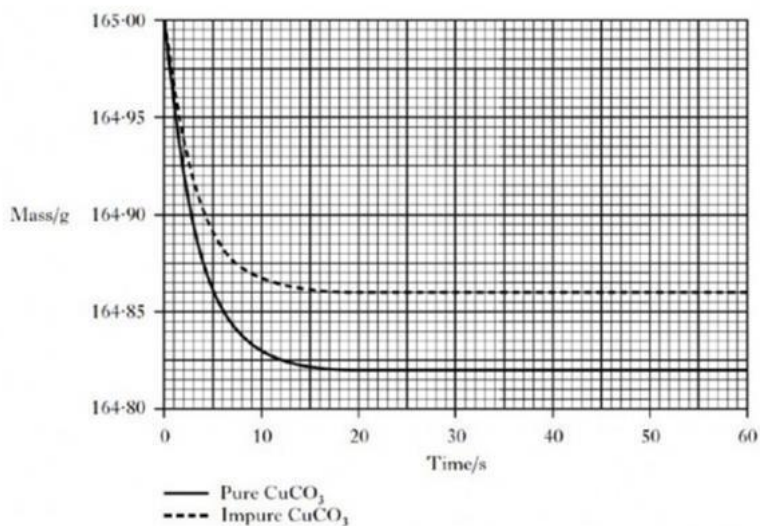
b) For the sample of pure copper(II) carbonate, calculate the average reaction rate, in g s^{-1}, over the first 10 seconds.

c) Calculate the mass, in grams, of copper(II) carbonate present in the impure sample.
In your jotter, show your working clearly