

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel**  
**International GCSE (9–1)**

Centre Number

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Candidate Number

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Sample Assessment Materials for first teaching September 2017

(Time: 2 hours)

Paper Reference **4CH1/1C 4SD0/1C**

**Chemistry**

**Unit: 4CH1**

**Science (Double Award) 4SD0**

**Paper: 1C**

**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.
- 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 ☒.

### Information

- The total mark for this paper is 110.
- 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.
- 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

[illegible]

\* 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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S 6 0 1 0 6 A 0 3 3 2

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

- 1** New elements can be made by scientists.

One new element has recently been given the name nihonium.

- (a) The atomic number of nihonium is 113

What does this indicate about nihonium?

(1)

- ☐ **A** a nihonium atom has 113 protons
- ☐ **B** a nihonium atom has 113 neutrons
- ☐ **C** nihonium has a relative atomic mass of 113
- ☐ **D** nihonium is a non-metal

- (b) Nihonium has been placed in Group 3 of the Periodic Table.

It has been given the symbol Nh

- (i) State the number of electrons in the outer shell of a nihonium atom.

(1)

- (ii) State why nihonium has been given the symbol Nh, and not N or Ni

(1)

- (c) Nihonium has many isotopes.

One of these isotopes is  $^{286}\text{Nh}$

- (i) State what is meant by the term **isotopes**.

(2)



(ii) How many neutrons are there in an atom of  $^{286}\text{Nh}$ ?

(1)

- ☐ A 113
- ☐ B 173
- ☐ C 286
- ☐ D 399

(d) Gallium is another element in Group 3. It has two isotopes,  $^{69}\text{Ga}$  and  $^{71}\text{Ga}$

A sample of gallium contains 60.1%  $^{69}\text{Ga}$  and 39.9%  $^{71}\text{Ga}$

Calculate the relative atomic mass of this sample of gallium, giving your answer to one decimal place.

(3)

relative atomic mass = .....

**(Total for Question 1 = 9 marks)**



2 The table shows some carbon compounds.

<p><b>P</b></p> <pre>       H   H             H — C — C — O — H                   H   H           </pre>	<p><b>Q</b></p> <pre>       H       CH<sub>3</sub>        \     /         C = C        /     \       H       H           </pre>
<p><b>R</b></p> <pre>       H         H — C — H               H           </pre>	<p><b>S</b></p> <pre>       H   H             H — C — C — H             H — C — C — H                   H   H           </pre>
<p><b>T</b></p> <pre>       H       H        \     /         C = C        /     \       H       H           </pre>	<p><b>U</b></p> <pre>       H   H   H   H   H                         H — C — C — C — C — C — H                               H   H   H   H   H           </pre>

(a) Which compound is **not** a hydrocarbon?

(1)

- ☒ **A** compound **P**
- ☒ **B** compound **Q**
- ☒ **C** compound **S**
- ☒ **D** compound **T**

(b) Give the empirical formula of compound **T**.

(1)



(c) What is the name of compound **U**?

(1)

- ☐ **A** propane
- ☐ **B** propene
- ☐ **C** pentane
- ☐ **D** pentene

(d) Compound **R** reacts with chlorine in the presence of ultraviolet radiation.

Draw the displayed formula of the organic compound made.

(1)

(e) The molecular formula of compound **S** is  $C_4H_8$

Student X states that compound **S** is an alkane.

Student Y states that compound **S** is an alkene.

Comment on each of the student's statements.

(4)

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(Total for Question 2 = 8 marks)



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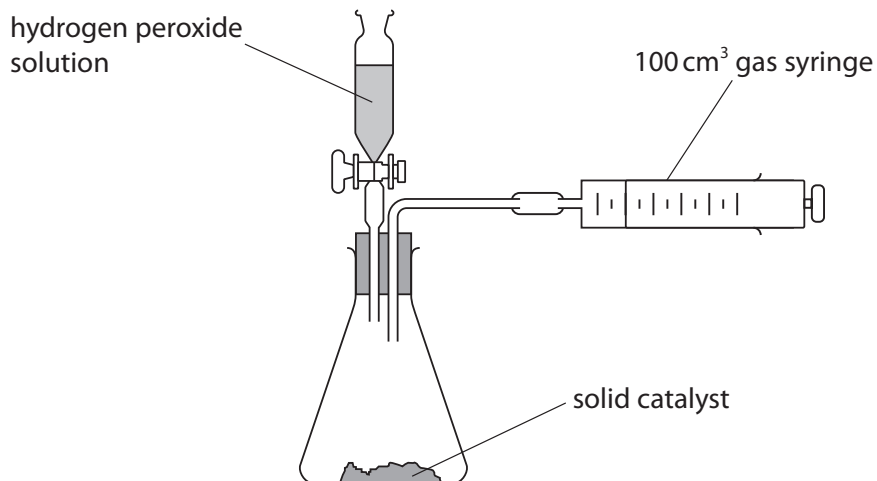
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3 Hydrogen peroxide,  $\text{H}_2\text{O}_2$ , is a solution that decomposes slowly.

A student uses this apparatus to investigate the rate of decomposition of hydrogen peroxide.



(a) Complete the chemical equation for the decomposition of hydrogen peroxide.

(1)



(b) This is the student's method.

- add  $10 \text{ cm}^3$  of hydrogen peroxide solution to the conical flask using the funnel
- measure the time it takes to collect  $20 \text{ cm}^3$  of oxygen
- repeat using  $10 \text{ cm}^3$  of hydrogen peroxide solution of different concentrations

State two variables that the student should control in his investigation.

(2)

1 .....

2 .....



S 6 0 1 0 6 A 0 9 3 2

- (c) The student makes the different concentrations of hydrogen peroxide solution by adding water.

The table shows some of the student's results.

Volume of hydrogen peroxide solution in $\text{cm}^3$	Volume of water added in $\text{cm}^3$	Time taken to collect $20 \text{ cm}^3$ of oxygen in s
10	0	15
8	2	19
6	4	26
4	6	
2	8	75

- (i) Explain why he does not do an experiment with  $0 \text{ cm}^3$  of hydrogen peroxide solution and  $10 \text{ cm}^3$  of water.

(2)

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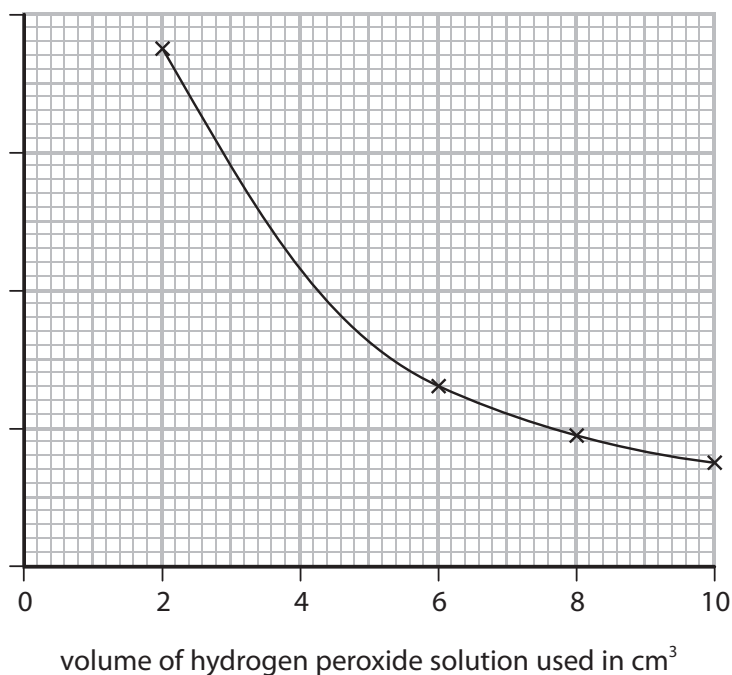
- (ii) Calculate the mean rate of oxygen production, in  $\text{cm}^3$  per second, for the reaction with  $6 \text{ cm}^3$  of hydrogen peroxide solution and  $4 \text{ cm}^3$  of water.

(2)

rate = .....  $\text{cm}^3$  per second



(iii) He uses his results to plot this graph.



Complete the graph by adding a scale and labelling the y-axis.

(2)

(iv) In the experiment using  $4 \text{ cm}^3$  of hydrogen peroxide solution and  $6 \text{ cm}^3$  of water, the student did not close the tap on the funnel after adding the solution.

Plot a point on the graph to show a possible result for this experiment.

(1)

(v) A solution containing  $5 \text{ cm}^3$  of hydrogen peroxide and  $5 \text{ cm}^3$  of water was decomposed.

Use the graph to determine the time taken to collect  $20 \text{ cm}^3$  of oxygen.

Show on the graph how you obtain your answer.

(2)

time = ..... s



S 6 0 1 0 6 A 0 1 1 3 2

(d) The original hydrogen peroxide solution was labelled as a 10 volume solution.

A 10 volume solution produces a volume of oxygen ten times greater than the volume of solution used.

Suggest what might happen if the student used more than  $10\text{ cm}^3$  of hydrogen peroxide solution in his first experiment.

(2)

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**(Total for Question 3 = 14 marks)**

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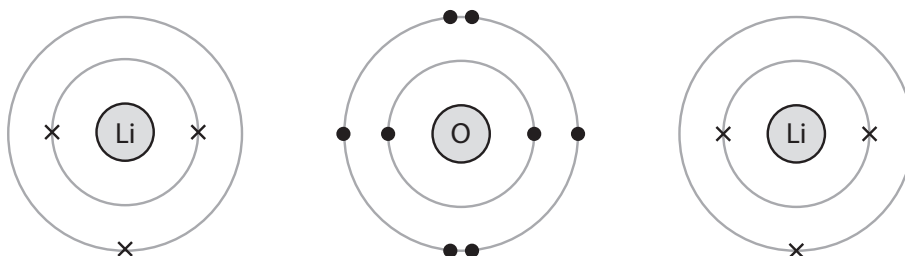


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4 The elements in Group 1 of the Periodic Table react with oxygen to form different oxides.

(a) Lithium reacts with oxygen to form lithium oxide,  $\text{Li}_2\text{O}$

The diagram shows the arrangement of the electrons in two lithium atoms and an oxygen atom.



Draw a dot-and-cross diagram to show the arrangement of the electrons in the ions in lithium oxide.

(3)

(b) 1.38 g of sodium is burned in oxygen. The product is an oxide of mass 2.34 g.

(i) Calculate the empirical formula of this oxide.

(3)

empirical formula = .....



- (ii) The oxide has a relative formula mass of 78

Determine the molecular formula of the oxide.

(1)

- (c) Potassium can react with oxygen to form potassium superoxide,  $\text{KO}_2$

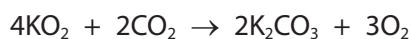
- (i) The equation shows the reaction of this oxide with water.



Complete the equation to show the missing product.

(1)

- (ii) Potassium superoxide reacts with carbon dioxide to produce potassium carbonate and oxygen.



5.5 million tonnes of carbon dioxide are released into the atmosphere each day as a by-product of the extraction of iron.

Calculate the mass, in tonnes, of potassium superoxide needed to react with this mass of carbon dioxide.

(3)

mass = ..... tonnes

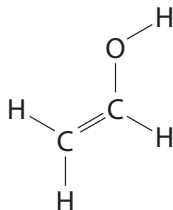
**(Total for Question 4 = 11 marks)**



S 6 0 1 0 6 A 0 1 5 3 2

- 5 Polyvinyl alcohol (PVA) is a polymer that can be used to make slime for special effects in films.

The monomer for PVA is commonly called vinyl alcohol.



- (a) The IUPAC names of all alcohols end with -ol.

What is the IUPAC name for vinyl alcohol?

(1)

- ☐ A ethanol  
☐ B ethenol  
☐ C propanol  
☐ D propenol

- (b) Explain the colour change observed when bromine water is added to a solution of vinyl alcohol.

(2)

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- (c) Draw the repeat unit of the PVA polymer.

(2)





(d) A typical molecule of PVA has a relative molecular mass of 27 500

Calculate the number of repeat units in this molecule of PVA.

(2)

(e) Pure PVA melts at a temperature of 200 °C.

State how the melting point of an impure sample of PVA would be different to that of a pure sample.

(1)

(Total for Question 5 = 8 marks)



S 6 0 1 0 6 A 0 1 7 3 2

- 6 *Ming fan* is used in Chinese medicine. It is a mixture of substances, including a compound called alum.

A student is told that alum is also known as potassium aluminium sulfate.

She does three tests on a sample of *ming fan* to show that it contains potassium ions, aluminium ions and sulfate ions.

- (a) The first test is a flame test.

What colour flame is produced?

(1)

- ☐ A green  
☐ B lilac  
☐ C red  
☐ D yellow

- (b) In the second test, she adds a solution of sodium hydroxide to a solution of *ming fan*.

She uses this test to show that *ming fan* contains aluminium ions.

The result is a white precipitate of aluminium hydroxide,  $\text{Al}(\text{OH})_3$

Write an ionic equation for the formation of aluminium hydroxide.

Include state symbols in your equation.

(2)

- (c) The third test is for the sulfate ion.

Describe how the student should do this test.

(3)

test.....

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.....

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result.....

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- (d) The ions present in alum are  $K^+$ ,  $Al^{3+}$  and  $SO_4^{2-}$ .  
Crystals of alum also contain water of crystallisation.

Alum has the formula  $K_xAl_y(SO_4)_z \cdot nH_2O$

- (i) Use the formulae of the ions in alum to suggest values for x, y and z in the chemical formula of alum.

(1)

x .....

y .....

z .....

- (ii) Calculate the value of n in the chemical formula of alum.  
[relative formula mass of alum = 474]

(3)

n = .....

(Total for Question 6 = 10 marks)



- 7 The table gives some information about three elements in Group 7 of the Periodic Table.

Name	State at room temperature	Colour	Boiling point in °C
chlorine	gas	pale green	–35
bromine	liquid	red-brown	
iodine	solid	dark grey	184

- (a) Use the information from the table to predict the boiling point of bromine.

(1)

boiling point = ..... °C

- (b) Fluorine is above chlorine in Group 7.

Predict the colour and state of fluorine at room temperature.

(2)

colour .....

state .....

- (c) Bromine reacts with iron(II) ions.



- (i) Explain why this reaction is described as a redox reaction.

(2)

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(d) Chlorine forms a covalent oxide called chlorine(I) oxide,  $\text{Cl}_2\text{O}$

- (i) Draw a dot-and-cross diagram to show the arrangement of electrons in a  $\text{Cl}_2\text{O}$  molecule.

Show only the outer electrons.

(3)

- (ii) Chlorine(I) oxide reacts with water to form a solution.

Suggest a value for the pH of this solution.

Give a reason for your answer.

(2)

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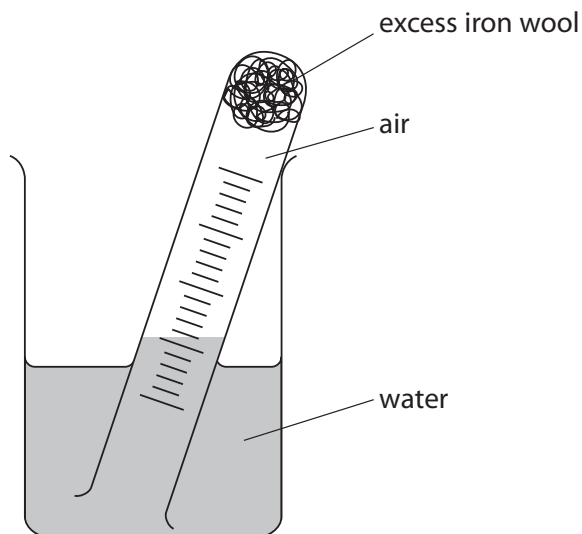
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**(Total for Question 7 = 16 marks)**



- 8 This apparatus is used to determine the percentage of oxygen in air.



A teacher sets up the apparatus and records the initial volume of gas in the tube.

When the level of water in the tube becomes constant, he records the final volume of gas in the tube.

- (a) Suggest the time taken for the volume of gas in the tube to become constant.

(1)

- ☐ A 1 second  
☐ B 1 minute  
☐ C 1 week  
☐ D 1 year

- (b) Other than changes to the levels of water in the apparatus, state one other observation that would be made at the end of the experiment.

(1)

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(c) The teacher adjusts the apparatus before recording the volume of gas in the tube.

Explain the change that he makes.

(2)

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(d) The teacher does the experiment four times.

The table shows his results.

Initial volume in cm <sup>3</sup>	Final volume in cm <sup>3</sup>	Percentage of oxygen in air
32	26	
30	24	20%
27	22	19%
22	18	18%

(i) Calculate the percentage of oxygen in the air in the first experiment.

(2)

percentage = ..... %

(ii) Although the mean percentage of oxygen in these experiments is 19%, the teacher states that this value may not be accurate.

Comment on this statement.

(2)

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(e) Explain the effect, if any, on the calculated percentage of oxygen in air when these changes are made.

(i) The iron wool is left for a shorter period of time.

(2)

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(ii) A larger piece of iron wool is used.

(2)

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**(Total for Question 8 = 12 marks)**

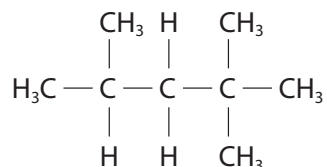


S 6 0 1 0 6 A 0 2 5 3 2

- 9 Crude oil can be separated into different fractions. These fractions can be used as fuels, or as raw materials for the chemical industry.

The gasoline fraction is used to make fuel for cars.

- (a) The diagram shows the structural formula of a compound in gasoline.



Which hydrocarbon is an isomer of this compound?

(1)

- ☐ A pentane
- ☐ B hexane
- ☐ C heptane
- ☐ D octane

- (b) Car exhaust fumes contain a number of different gases, including water vapour, carbon dioxide and carbon monoxide. These gases form when the fuel burns in the engine.

- (i) Another gas is the largest component of car exhaust fumes.

Suggest the identity of this gas.

(1)

- (ii) Car exhaust fumes also contain some nitrogen oxides.

State one effect that nitrogen oxides have on the atmosphere.

(1)



(iii) Explain why car exhaust fumes contain both carbon dioxide and carbon monoxide.

(3)

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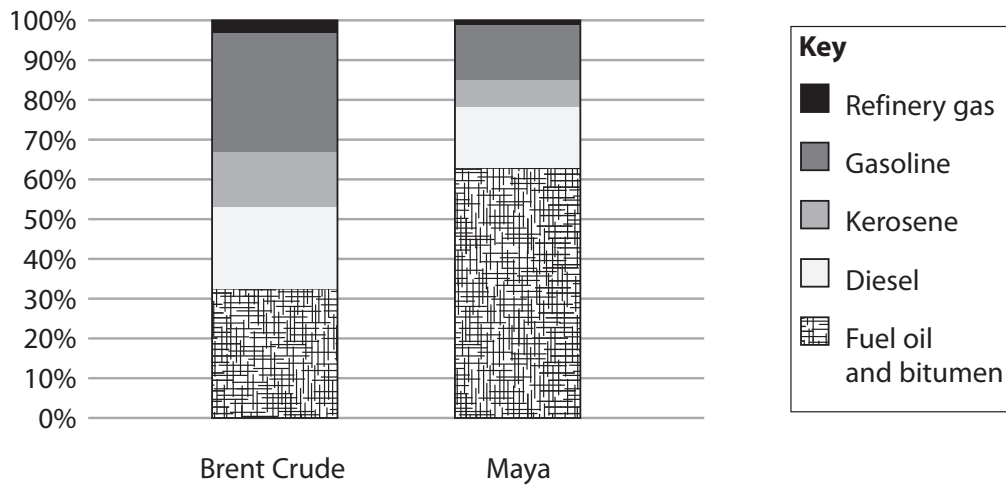
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(c) Different crude oils have different compositions.

The diagram shows the composition of two different crude oils.



The table shows the price of each type of oil.

Crude oil	Brent Crude	Maya
Price per barrel	\$63	\$51

Discuss why Brent crude oil and Maya crude oil have different prices.

Use information from the diagram in your answer.

(3)

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(d) Describe, using a labelled diagram, how a sample of the diesel fraction can be cracked in a laboratory to produce a gaseous alkene.

(4)

(Total for Question 9 = 13 marks)



10 Most silver-coloured coins do not contain silver, but are made from a mixture of other metals.

(a) Describe the difference between a compound and a mixture.

(2)

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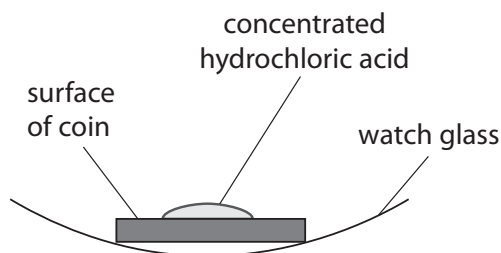
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(b) A student uses chromatography to investigate the metals present in a silver-coloured coin.

She places the coin on a watch glass.

She adds two drops of concentrated hydrochloric acid to the coin.

No visible reaction takes place, but the metals on the surface of the coin slowly react with the acid to form a solution.



(i) Which type of salt is formed when the metals in the coin react with the acid?

(1)

- ☐ A chlorate
- ☐ B chloride
- ☐ C chlorite
- ☐ D hypochlorite

(ii) The student states that there is no magnesium in the surface of the coin.

Explain why she is correct.

(2)

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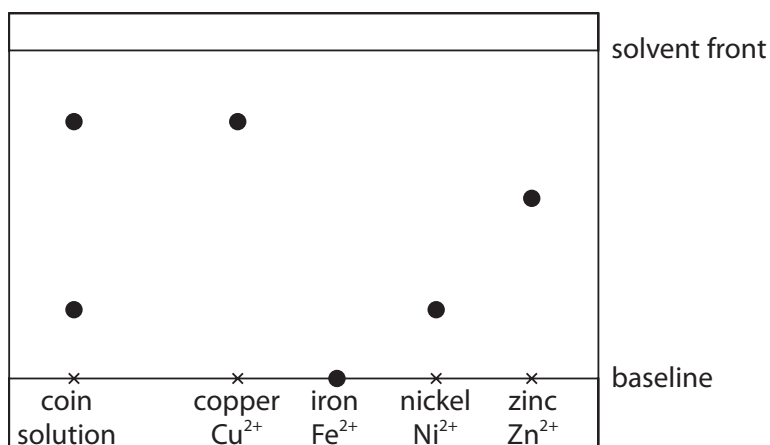


- (c) The student places a spot of solution from the coin on a piece of chromatography paper.

Four other spots, each containing a different metal ion, are placed on the paper.

The bottom of the paper is placed in a solvent for some time. The paper is then removed and dried.

The results are shown in the diagram.



- (i) The spots on the baseline are made as small as possible.

Suggest a reason for this.

(1)

- (ii) State why the spot containing  $\text{Fe}^{2+}$  ions stays on the baseline.

(1)

- (iii) Explain which metals are present in the coin.

(2)

(Total for Question 10 = 9 marks)

TOTAL FOR PAPER = 110 MARKS



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