

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 This question is about the metals and non-metals in period 3 of the periodic table.

(a) Figure 1 shows some data about some of the elements in period 3.

symbol	atomic number	melting point in °C
Na	11	98
Mg	12	650
Al	13	660
Si	14	1410
P	15	44
Cl	17	-101
Ar	18	-189

Figure 1

Use the periodic table to answer these questions.

(i) Give the **name** of the element in period 3 that is not shown in Figure 1.

(1)

.....

(ii) Give the relative atomic mass of silicon.

(1)

.....

(iii) State which metal and which non-metal in Figure 1 have the lowest melting points.

(2)

metal with lowest melting point

.....

non-metal with lowest melting point

.....



- (b) Alkali metals react with water to produce an alkaline solution and hydrogen gas.

A test tube of gas can be tested to see if the gas is hydrogen by putting a lighted splint at the top of the test tube.

A student suggests the following method to show that an alkaline solution and hydrogen gas are produced in this reaction.

step 1 pour 150 cm^3 water into the container shown in Figure 2

step 2 add a small piece of lithium to the water in the container shown in Figure 2

step 3 hold a lighted splint above the container

step 4 hold some damp red litmus paper above the mixture in the container

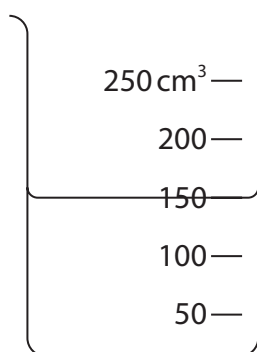


Figure 2

- (i) Give the name of the container shown in Figure 2.

(1)

- (ii) A teacher says that step 3 and step 4 will **not** work to show that hydrogen gas and an alkaline solution are produced in the reaction.

Explain **one** change that could be made in each step to make the method work.

(3)

step 3.....

.....

.....

step 4.....

.....

.....

(Total for Question 1 = 8 marks)



- 2 (a) In one reaction the temperature of the reaction mixture decreases.

Which word describes this type of reaction?

(1)

- ☐ **A** displacement
- ☐ **B** endothermic
- ☐ **C** exothermic
- ☐ **D** neutralisation

- (b) In an experiment, a salt is dissolved in water.

The temperature change is measured.

Figure 3 shows the apparatus that is used.

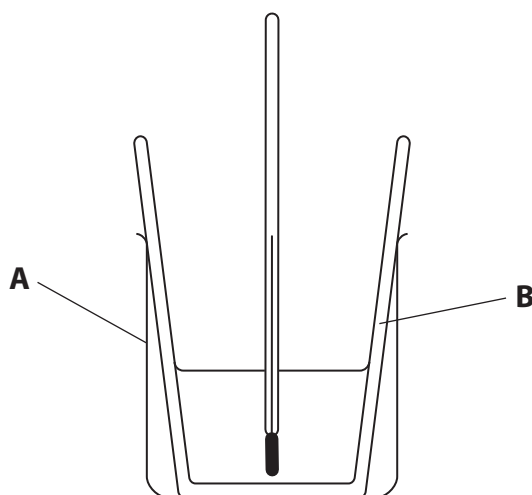


Figure 3

- (i) State what is used to measure the temperature change in Figure 3.

(1)

- (ii) State **one** reason for using the piece of equipment **A** in Figure 3.

(1)

- (iii) A student suggests putting a lid on piece of equipment **B**.

State why this would help to give a more accurate value for the temperature change.

(1)

- (iv) Four different salts, **P**, **Q**, **R** and **S**, are dissolved in water.

Figure 4 shows the starting temperature of the water and the final temperature of the solution after the salt dissolves.

	salt P	salt Q	salt R	salt S
starting temperature in °C	20.0	20.0	20.0	20.0
final temperature in °C	22.4	19.5	23.0	18.5
temperature change in °C	+2.4	-0.5		
salt that absorbed most heat energy when it dissolved				

Figure 4

Complete the table

- to show the temperature changes when salt **R** and salt **S** dissolve
- by placing a tick (✓) in the box, on the bottom row, for the salt that **absorbs** the most heat energy when it dissolves.

(4)

- (v) One of the salts dissolved is barium chloride, BaCl_2 .

Barium chloride contains the chloride ion, Cl^- .

Give the **formula** of the barium ion in barium chloride.

(1)

(Total for Question 2 = 9 marks)



- 3 (a) Figure 5 shows the structure of one molecule of three different compounds, **X**, **Y** and **Z**.

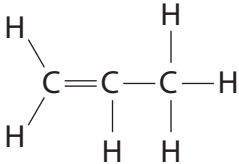
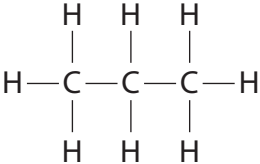
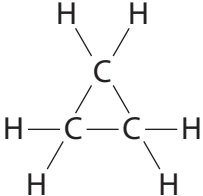
X	Y	Z
		

Figure 5

The molecules of the compounds shown in Figure 5 all contain the same number of carbon atoms.

- (i) Give the number of carbon atoms in a molecule of compound **X**. (1)

- (ii) Compound **X** contains carbon and one other element.

Give the **name** of the other element in compound **X**. (1)

- (iii) Which of the compounds in Figure 5 is a hydrocarbon? (1)

- ☐ **A** **X** only
- ☐ **B** **Y** only
- ☐ **C** **X** and **Y** only
- ☐ **D** **X**, **Y** and **Z**

- (iv) Which of the compounds in Figure 5 have the same molecular formula? (1)

- ☐ **A** none of them
- ☐ **B** **X** and **Y** only
- ☐ **C** **X** and **Z** only
- ☐ **D** **X**, **Y** and **Z**

- (b) Figure 6 shows where fractions are produced in the fractional distillation of crude oil.

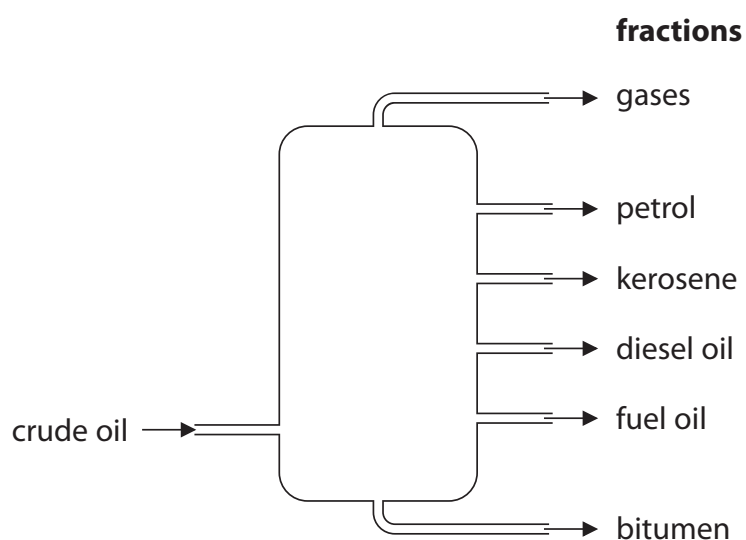


Figure 6

Complete the sentences about fractions obtained from crude oil.

(3)

The fraction with the smallest molecules is called

Compared to petrol, the boiling point of kerosene is

When petrol burns, one product is

- (c) When some impure hydrocarbon fuels are burned, sulfur dioxide is one of the products.

Some sulfur dioxide gas is dissolved in water to form solution **W**.

When solution **W** is added to sodium hydroxide solution of pH 12

- the pH changes
- the temperature increases.

Explain how the pH changes and why the temperature increases.

(3)

(Total for Question 3 = 10 marks)



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4 This question is about bromine.

(a) Give the colour and physical state of bromine at room temperature.

(2)

colour

physical state

(b) Bromine reacts with hydrogen to form hydrogen bromide.

(i) Write the word equation for this reaction.

(2)

..... + →

(ii) Hydrogen bromide dissolves in water to form a solution.

This solution of hydrogen bromide reacts with alkalis.

State the type of reaction that occurs when a solution of hydrogen bromide reacts with an alkali.

(1)

.....

.....



(c) Bromine and the other halogens react with hot iron wool.

Figure 7 shows the relative speed of some of these reactions.

halogen	relative speed of reaction
fluorine	
chlorine	reacts very quickly
bromine	reacts quickly
iodine	reacts slowly

Figure 7

Fluorine also reacts with hot iron wool.

Use Figure 7 to predict the relative speed of this reaction.

(1)

.....

.....

(d) Potassium bromide contains 32.8% potassium by mass.

Calculate the mass of potassium and the mass of bromine in 500 g potassium bromide.

(3)

.....

.....

.....

.....

mass of potassium = g

mass of bromine = g

(Total for Question 4 = 9 marks)

.....

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- 5 A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

- (a) Figure 8 shows part of the apparatus used in the experiment.

Complete Figure 8 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas.

(2)

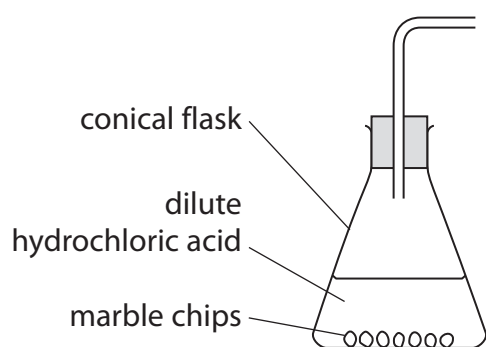


Figure 8

(b) Figure 9 shows a graph of the results of the experiment.

A tangent has been drawn on the curve at a time of 3.5 minutes.

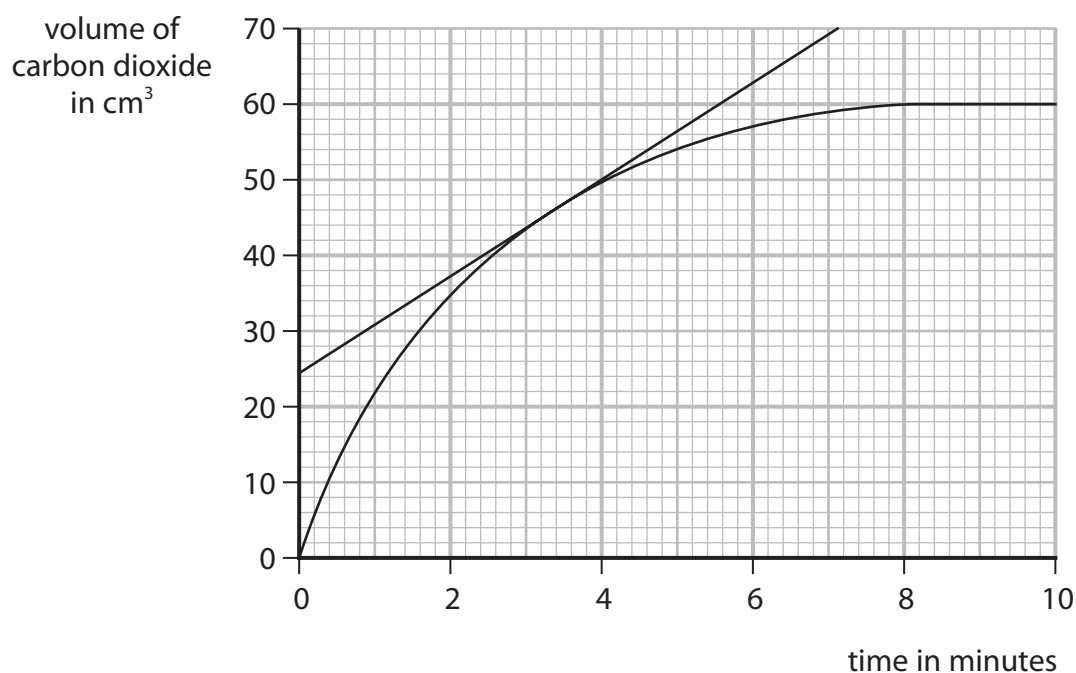


Figure 9

(i) State the total volume of carbon dioxide produced in the first 3.5 minutes.

(1)

volume = cm³

(ii) Using the tangent, calculate the rate of reaction at 3.5 minutes in cm³ per minute.

$$\text{rate of reaction} = \frac{\text{change in gas volume}}{\text{change in time}}$$

(3)

rate = cm³ per minute

(c) The student repeats the experiment using the same mass of smaller marble chips.

All other conditions remain the same.

Explain the effect on the rate of reaction of using smaller marble chips.

(2)

(d) Which change would make the rate of reaction slower?

(1)

- ☐ **A** using the same acid at a higher temperature
- ☐ **B** using acid of a lower concentration
- ☐ **C** using a larger flask
- ☐ **D** adding a catalyst

(e) In this experiment the volume of carbon dioxide gas produced is measured.

Give a different way that the amount of carbon dioxide produced can be measured.

(1)

(f) In this experiment there is an excess of dilute hydrochloric acid.

State what you would **see** in the conical flask at the end of the experiment.

(1)

(Total for Question 5 = 11 marks)



6 This question is about the atmosphere.

(a) Describe the test to show that a gas is oxygen.

(2)

(b) Copper reacts with oxygen to form copper oxide.

2.100 g of copper will react completely with 0.529 g of oxygen.

In an experiment, 4.200 g of copper is heated with 50.000 g of oxygen until the reaction is complete.

Calculate the mass of oxygen remaining at the end of the experiment.

(2)

mass of oxygen = g

(c) Helium, neon and argon are all inert.

(i) Explain, in terms of electrons, why these gases are inert.

(2)

(ii) Two pieces of steel can be joined by heating the metal pieces with a very hot flame.

This process is often carried out in an argon atmosphere rather than in air.

Which property makes argon gas suitable for this use?

(1)

- ☐ A argon has a low density
- ☐ B argon has a low melting point
- ☐ C argon is colourless
- ☐ D argon is unreactive

*(d) Figure 10 shows how plant life and the atmosphere of Earth have changed over time.

period of time	plant life	amount of carbon dioxide in atmosphere	amount of oxygen in atmosphere
the earliest Earth	no plant life	very high	none
about 3,500 million years ago	plant life evolved	high	very low
about 10,000 years ago	about 60% of land covered by trees	0.03%	about 21%
today	less than 40% of land covered by trees	0.04%	about 21%

Figure 10

Explain the effect that plant life has had on the Earth's atmosphere and the temperature of the Earth.

You should refer to the information in Figure 10 including

- the plant life
- the amounts of carbon dioxide
- the amounts of oxygen

(6)



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(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS



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Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Tuesday 11 June 2024

Paper
reference

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Combined Science

PAPER 5

Foundation Tier

Periodic Table Insert

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The periodic table of the elements

1	2	Key										3	4	5	6	7	0
		relative atomic mass atomic symbol name atomic (proton) number															
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86

1
H
hydrogen
1

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.