

Write your name here

Surname

Other names

Centre Number

Candidate Number

Pearson Edexcel

Level 1/Level 2 GCSE (9–1)

Combined Science

Paper 4: Chemistry 2

Foundation Tier

Sample Assessment Material for first teaching September 2016

Time: 1 hour 10 minutes

Paper Reference

1SC0/2CF

You must have:

Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *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**.

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.

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.

Turn over ►

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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 The Earth's early atmosphere was different from that of the Earth's atmosphere today.

(a) The Earth's early atmosphere was formed by

(1)

- ☐ A animals breathing.
- ☐ B global warming.
- ☐ C plants growing.
- ☐ D volcanic activity.

(b) Figure 1 shows some data about the composition of gases present in the Earth's early atmosphere and today's atmosphere.

| gas | composition (%) | |
|----------------|--------------------------|--------------------|
| | Earth's early atmosphere | today's atmosphere |
| nitrogen | 4 | 78 |
| oxygen | <0.01 | 21 |
| argon | <0.01 | 0.9 |
| gas X | 95 | 0.04 |
| ammonia | 0.5 | <0.001 |
| sulfur dioxide | 0.5 | <0.001 |

Figure 1

Explain, using the data, the identity of gas X.

(2)

.....

.....

.....

.....

- (c) Figure 2 shows the concentration of carbon dioxide in the atmosphere above Hawaii from 1960 to 2010.

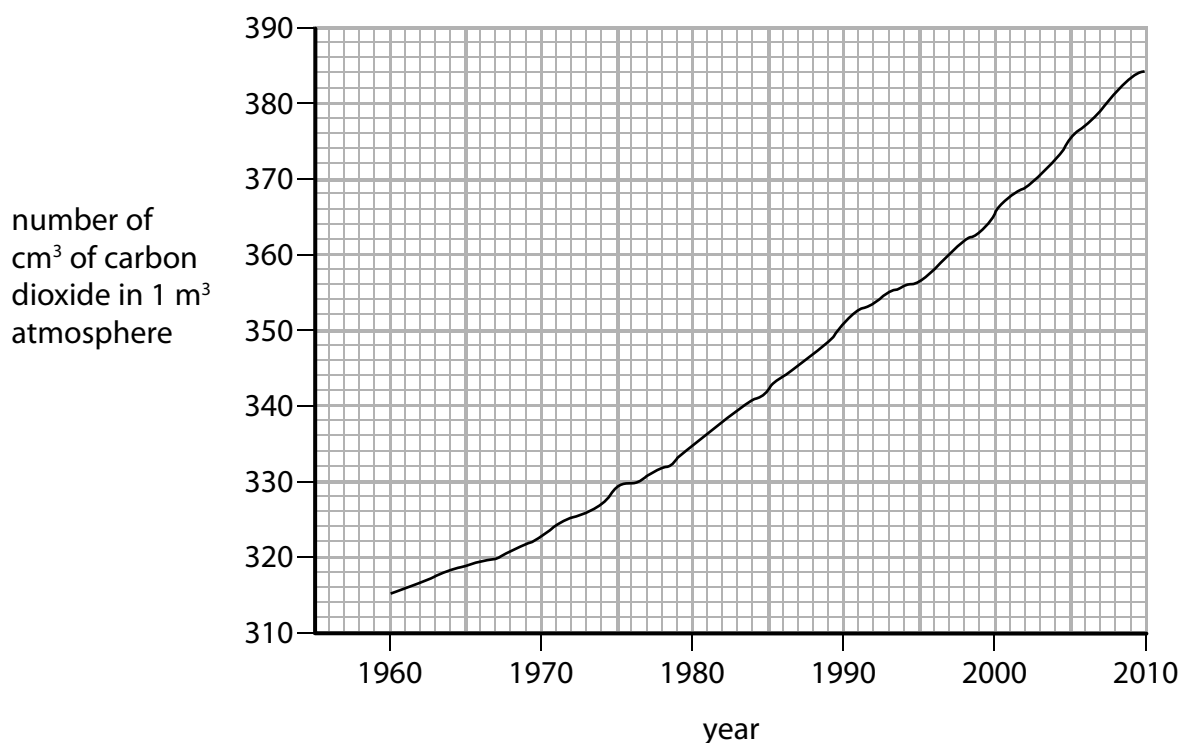


Figure 2

- (i) Use the graph to calculate the increase in the volume of carbon dioxide in 1 m³ of atmosphere from 1960 to 2010.

(2)

increase in volume of carbon dioxide =cm³

- (ii) Describe how carbon dioxide is released into today's atmosphere.

(2)

(Total for Question 1 = 7 marks)

- | | | | | | | | | | | | | | | | | | | | | | |
|----|----|--|--|--|--|--|--|--|--|---|--|----|----|---|---|----|----|--|--|--|----|
| | | | | | | | | | | H | | | | | | | | | | | He |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne | | | | |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar | | | | |
| K | Ca | | | | | | | | | | | | | | | | | | | | |

(i) From the position of beryllium, Be, in the periodic table, beryllium is most likely to be a

☐ **A** metal

☐ **B** halogen

☐ **C** compound

☐ **D** gas at room temperature

- (ii) Give the symbol of the element that is in period 2 and in group 3.

(1)

- (iii) State the number of electron shells in an atom of potassium, K.

(1)

- (b) Figure 4 shows information about some of the elements in group 7 of the periodic table.

| element | melting point/°C | boiling point/°C |
|----------|------------------|------------------|
| fluorine | –220 | –188 |
| chlorine | –101 | –35 |
| bromine | 7 | 59 |
| iodine | 114 | 184 |

Figure 4

Astatine is below iodine in group 7 of the periodic table.

Estimate the boiling point of astatine.

(1)

boiling point of astatine =°C

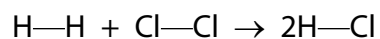
- (c) Chlorine reacts with potassium iodide to form iodine and potassium chloride.

Complete the word equation for the reaction between bromine and potassium astatide.

(2)

bromine + potassium astatide → +

(d) Hydrogen reacts with chlorine to form hydrogen chloride.



The symbol — is used to show a covalent bond.

The electronic configuration of hydrogen is 1.

The electronic configuration of chlorine is 2.8.7.

Draw the dot-and-cross diagram for the molecule of hydrogen chloride.
Show outer electrons only.

(2)

(Total for Question 2 = 8 marks)

- 3 (a) When a solid amount of ammonium chloride is shaken with water, a colourless solution forms and the temperature changes from 20 °C to 16 °C.

Give the name of the type of heat change occurring.

(1)

- (b) A student carries out an experiment to measure accurately the temperature changes when different metals are added to iron(II) sulfate solution.

The method for the experiment is:

- measure 25 cm³ of iron(II) sulfate solution and pour into a container
- record the initial temperature of the solution
- add excess magnesium ribbon
- record the highest temperature of the mixture
- repeat the experiment using excess copper turnings, then using excess zinc foil.

- (i) State a suitable container for the iron(II) sulfate solution in this experiment.

(1)

- (ii) State what the student should do to the mixtures during the experiment.

(1)

(iii) Figure 5 shows the results obtained by the student.

| metal added to iron(II) sulfate solution | temperature rise/°C |
|--|---------------------|
| magnesium | 6.0 |
| copper | 0.0 |
| zinc | 2.8 |

Figure 5

Use the results to explain the order of reactivity of the metals magnesium, copper and zinc.

(2)

(iv) Explain how the student could improve the method to make a fairer comparison of the temperature change produced by the different metals.

(2)

(v) The iron(II) sulfate solution contained 6.2 g of iron(II) sulfate in 50 cm³ of solution.

Calculate the concentration of the iron(II) sulfate solution in g dm⁻³.

(2)

concentration = g dm⁻³

(Total for Question 3 = 9 marks)

- 4 A student used the equipment in Figure 6 to investigate the rate of reaction between zinc and excess dilute hydrochloric acid.

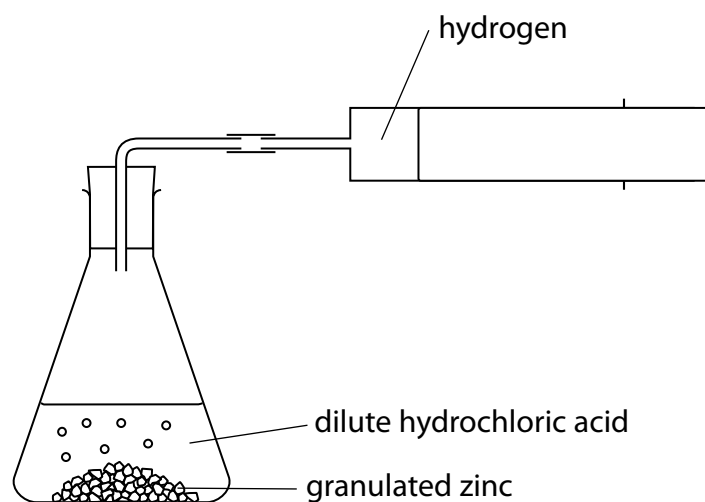


Figure 6

The student uses the following method:

- place a known mass of granulated zinc into the conical flask
- pour 25 cm³ of dilute hydrochloric acid (an excess) into the conical flask and fit the bung quickly into the neck of the flask
- measure the volume of gas produced every 20 seconds until after the reaction finishes.

Figure 7 shows the results.

| time/s | volume of hydrogen/cm ³ |
|--------|------------------------------------|
| 0 | 0 |
| 20 | 42 |
| 40 | 66 |
| 60 | 75 |
| 80 | 80 |
| 100 | 82 |
| 120 | 82 |
| 140 | 82 |

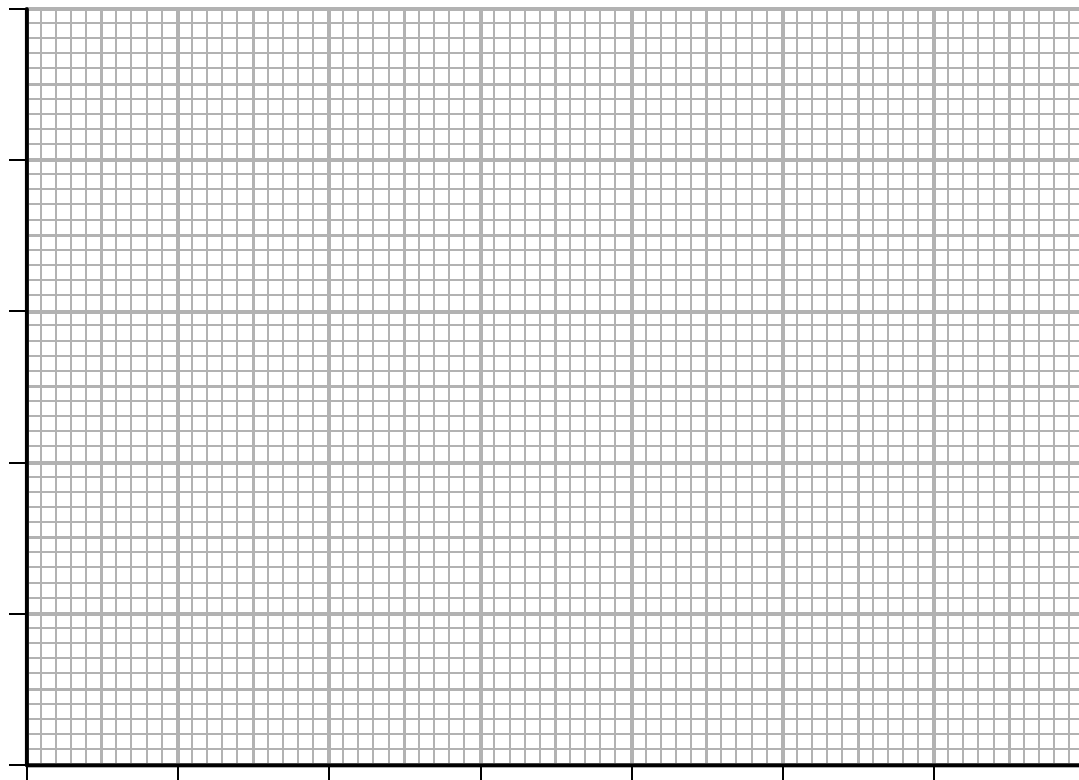
Figure 7

- (a) Give the name of a piece of equipment that can be used to measure 25 cm^3 of dilute hydrochloric acid accurately.

(1)

- (b) Draw a graph of the volume of hydrogen gas produced against time using the grid.

(3)



- (c) The average rate of reaction in the first 20 seconds in cm^3 of hydrogen produced per second is

(1)

- ☐ **A** 2.1
☐ **B** 8.4
☐ **C** 21
☐ **D** 84

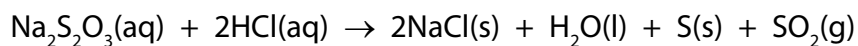
- (d) The student repeated the experiment keeping all conditions the same but using the same mass of powdered zinc instead of granulated zinc.

On the grid above sketch the graph you would expect when the experiment is repeated using powdered zinc.

Label your line **A**.

(2)

- (e) Sodium thiosulfate solution, $\text{Na}_2\text{S}_2\text{O}_3$, reacts with dilute hydrochloric acid as shown in the equation.



The rate of this reaction can be investigated by mixing the reactants and finding the time taken for a precipitate of sulfur to become visible.

A student wants to investigate the effect of changing the temperature on the rate of this reaction.

Devise a method the student could use to find out how the time taken for the precipitate of sulfur to become visible changes with temperature.

(3)

(Total for Question 4 = 10 marks)

5 This question is about some of the elements in groups 1 and 2 of the periodic table.

- (a) The atomic number of lithium is 3.
The mass number of a lithium atom is 7.

Which row of the table shows the number of protons, neutrons and electrons in an atom of lithium-7?

(1)

| | number of protons | number of neutrons | number of electrons |
|----------------------------|----------------------|-----------------------|------------------------|
| <input type="checkbox"/> A | 3 | 3 | 4 |
| <input type="checkbox"/> B | 3 | 4 | 3 |
| <input type="checkbox"/> C | 4 | 3 | 7 |
| <input type="checkbox"/> D | 7 | 4 | 3 |

- (b) Lithium, sodium and potassium are in group 1 of the periodic table.

State, in terms of the electrons in their atoms, what the atoms of lithium, sodium and potassium have in common.

(1)

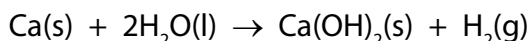
- (c) Magnesium has atomic number 12.
Magnesium exists as magnesium-24, magnesium-25 and magnesium-26 atoms.

Explain, in terms of protons and neutrons, why these atoms are isotopes of magnesium.

(2)

- (d) Magnesium and calcium are in group 2 of the periodic table. They are less reactive than the metals in group 1.

Calcium reacts with water to form calcium hydroxide, Ca(OH)_2 , and hydrogen, H_2 .



Describe what would be **seen** when a piece of calcium is dropped into a container of water.

(2)

- (e) Magnesium reacts very slowly with cold water but it reacts faster with steam, H_2O , to form magnesium oxide, MgO , and hydrogen.

Write the balanced equation for the reaction between magnesium and steam.

(2)

- (f) The electronic configurations of magnesium and calcium are

magnesium 2.8.2
calcium 2.8.8.2

When magnesium and calcium react with water they form positive ions.

Suggest an explanation, in terms of their electronic configurations, why calcium is more reactive than magnesium.

(2)

(g) A sample of calcium bromide contains 0.2 g calcium and 0.8 g bromine by mass.

Calculate the empirical formula of calcium bromide.

(relative atomic masses: Ca = 40, Br = 80)

(3)

empirical formula =

(Total for Question 5 = 13 marks)

6 Crude oil is a mixture of hydrocarbons.

It can be separated into fractions.

- (a) Which of these mixtures shows formulae of substances that could be in the gaseous fraction of crude oil?

(1)

- ☐ **A** C_2H_4 , C_3H_8 , $C_4H_{10}O$
- ☐ **B** C_2H_4 , C_3H_7Br , C_4H_{10}
- ☐ **C** C_2H_6 , C_3H_8 , C_4H_{10}
- ☐ **D** C_2H_6 , C_3H_7Br , $C_4H_{10}O$

- (b) Figure 8 shows the percentages of the fractions in crude oil from three different oil wells.

| fraction | percentage of fraction in crude oil from | | |
|------------|--|------------|------------|
| | oil well A | oil well B | oil well C |
| gases | 1 | 6 | 9 |
| petrol | 2 | 15 | 24 |
| kerosene | 6 | 14 | 20 |
| diesel oil | 7 | 10 | 16 |
| fuel oil | 26 | 28 | 30 |
| bitumen | 58 | 27 | 1 |

Figure 8

- (i) State which oil well produces a crude oil containing the highest percentage of the high boiling point fractions.

(1)

- (ii) A barrel of crude oil from oil well B weighs 130 kg.

Calculate the mass of kerosene in this barrel.

(1)

..... kg

*(c) Diesel is the fuel used in most bus engines.

Research is being carried out into the use of hydrogen, instead of diesel, as a fuel for buses.

Discuss the advantages and disadvantages of using hydrogen, rather than diesel, as a fuel for buses.

(6)

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(d) Fractions of crude oil contain alkanes.

A sample of decane, $C_{10}H_{22}$, was cracked using the apparatus in Figure 9.

This produced a mixture of products, including ethene.

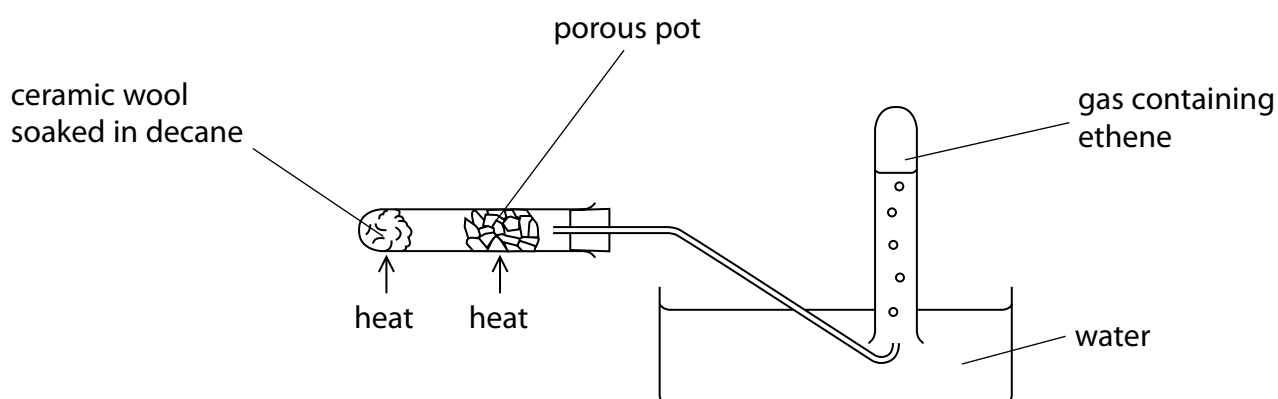
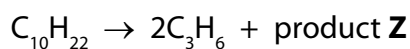


Figure 9

(i) Explain how ethene is produced using the apparatus in Figure 9.

(3)

(ii) One molecule of decane produced two molecules of propene, C_3H_6 , and one molecule of product **Z**.



What is the formula of product **Z**?

(1)

- ☐ **A** C_4H_8
- ☐ **B** C_4H_{10}
- ☐ **C** C_7H_{14}
- ☐ **D** C_7H_{16}

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS