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| Candidate surname | | | | | Other names | | | | |
| Centre Number | | | | | Candidate Number | | | | |
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Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Time 1 hour 10 minutes **Paper reference** **1SC0/2CH**

Combined Science
PAPER 5
Higher Tier

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.
- There is a periodic table on the back cover of the paper.

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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Q:1/1/

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 A student used the apparatus in Figure 1 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.

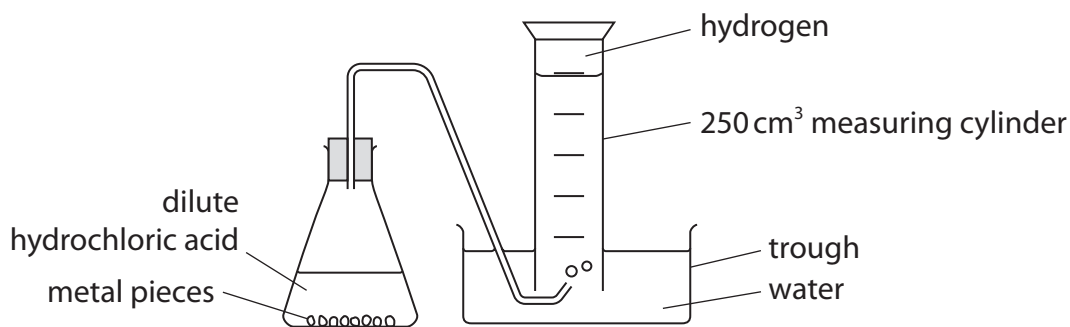


Figure 1

- (a) Figure 2 shows a graph of the student's results.

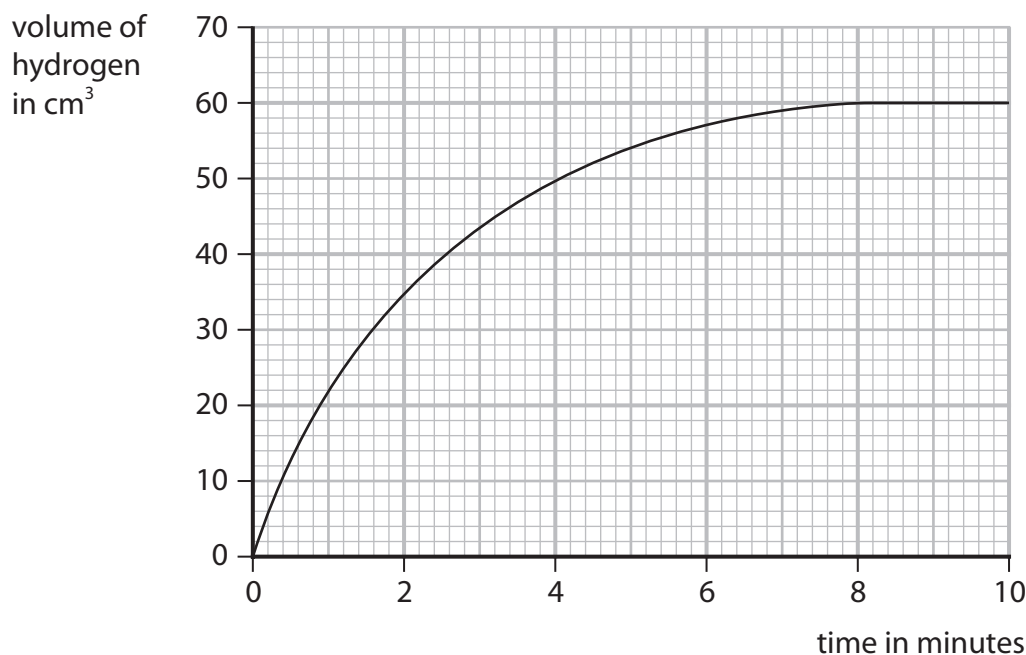


Figure 2

- (i) Name a piece of apparatus that would be better to measure the volume of gas produced, instead of the 250 cm^3 measuring cylinder.

Give a reason for your answer.

(2)

name of apparatus

reason

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

(3)

rate = cm^3 per second

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

State why the measurements could have been stopped at 9 minutes.

(1)

- (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)

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

Which one is correct?

(1)

- ☐ **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

(Total for Question 1 = 9 marks)

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2 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)

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

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

Which gas bleaches damp litmus paper?

(1)

- ☐ **A** carbon dioxide
- ☐ **B** chlorine
- ☐ **C** hydrogen
- ☐ **D** oxygen

(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)

mass of carbon dioxide = g

(d) A diagram of an atom of helium is shown in Figure 3.

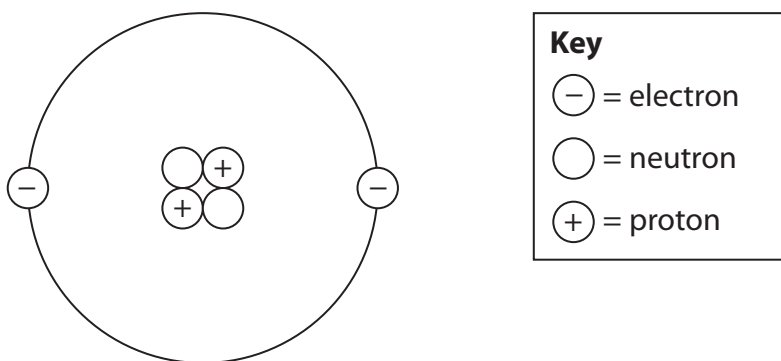


Figure 3

(i) Explain, using Figure 3, why helium is inert.

(2)

(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)

(e) Oxygen gas has the formula O_2 .

Calculate the number of oxygen **atoms** in 3.50 mol of oxygen gas.

(Avogadro constant = 6.02×10^{23})

(2)

number of oxygen atoms =

(Total for Question 2 = 9 marks)

- 3 (a) Figure 4 shows some information about the composition of pollutant exhaust gases from the engines of two different vehicles.

| pollutant | mass of pollutant given out in g per kilometre driven | |
|----------------------|--|---------------|
| | petrol engine | diesel engine |
| carbon dioxide | 210 | 180 |
| carbon monoxide | 1.5 | 0.10 |
| unburnt hydrocarbons | 0.13 | 0.020 |
| nitrogen oxides | 0.36 | 2.0 |
| particulates | 0.0060 | 0.046 |
| sulfur dioxide | 0.0089 | 0.0037 |

Figure 4

- (i) Give **two** ways in which the data in Figure 4 shows that the diesel engine is **more** damaging to the environment than the petrol engine. (2)
- (ii) Explain, using information from Figure 4, **one** way in which the diesel engine is **less** damaging to the environment than the petrol engine. (2)

(b) (i) Which statement about the members of the alkane homologous series is correct?

(1)

- ☐ **A** they show a trend in chemical properties
- ☐ **B** their boiling point decreases as the molecules get larger
- ☐ **C** the molecular formula of neighbouring compounds differs by CH_3
- ☐ **D** their viscosity increases as the molecules get larger

(ii) Which one of the following hydrocarbons belongs to the same homologous series as octane, C_8H_{18} ?

(1)

- ☐ **A** C_4H_6
- ☐ **B** C_4H_8
- ☐ **C** C_4H_{10}
- ☐ **D** C_4H_{12}

(iii) Write the balanced equation for the complete combustion of octane, C_8H_{18} .

(3)

(Total for Question 3 = 9 marks)

4 The elements in group 7 of the periodic table are known as the halogens.

(a) Name the halogen that is in period 4 of the periodic table.

(1)

(b) Explain why chlorine is more reactive than iodine.

(3)

(c) A piece of burning sodium is placed into a gas jar containing chlorine gas, as shown in Figure 5.

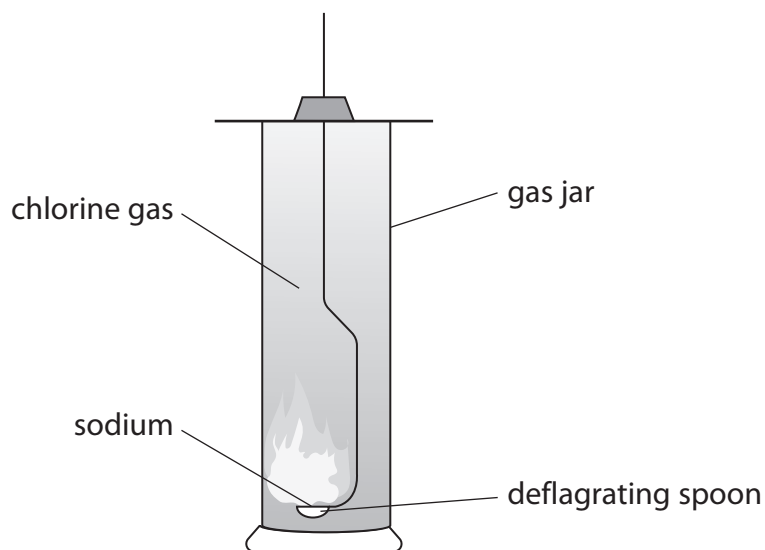


Figure 5

At the end of the reaction, the inside of the gas jar is coated with white crystals. Identify the white crystals.

(1)

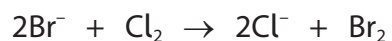
(d) Sodium also reacts with bromine.

(i) Write the balanced equation for the reaction between sodium and bromine. (2)

(ii) In another experiment, a student adds colourless sodium bromide solution to chlorine water.

State what you would **see** in this reaction. (1)

(iii) The ionic equation for the reaction between sodium bromide and chlorine is:



Explain which species has been oxidised in this reaction. (2)

(Total for Question 4 = 10 marks)

5 This question is about oxygen.

- (a) The percentage of oxygen in today's atmosphere is greater than the percentage of oxygen in the Earth's early atmosphere.

Explain what caused this change to happen.

(2)

- (b) Magnesium reacts with oxygen from the air to form magnesium oxide.

A student carries out an investigation to determine the mass of magnesium oxide formed when a known mass of magnesium reacts completely with oxygen.

This is the method the student used.

- step 1** find the mass of a crucible and lid
- step 2** put a known mass of magnesium into the crucible and put the lid on
- step 3** heat for five minutes using a roaring Bunsen burner flame
- step 4** let the crucible, lid and contents cool down
- step 5** find the final mass of the crucible, lid and contents

Explain how the student could check that the magnesium had reacted completely with oxygen.

(2)

- (c) In another experiment, it was found that 1.24 g of phosphorus reacted completely with 1.60 g of oxygen to form phosphorus oxide.

The relative formula mass of this phosphorus oxide is 284.

Deduce the molecular formula of this phosphorus oxide.

You must show your working.

(relative atomic masses: O = 16, P = 31)

(4)

molecular formula =

- (d) A student uses the apparatus shown in Figure 6 to investigate the percentage of oxygen in the atmosphere.

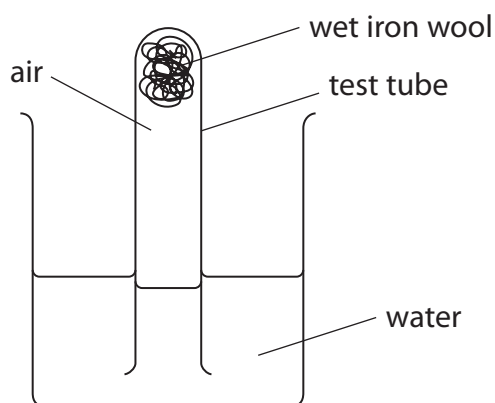


Figure 6

The apparatus was left for a few days.

- (i) Explain one change the student would see after a few days. (2)
- (ii) Explain one change that can be made to the apparatus in Figure 6 to allow the student to calculate the percentage of oxygen in the atmosphere. (2)

(Total for Question 5 = 12 marks)

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- 6 (a) In some chemical reactions, bonds are broken in the reactant molecules and new bonds are formed to make the product molecules.

(i) Which row is correct about the energy changes for these processes?

(1)

| | | energy change | |
|--------------------------|---|--------------------|--------------------|
| | | breaking a bond | making a bond |
| <input type="checkbox"/> | A | energy is released | energy is released |
| <input type="checkbox"/> | B | energy is released | energy is absorbed |
| <input type="checkbox"/> | C | energy is absorbed | energy is released |
| <input type="checkbox"/> | D | energy is absorbed | energy is absorbed |

(ii) Hydrogen reacts with fluorine.

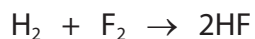


Figure 7 shows the bond energies for the bonds in the three molecules in the equation.

| bond | bond energy in kJ mol^{-1} |
|------|-------------------------------------|
| H—H | 436 |
| F—F | 158 |
| H—F | 562 |

Figure 7

Calculate the energy change for this reaction.

(4)

energy change = kJ mol⁻¹

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*(b) The reaction profile for an uncatalysed exothermic reaction is shown in Figure 8.

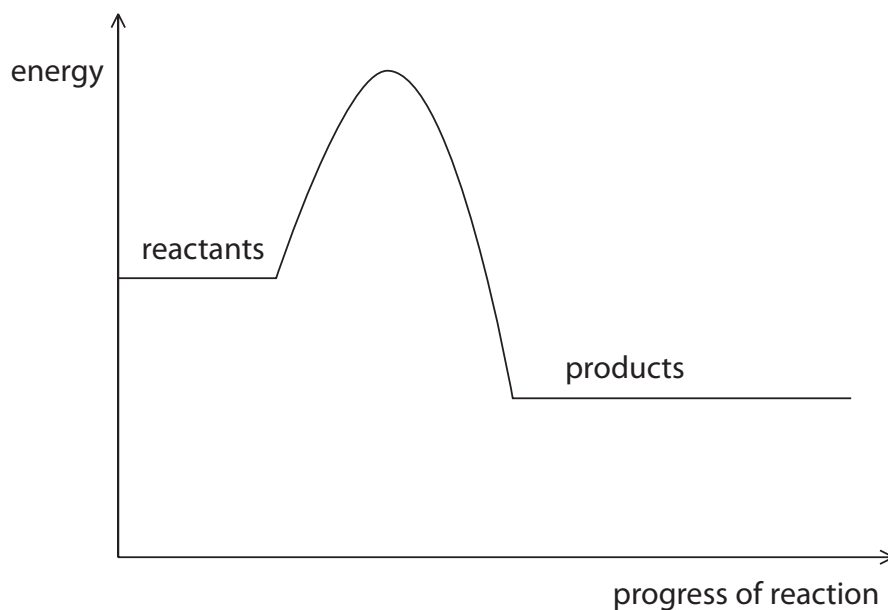


Figure 8

Using some examples of catalysts you have met in chemistry, discuss what catalysts do and their effect on the activation energy of a reaction.

You can use Figure 8 to illustrate your answer.

(6)

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(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

[illegible]

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