Answer any **two** questions from this section in the spaces provided.

5 **(a)** The hydrocarbons, butane, C_4H_{10}, and pentane, C_5H_{12}, are members of the same homologous series.

(i) Explain what is meant by the term '*hydrocarbons'.*

……

…….. [1]

(ii) Members of a homologous series, such as the alkanes, have the same general formula.

State two **other** general properties of a homologous series.

1. ……

……

2. ……

…….. [2]

(b) The table below shows the boiling points of some members of the homologous series of alkanes.

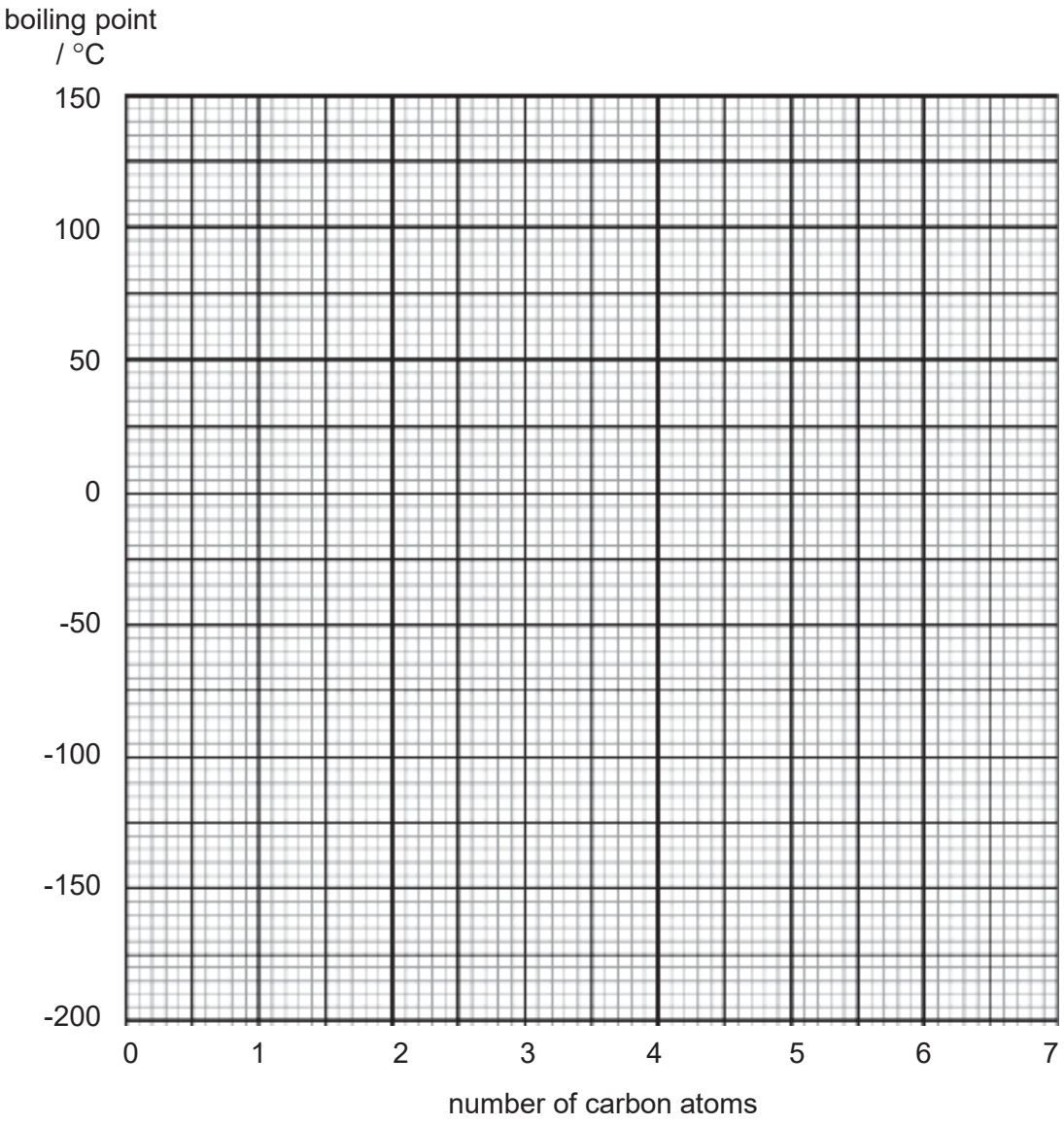
Formula of alkane	Number of carbon atoms	Boiling point/°C
CH_4	1	-162
C_2H_6	2	-89
C_3H_8	3	-42
C_4H_{10}	4	0
C_5H_{12}	5	
C_6H_{14}	6	69
C_7H_{16}	7	98

(i) State the general formula of alkanes.

…….. [1]

(ii) Plot a graph of boiling point against the number of carbon atoms, marking each point with a cross (x).

Draw a curved line of best fit for your plotted points.



[2]

(iii) Use your graph to predict the boiling point of the alkane with the formula C_5H_{12}.

boiling point = ... °C [1]

(iv) Describe the general trend in boiling point shown by your graph.

…..……..…

…….. [1]

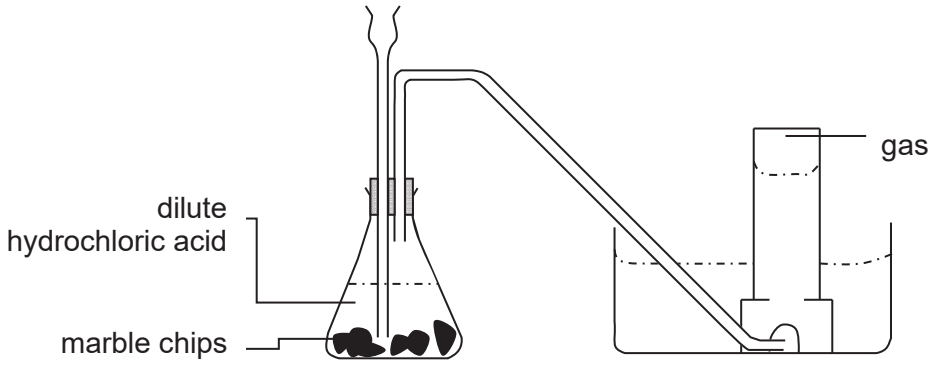
[Total: 8]

6 **(a)** The table below shows information about solutions of an acid and an alkali. Complete the table by filling in the empty boxes.

Name of solution	**Chemical formula** of acid or alkali	**Colour change** when mixed with universal indicator solution	**Formula of ion** that caused the colour change
dilute	HNO_3	from green to	.....
potassium hydroxide	.....	from green to	.....

[3]

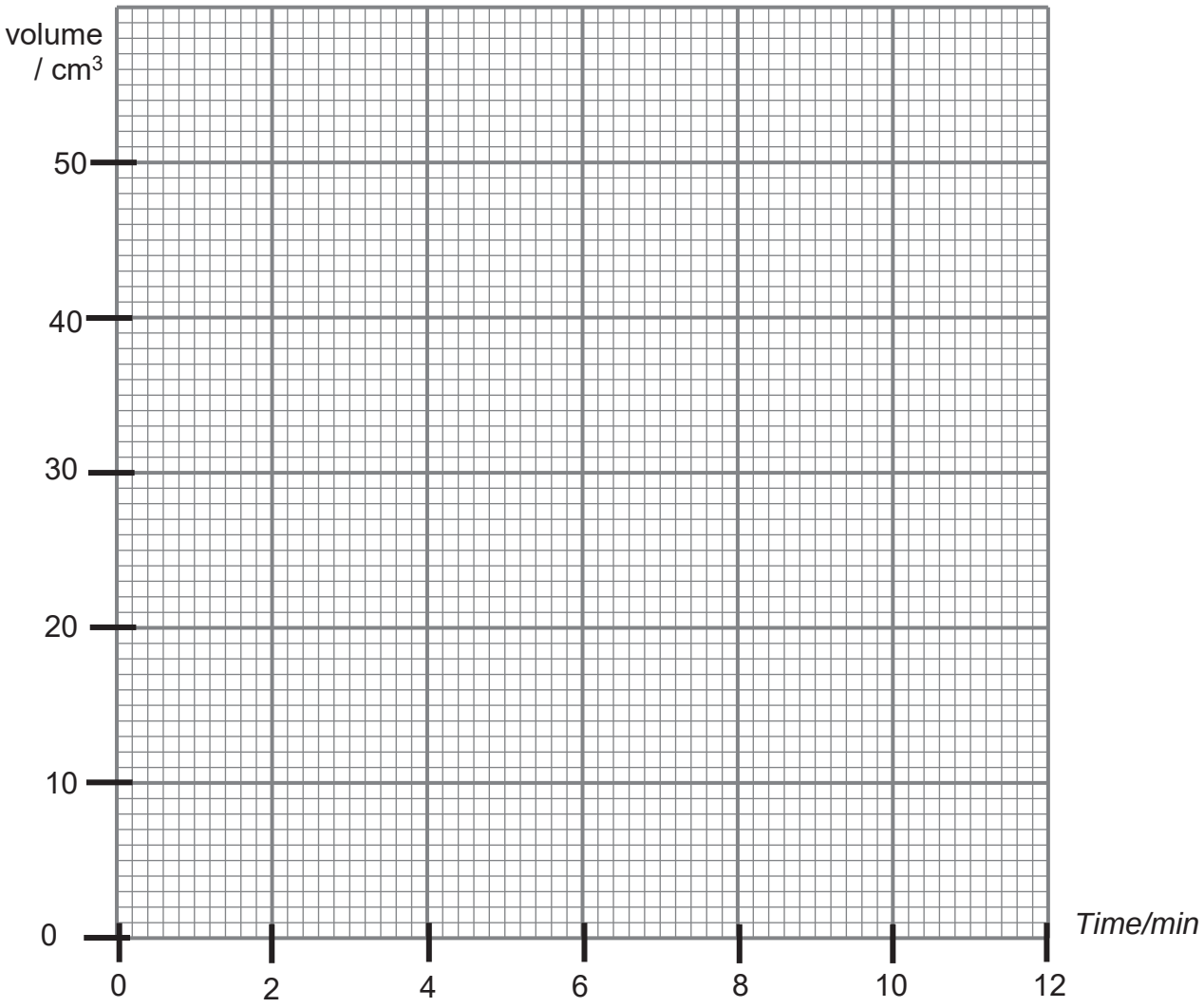
(b) Some marble chips, containing calcium carbonate, were reacted with excess hydrochloric acid. The gas produced was collected and its volume measured every two minutes.



The results are shown in the table below:

Time / min	**Total volume of gas given off / cm^3**
0	0
2	32
4	44
6	50
8	52
10	52
12	52

(i) Plot a graph of total volume of gas produced against time using the grid below. Mark each point with a cross (x).



[2]

(ii) What is the volume of gas collected in the first 5 minutes? Obtain this from the graph.

Volume of gas collected = …… cm^3 [1]

(iii) Suggest an explanation for the shape of the graph after 8 minutes.

……

…….. [1]

(iv) Write a balanced chemical equation for the reaction between calcium carbonate, $CaCO_3$, and hydrochloric acid. State symbols are not required.

…….. [1]

[Total: 8]

7 The figure below describes the results of tests on four unlabelled metals, **D**, **E**, **F** and **G**.

metal **D**	metal **E**	metal **F**	metal **G**
does not react with dilute nitric acid	reacts explosively with water	reacts steadily with water	reacts with dilute nitric acid, and with steam only when very hot

(a) Place the metals **D**, **E**, **F** and **G** in order of reactivity.

most reactive ⟶ least reactive

[1]

(b) When metals, **E**, **F** and **G** react with water or acid, a gas is given off.
Name the gas and describe a positive test to identify the gas.

Name of gas: ..... [1]

Positive test for gas: .....

..... [1]

(c) Metal **G** and carbon are melted together to form a mixture called steel.

(i) Steel is used in the construction of buildings as it is harder and stronger than pure metal **G**. Explain why this is so, in terms of the sizes of atoms present in steel.

.....

.....

.....

..... [2]

(ii) When steel is exposed to water and oxygen, it will rust. However, when a piece of magnesium metal is placed beside the steel structure, steel does not rust as quickly. Explain how magnesium slows down the rusting of steel.

.....

.....

..... [2]

(d) Suggest a possible name for any one of the metals, **D, E**, **F** or **G**.

..... [1]

[Total: 8]

End of Paper 4