

Combined Science
PAPER 5
Foundation Tier

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|-------------|
| Total Marks |
|-------------|

Time: 1 hour 10 minutes

In the boxes below, write your name, centre number and candidate number.

| | | | | | |
|------------------|--|--|--|--|--|
| Surname | | | | | |
| Other names | | | | | |
| Centre Number | | | | | |
| Candidate Number | | | | | |

YOU MUST HAVE

Calculator, ruler

YOU WILL BE GIVEN

Diagram Booklet

Periodic Table

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided in this Question Paper or in the separate Diagram Booklet – there may be more space than you need.

Calculators may be used.

Any diagrams may NOT be accurately drawn, unless otherwise indicated.

You must show all your working out with your answer clearly identified at the end of your solution.

Turn over

INFORMATION

The total mark for this paper is 60.

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

In questions marked with an ASTERISK (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

A periodic table is provided as a separate insert.

There may be spare copies of some diagrams.

ADVICE

Read each question carefully before you start to answer it.

Try to answer every question.

Check your answers if you have time at the end.

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 elements in group 1 of the periodic table.

(a) Look at Figure 1 for Question 1(a) in the Diagram Booklet. It shows the symbols of the first three elements in group 1 of the periodic table and their melting points.

Use the periodic table to answer these questions.

**(i) Give the symbol of ANOTHER element in group 1.
(1 mark)**

**(ii) Give the atomic number of lithium.
(1 mark)**

(continued on the next page)

Turn over

1 continued.

**(iii) Describe the trend in the melting points of the elements in Figure 1.
(2 marks)**

(continued on the next page)

Turn over

1 continued.

(b) The elements in group 1 react very vigorously with water.

A student suggests this method to see what happens when sodium reacts with water.

STEP 1 put on safety glasses and a laboratory coat

STEP 2 cut a $2\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$ cube of sodium

STEP 3 Look at Figure 2 for Question 1(b) in the Diagram Booklet. Put a few drops of water in the container shown in Figure 2

STEP 4 add the sodium to the water in the container and observe the reaction

(continued on the next page)

Turn over

1 continued.

- (i) Look at Figure 2 for Question 1(b) in the Diagram Booklet. It shows a diagram of the container the student suggested for step 3.**

**Give the name of the container shown in Figure 2.
(1 mark)**

(continued on the next page)

1 continued.

(ii) A teacher says that the method is not safe because the reaction is too vigorous.

**Explain changes that could be made to step 2 and to step 3 that would make the method safer.
(3 marks)**

step 2: change and explanation

(continued on the next page)

Turn over

1 continued.

step 3: change and explanation

(Total for Question 1 = 8 marks)

2 Some reactions are exothermic and some reactions are endothermic.

**(a) What does an exothermic reaction always give out?
(1 mark)**

☐ **A heat energy**

☐ **B light**

☐ **C a gas**

☐ **D sound**

(continued on the next page)

2 continued.

(b) In an experiment, a solid is mixed with a liquid.

The temperature change of the mixture is measured.

Look at Figure 3 for Question 2(b) in the Diagram Booklet. It shows the apparatus that is used.

**(i) Give the letter of the piece of apparatus, A, B, C or D, in Figure 3 that is used to measure the temperature.
(1 mark)**

**(ii) Give the name of the piece of apparatus B shown in Figure 3.
(1 mark)**

(continued on the next page)

Turn over

2 continued.

(iii) The piece of apparatus labelled C is made from polystyrene.

**State why polystyrene is a better material than glass for this piece of apparatus.
(1 mark)**

(continued on the next page)

2 continued.

(iv) Look at Figure 4 for Question 2(b)(iv) in the Diagram Booklet. The results of the experiment are given.

Calculate the change in temperature.

**Give a sign and a unit in your answer.
(3 marks)**

temperature change =

(continued on the next page)

Turn over

2 continued.

(v) The solid used in this experiment contained only NH_4^+ ions and NO_3^- ions.

**Give the formula and the name of the solid.
(2 marks)**

formula

name

(Total for Question 2 = 9 marks)

Turn over

3 (a) Look at Figure 5 for Question 3(a) in the Diagram Booklet. It shows one molecule of a compound obtained from crude oil.

**(i) Give the names of the TWO elements in this molecule.
(2 marks)**

**(ii) What is the molecule in Figure 5?
(1 mark)**

☐ **A an oxide**

☐ **B a chain molecule**

☐ **C a fullerene**

☐ **D a ring molecule**

(continued on the next page)

Turn over

3 continued.

(iii) What is the relative formula mass of the compound in Figure 5?

**(relative atomic masses:
H = 1.0, C = 12)
(1 mark)**

☐ **A 13**

☐ **B 42**

☐ **C 44**

☐ **D 96**

(continued on the next page)

Turn over

3 continued.

(b) Crude oil can be separated into different fractions.

**Using the diagram for Question 3(b) in the Diagram Booklet, draw ONE straight line from each fraction to a use of that fraction.
(3 marks)**

(continued on the next page)

3 continued.

(c) Hydrogen chloride gas and sulfur dioxide gas are dissolved in separate test tubes of water.

Blue litmus paper is dipped into each test tube.

**State and explain the colour change you would observe in each test tube.
(3 marks)**

(continued on the next page)

Turn over

3 continued.

(Total for Question 3 = 10 marks)

4 This question is about elements in group 7, the halogens.

**(a) Which halogen is a green gas at room temperature and pressure?
(1 mark)**

☐ **A bromine**

☐ **B chlorine**

☐ **C fluorine**

☐ **D iodine**

(continued on the next page)

4 continued.

(b) Bromine, chlorine and iodine all react with heated iron wool.

Look at Figure 6 for Question 4(b) in the Diagram Booklet. It shows the speed of these reactions.

(i) When iron wool is heated with chlorine, iron chloride is formed.

**Write the word equation for this reaction.
(2 marks)**

(continued on the next page)

Turn over

4 continued.

- (ii) Give the name of the halogen in Figure 6 that is the most reactive with iron.
(1 mark)**

(continued on the next page)

4 continued.

**(iii) 34.4 % of the mass of
iron chloride is iron.**

**Calculate the mass of iron and
the mass of chlorine in 125 g of
iron chloride.
(3 marks)**

mass of iron = _____ g

mass of chlorine = _____ g

(continued on the next page)

Turn over

4 continued.

(c) Alkenes react with halogens.

When iron chloride is added to the reaction mixture, the reaction is much faster but the products are the same.

**Look at the list for Question 4(c) in the Diagram Booklet. Use words from the list to complete the sentences.
(2 marks)**

The iron chloride speeds up the reaction because it is

After the reaction, the mass of iron chloride is

(Total for Question 4 = 9 marks)

Turn over

- 5 Look at Figure 7 for Question 5 in the Diagram Booklet. A student used the apparatus in Figure 7 to investigate the rate of the reaction between a metal and dilute hydrochloric acid.**

Pieces of the metal were placed in dilute hydrochloric acid in the flask, and the total volume of gas produced was measured every minute.

(continued on the next page)

5 continued.

(a) Look at Figure 8 for Question 5(a) in the Diagram Booklet. It shows a graph of the student's results.

(i) Name a piece of apparatus that would be better to measure the volume of gas produced, instead of the 250 cm³ measuring cylinder.

**Give a reason for your answer.
(2 marks)**

name of apparatus

(continued on the next page)

Turn over

5 continued.

reason

(continued on the next page)

5 continued.

- (ii) Calculate the mean rate of production of hydrogen over the first 90 seconds, in cm^3 per second. (3 marks)**

rate = _____ cm^3 per second

(continued on the next page)

Turn over

5 continued.

(iii) The student measured the volume of gas for 10 minutes.

**State why the measurements could have been stopped at 9 minutes.
(1 mark)**

(continued on the next page)

5 continued.

(b) The experiment was repeated, but with acid of a higher concentration.

The rate of reaction was faster.

**(i) Explain why the rate of reaction increases when the concentration of acid is increased.
(2 marks)**

(continued on the next page)

Turn over

5 continued.

(ii) Another student suggests four other ways of increasing the rate of this reaction.

**Which one is correct?
(1 mark)**

- ☐ **A use the same acid but at a lower temperature**
- ☐ **B use a larger trough**
- ☐ **C use a smaller flask**
- ☐ **D use the same metal but in a powdered form**

(continued on the next page)

Turn over

5 continued.

(c) The apparatus in Figure 7 can be used to measure the rate of the reaction between marble chips and hydrochloric acid.

The student needs different sized marble chips.

**Describe how the student can make small and medium sized marble chips from large chips.
(2 marks)**

(Total for Question 5 = 11 marks)

Turn over

6 This question is about gases.

(a) When sodium is added to water, hydrogen gas is produced.

**Which observation shows that a gas has been produced?
(1 marks)**

- ☐ **A a white precipitate forms**
- ☐ **B effervescence is seen**
- ☐ **C the sodium sinks in the water**
- ☐ **D the water changes to a pink colour**

(continued on the next page)

6 continued.

(b) Some damp litmus paper is placed in a gas.

The litmus paper is bleached.

**Which gas bleaches damp litmus paper?
(1 mark)**

☐ **A carbon dioxide**

☐ **B chlorine**

☐ **C hydrogen**

☐ **D oxygen**

(continued on the next page)

Turn over

6 continued.

(c) When calcium carbonate is heated it decomposes.



When 5.000 g of calcium carbonate is heated, the mass of solid remaining is 2.800 g.

Calculate the mass of carbon dioxide that has been released.

**Give your answer to three significant figures.
(2 marks)**

mass of carbon dioxide =

_____ g

(continued on the next page)

Turn over

6 continued.

(d) Look at Figure 9 for Question 6(d) in the Diagram Booklet. It shows a diagram of an atom of helium.

**(i) Explain, using Figure 9, why helium is inert.
(2 marks)**

(continued on the next page)

Turn over

6 continued.

(ii) Helium is used to fill balloons.

**State one property of helium,
apart from it being inert,
that makes it suitable for
filling balloons.
(1 mark)**

(continued on the next page)

6 continued.

***(e) Look at Figure 10 for Question 6(e) in the Diagram Booklet. It shows the relative amounts of three gases in the early atmosphere compared to the composition of today's atmosphere.**

Natural processes and human activities have altered the relative amounts of these gases in the atmosphere.

**Explain how the relative amount of each of the gases in Figure 10 has increased or decreased over time.
(6 marks)**

(continued on the next page)

Turn over

6 continued.

(continued on the next page)

6 continued.

(continued on the next page)

Turn over

6 continued.

(continued on the next page)

6 continued.

(continued on the next page)

Turn over

6 continued.

(continued on the next page)

6 continued.

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS
END OF PAPER