

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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## Pearson Edexcel International GCSE (9–1)

**Tuesday 13 June 2023**

Morning (Time: 1 hour 10 minutes)

Paper  
reference

**4SS0/1C**

### Science (Single Award)

**Chemistry  
PAPER: 1C**

**You must have:**  
Calculator, ruler

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **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.

### 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.*

### Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Pearson



# The Periodic Table of the Elements

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Elements with atomic numbers 112–116 have been reported but not fully authenticated

\* The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.

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

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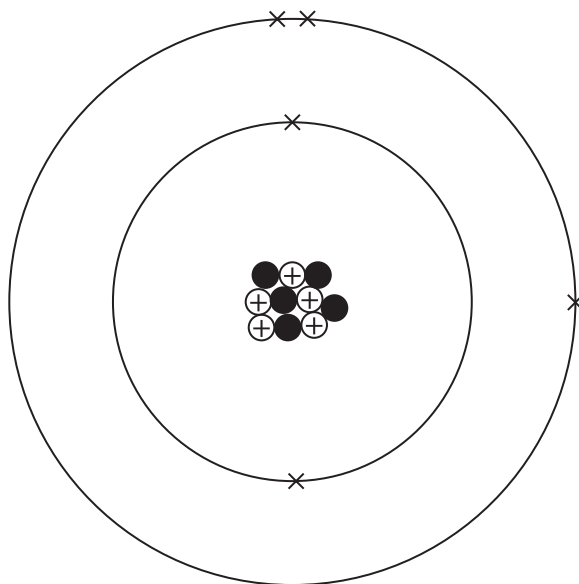


Answer ALL questions.

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 element boron, B.

(a) The diagram represents an atom of boron.



(i) Give the name of the central part of the atom.

(1)

(ii) Give the period number and group number of boron in the Periodic Table.

(2)

period number

group number

(iii) Give the number of electrons in a  $B^{3+}$  ion.

(1)

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(b) There are two common isotopes of boron.



In terms of sub-atomic particles, give one similarity and one difference between these isotopes.

(2)

similarity

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.....

difference

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**(Total for Question 1 = 6 marks)**

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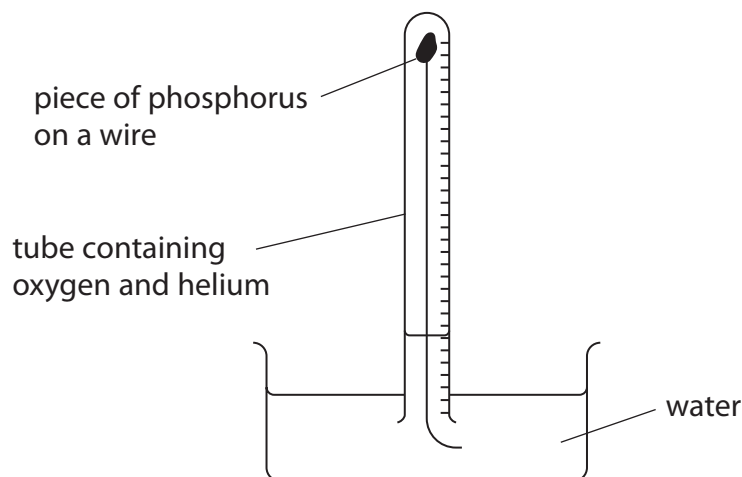
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- 2 A teacher wants to determine the percentage by volume of oxygen in a mixture of oxygen and helium.

Helium is an unreactive gas.

The teacher uses this apparatus and an excess of phosphorus.



The volume of gas in the tube decreases as the phosphorus reacts with oxygen.

The teacher measures the volume of gas in the tube at five-minute intervals.

The table shows the teacher's results.

Time in minutes	Volume of gas in $\text{cm}^3$
0	51.7
5	48.2
10	46.9
15	45.4
20	43.8
25	43.8
30	43.8

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(a) State how the results show that all the oxygen has reacted.

(1)

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.....

(b) Use the results to calculate the percentage of oxygen by volume in the mixture of oxygen and helium.

Give your answer to 1 decimal place.

(3)

percentage = ..... %

(c) An oxide of phosphorus has the formula  $P_4O_6$

Calculate the relative formula mass ( $M_r$ ) of  $P_4O_6$

[for phosphorus,  $A_r = 31$  for oxygen,  $A_r = 16$ ]

(1)

$M_r =$  .....

**(Total for Question 2 = 5 marks)**



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3 This question is about mixtures and compounds.

(a) The table shows some methods used in the separation of mixtures.

Place one tick (✓) in each row to show the best method for each separation.

(2)

Separation	Method			
	Crystallisation	Filtration	Fractional distillation	Simple distillation
kerosene from crude oil				
water from potassium nitrate solution				

(b) Rock salt is a mixture of sand and salt.

Salt is soluble in water.

Describe a method to separate the sand and the salt from a sample of rock salt.

(3)

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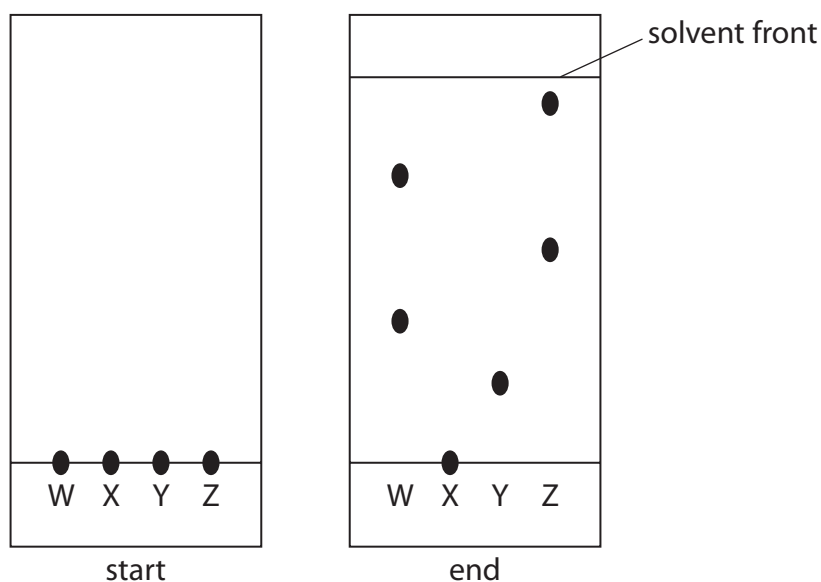
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- (c) A student uses paper chromatography to separate the dyes contained in food colourings.

The student places spots of four known food colourings, W, X, Y and Z, on the chromatography paper.

The diagram shows the chromatography paper at the start and at the end of the experiment.



- (i) Describe how the student should complete the experiment after placing the four spots on the paper.

(3)

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(ii) Describe how the student could determine the  $R_f$  value for food dye Y.

Do not include any calculations.

(2)

(iii) Give a reason why food colouring X does not move during the experiment.

(1)

(d) A compound has the formula  $Al_2(SO_4)_3$

(i) How many different elements are in  $Al_2(SO_4)_3$ ?

(1)

A 3

B 4

C 5

D 9

(ii) How many atoms are in the formula  $Al_2(SO_4)_3$ ?

(1)

A 3

B 10

C 17

D 21

(Total for Question 3 = 13 marks)

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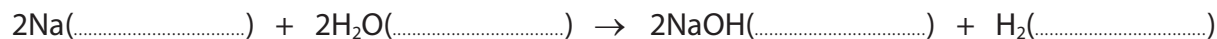
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4 This question is about Group 1 metals.

- (a) (i) Complete the equation for the reaction between sodium and water by adding the state symbols.

(2)



- (ii) Give two observations that would be made when a small piece of sodium is added to a large trough containing water.

(2)

1 .....

.....

2 .....

.....

- (iii) At the end of the reaction, a few drops of red litmus indicator are added to the trough.

Explain the final colour of the indicator.

(2)

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- (b) A small piece of a different Group 1 metal is added to water. The reaction is faster than the reaction of sodium with water, and a lilac flame is seen.

Identify this Group 1 metal.

(1)

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**(Total for Question 4 = 7 marks)**



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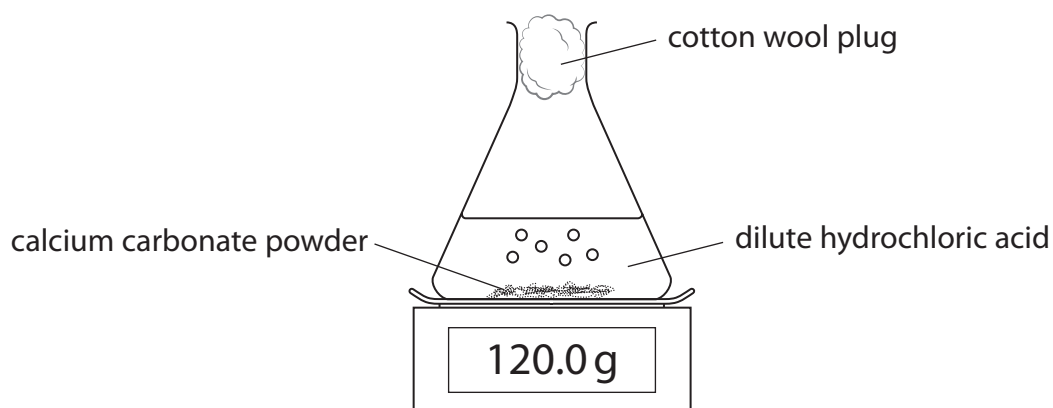
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P 7 2 5 9 1 A 0 1 3 2 0

- 5 A student uses this apparatus to investigate the rate of reaction between calcium carbonate powder and an excess of dilute hydrochloric acid.

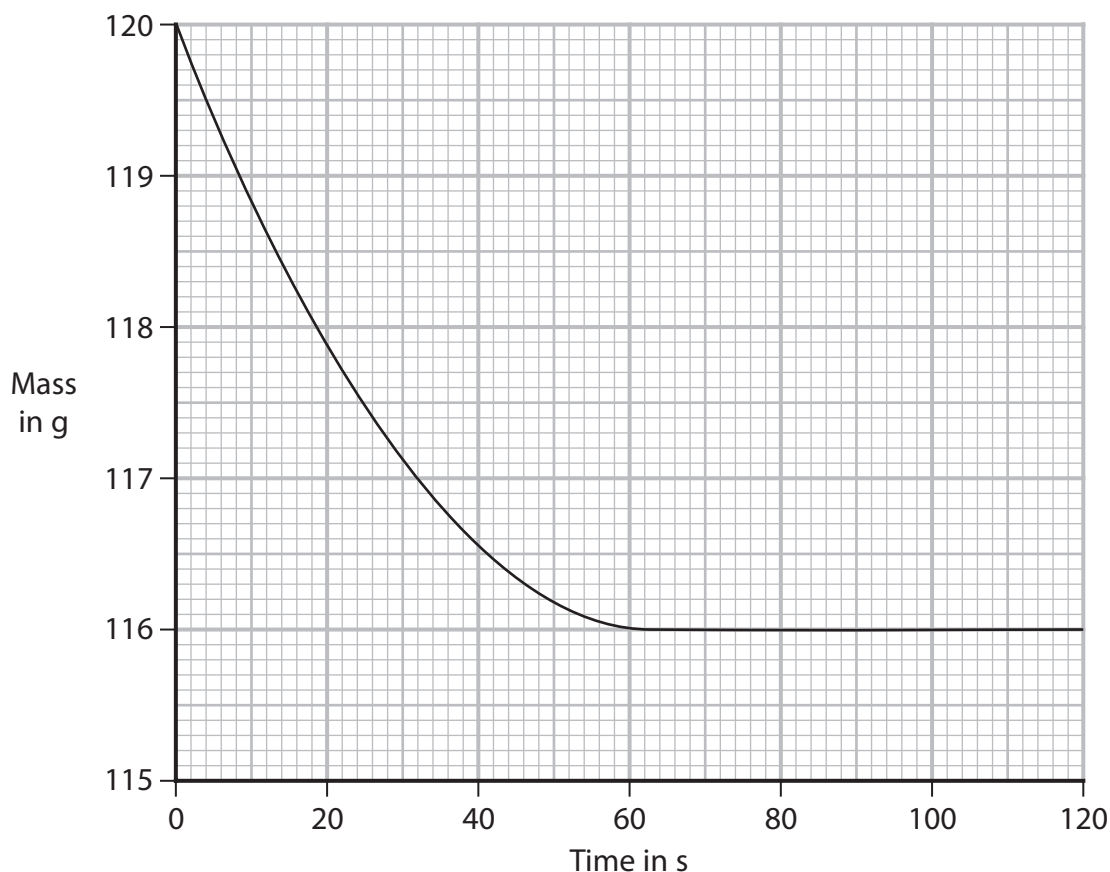


This is the equation for the reaction.



The student records the mass of the flask and its contents every 20 seconds for two minutes.

The graph shows the student's results.



- (a) (i) Give a reason why using a cotton wool plug makes the results more accurate. (1)



(ii) Give a reason why the reaction stops.

(1)

.....

.....

(b) The student repeats the experiment using the same mass of calcium carbonate, but uses lumps instead of powder.

The rate of reaction decreases.

(i) Describe how the curve on the graph would change when lumps of calcium carbonate are used.

(2)

.....

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(ii) Give a reason why the rate of reaction decreases when lumps of calcium carbonate are used.

(1)

.....

.....

(c) The mean rate of reaction can be determined using this formula.

$$\text{mean rate of reaction} = \frac{\text{mass lost}}{\text{time taken to lose this mass}}$$

Determine the mean rate of reaction during the first 10 seconds.

Give the unit.

(3)

mean rate of reaction = ..... unit .....

**(Total for Question 5 = 8 marks)**

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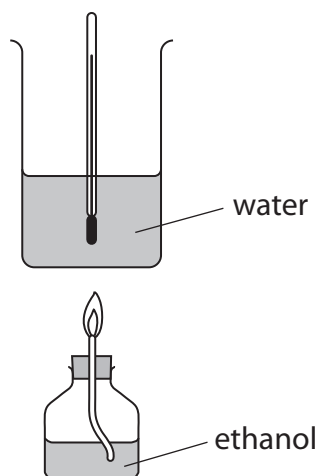
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P 7 2 5 9 1 A 0 1 5 2 0

6 This question is about fuels.

- (a) A scientist uses this apparatus to find the heat energy change when ethanol ( $C_2H_5OH$ ) is burned.



- (i) These are the scientist's results.

mass of water	150 g
temperature of water at the start	21.5 °C
maximum temperature of water	62.7 °C

Calculate the heat energy change, in joules.

[for water,  $c = 4.2 \text{ J/g/}^\circ\text{C}$ ]

(3)

heat energy change = ..... J

- (ii) Give one reason why the apparatus produces an inaccurate value for the heat energy change.

(1)

.....

.....





(b) Octane (C<sub>8</sub>H<sub>18</sub>) is another fuel.

(i) Identify a toxic gas produced by the incomplete combustion of octane. (1)

(ii) Identify a black solid produced by the incomplete combustion of octane. (1)

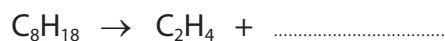
(c) Petrol contains octane.

Describe one way that the combustion of petrol causes acid rain.

Do not refer to carbon dioxide in your answer. (3)

(d) When heated in the absence of air, octane can decompose to form ethene and one other product.

(i) Complete the equation for this decomposition of octane. (1)



(ii) Poly(ethene) is produced from ethene.  
Give the repeat unit of poly(ethene). (1)

(Total for Question 6 = 11 marks)



7 Silicon chloride and silicon dioxide have different structures, but both contain covalent bonds.

(a) (i) State what is meant by the term **covalent bond**.

(2)

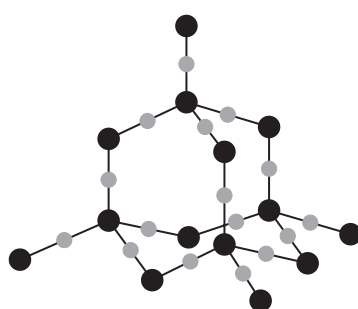
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(ii) Diagram 1 shows the structure of silicon dioxide.



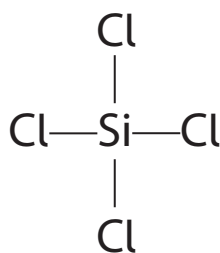
**Key**

● silicon atom

● oxygen atom

**Diagram 1**

Diagram 2 shows a molecule of silicon chloride.



**Diagram 2**



Explain why silicon dioxide has a higher melting point than silicon chloride.

Refer to structure and bonding in your answer.

(5)

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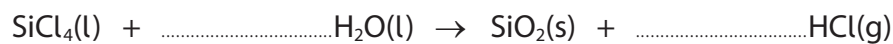
**QUESTION 7 CONTINUES ON NEXT PAGE**



(b) Silicon chloride reacts with water, producing silicon dioxide and hydrogen chloride.

- (i) Complete the chemical equation for the reaction between silicon chloride and water.

(1)



- (ii) Hydrogen chloride gas dissolves in water to produce an acidic solution.

Describe a test, other than using an indicator, to show that the solution is acidic.

(2)

.....

.....

.....

.....

**(Total for Question 7 = 10 marks)**

**TOTAL FOR PAPER = 60 MARKS**

