AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



EXAM QUESTION PACK

4.1.2 THE PERIODIC TABLE (PACK 5)

SCORE	PERCENTAGE
/271	%

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Q1.

This question is about the halogens.

(a) Which group in the periodic table is known as the halogens?

Tick **one** box.

Group 1 ☐

Group 2 ☐

Group 7 ☐

Group 0 ☐

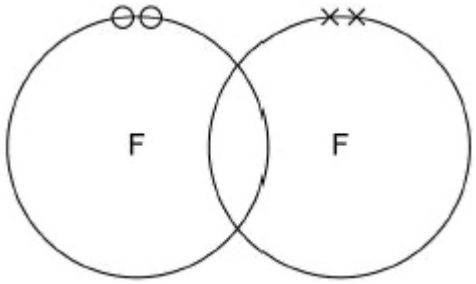
(1)

(b) A fluorine atom has 7 electrons in the outer shell.

The diagram below shows part of a dot and cross diagram to represent a molecule of fluorine (F_2).

Complete the dot and cross diagram.

You should show only the electrons in the outer shells.



(2)

(c) Chlorine reacts with potassium bromide solution.

Complete the word equation.

chlorine + potassium bromide → _____ + _____

(2)

(d) What type of reaction happens when chlorine reacts with potassium bromide solution?

Tick **one** box.

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decomposition ☐

displacement ☐

neutralisation ☐

precipitation ☐

(1)

(e) Complete the sentence.

Choose the answer from the box.

an atom	**an electron**	**a neutron**	**a proton**

Chlorine is more reactive than bromine.

This is because chlorine gains _____ more easily.

(1)

(f) How does the size of a chlorine atom compare with the size of a bromine atom?

Complete the sentence.

Choose the answer from the box.

bigger than	**the same size as**	**smaller than**

A chlorine atom is _____ a bromine atom.

(1)

(g) Give a reason for your answer to part **(f)**

Reason _____

_____

(1)

(h) Fluorine reacts with chlorine to produce ClF_3

Balance the chemical equation for the reaction.

$$Cl_2 + _____F_2 \longrightarrow 2\ ClF_3$$

(1)

(i) Explain why fluorine is a gas at room temperature.

Use the following words in your answer:

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energy **forces** **molecules** **weak**

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 13 marks)

Q2.

This question is about acids and bases.

(a) Which ion is found in all acids?

Tick **one** box.

Cl^- ☐ H^+ ☐ Na^+ ☐ OH^- ☐

(1)

(b) Zinc nitrate can be produced by reacting an acid and a metal oxide.

Name the acid and the metal oxide used to produce zinc nitrate.

Acid _____

Metal oxide _____

(2)

(c) In an equation, zinc nitrate is written as $Zn(NO_3)_2(aq)$.

What does (aq) mean?

Tick **one** box.

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Dissolved in water	☐
Insoluble	☐
Not all reacted	☐
Reactant	☐

(1)

(d) The pH of a solution is 8

Some hydrochloric acid is added to the solution.

Suggest the pH of the solution after mixing.

pH = _____

(1)

(e) **Table 1** shows the solubility of three solids in water at room temperature.

Table 1

Solid	**The mass of the solid that dissolves in 100 cm^3 of water**
Phosphorus oxide	50 g
Silicon dioxide	0 g
Sodium hydroxide	100 g

A teacher labelled these three solids **A**, **B** and **C**.

She gave a student the information shown in **Table 2**

Table 2

Solid	**Observation when added to water**	**pH of the solid in water**
A	colourless solution	14
B	colourless solution	2
C	solid does not dissolve	7

Describe a method that could be used to identify each of the three solids **A**, **B** and **C**.

You must use an indicator in the method.

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Use information in **Table 1** and **Table 2**

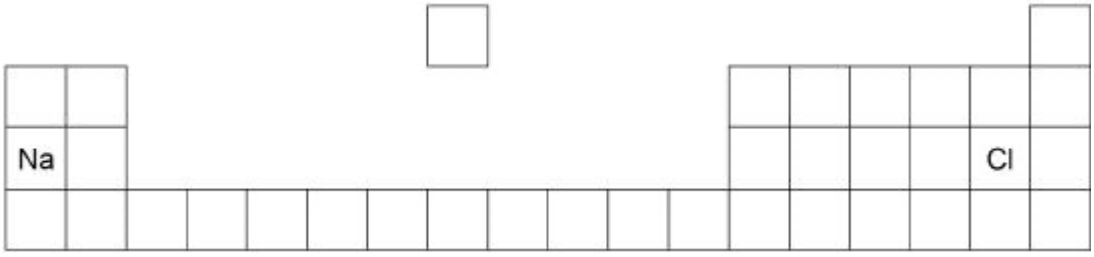
(4)
(Total 9 marks)

Q3.

This question is about sodium and chlorine.

Figure 1 shows the positions of sodium and chlorine in the periodic table.

Figure 1



(a) State **one** difference and **one** similarity in the electronic structure of sodium and of chlorine.

Difference _____

Similarity _____

(2)

(b) Sodium atoms react with chlorine atoms to produce sodium chloride (NaCl).

Describe what happens when a sodium atom reacts with a chlorine atom.

Write about electron transfer in your answer.

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_____

_____

_____

_____

_____

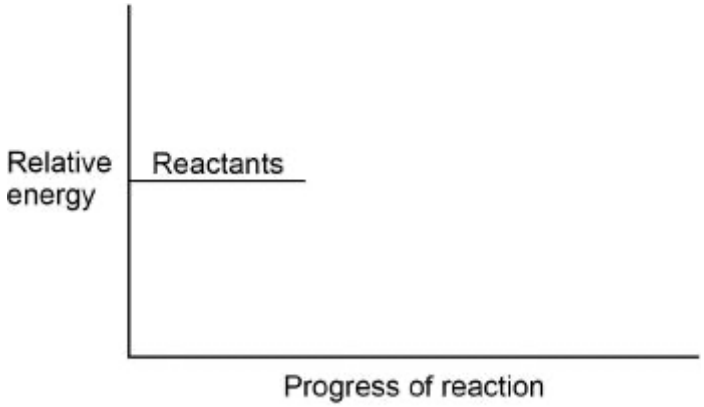
_____

(4)

(c) The reaction between sodium and chlorine is an exothermic reaction.

Complete the reaction profile for the reaction between sodium and chlorine.

Figure 2



(2)

(Total 8 marks)

Q4.

This question is about the halogens.

(a) Write the state symbol for chlorine at room temperature.

Cl_2 (_____)

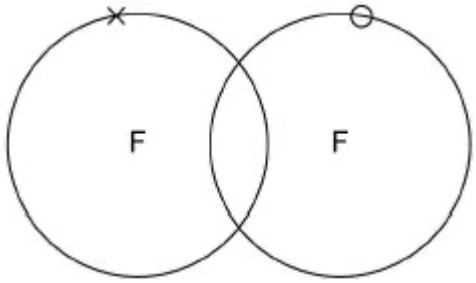
(1)

(b) The diagram below represents one molecule of fluorine.

Complete the dot and cross diagram on the diagram above.

You should show only the electrons in the outer shells.

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(2)

(c) A fluorine atom can be represented as $^{19}_{9}F$

What is the total number of electrons in a fluorine molecule (F_2)?

Tick **one** box.

9 ☐ 14 ☐ 18 ☐ 38 ☐

(1)

(d) Aluminium reacts with bromine to produce aluminium bromide.

Complete the balanced chemical equation for this reaction.

_____Al + _____Br_2 ⟶ 2_____

(2)

(e) When chlorine reacts with potassium bromide, chlorine displaces bromine.

$$Cl_2 + 2\ KBr \longrightarrow Br_2 + 2\ KCl$$

Explain why chlorine is more reactive than bromine.

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_____

_____

(3)

(Total 9 marks)

Q5.

A scientist does two tests on four white solids. The solids are labelled **A**, **B**, **C** and **D**.

Test 1 Adds the sample of the solid to distilled water and stirs.

Test 2 Measures the pH of the solution after **Test 1**

Table 1 shows the results.

Table 1

Solid	Appearance after stirring	pH
A	colourless solution, no solid	14
B	colourless solution, no solid	3
C	colourless solution, solid remains	9
D	colourless liquid, solid remains	7

These four solids are:

- magnesium oxide
- phosphorus oxide
- silicon dioxide
- sodium oxide.

Table 2 shows the solubility of these four solids in water.

Table 2

Solid	Solubility in grams per 100 cm^3 of water
Magnesium oxide	0.01
Phosphorus oxide	52
Silicon dioxide	0
Sodium oxide	109

(a) Identify the solids **A**, **B**, **C** and **D**.

Explain your answers.

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(6)

(b) 10 cm^3 of solution **B** is added to a beaker.

Distilled water is added to the beaker until the final volume in the beaker is 1000 cm^3

The pH of the solution is measured before and after distilled water is added.

Table 3 shows the results.

Table 3

Volume of solution in beaker	pH of solution B
10 cm^3	3
1000 cm^3	**X**

Calculate the value of **X**.

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_____

_____

_____

_____

X = _____

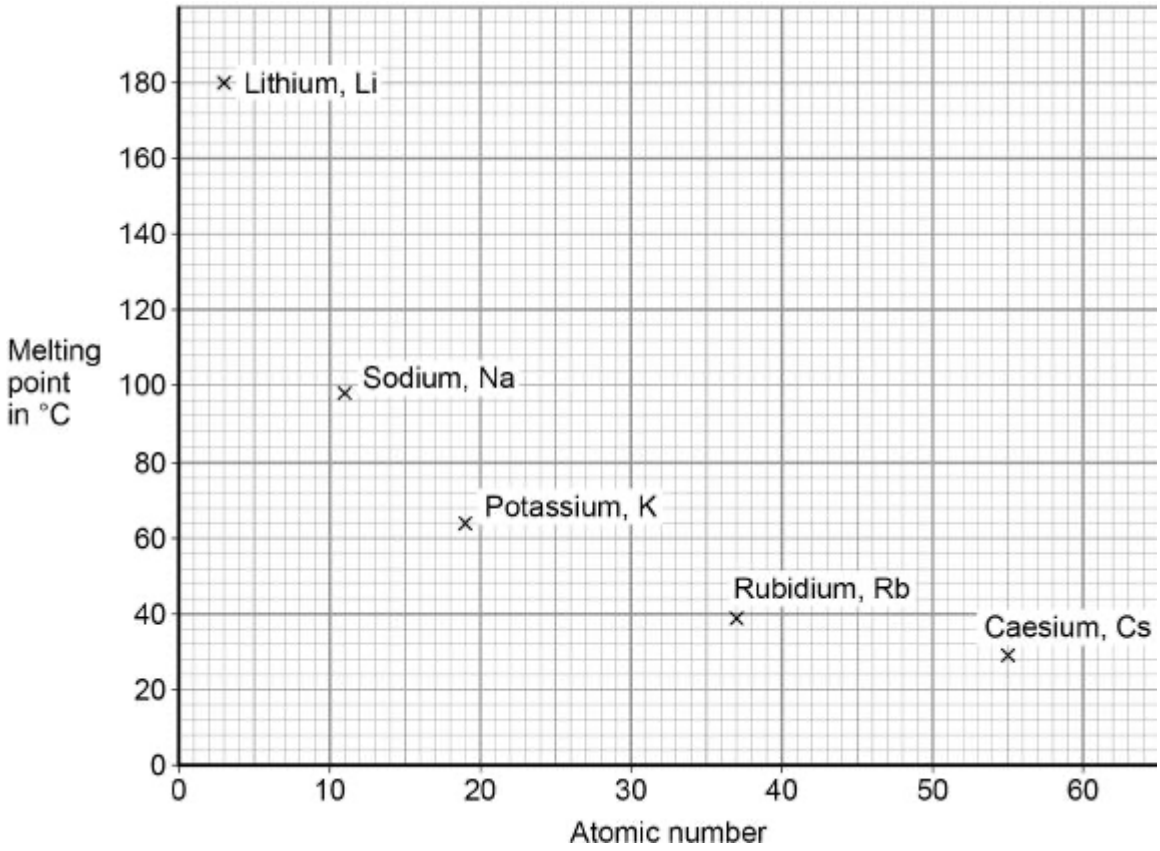
(2)

(Total 8 marks)

Q6.

This question is about Group 1 metals.

The graph below shows the melting points of Group 1 metals plotted against their atomic number.



(a) Describe the trend shown by the melting points of Group 1 metals as the atomic number increases.

_____

_____

(1)

(b) Determine the atomic number and melting point of caesium.

Use the graph above.

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Atomic number of caesium = _____

Melting point of caesium = _____ °C

(1)

Lithium is a Group 1 metal.

(c) A lithium atom can be shown as $^{7}_{3}Li$

How many electrons does the **outer shell** of a lithium atom contain?

Tick **one** box.

1 ☐

3 ☐

4 ☐

7 ☐

(1)

(d) Lithium reacts with oxygen to produce lithium oxide.

Draw **one** line from each substance to the correct description of the substance.

Substance	Description
	compound
Lithium oxide	element
	metal
Oxygen	mixture
	polymer

(2)

(e) Balance the equation for the reaction of lithium with oxygen.

$$____Li + O_2 \longrightarrow 2Li_2O$$

(1)

(f) What type of bonding is present in lithium oxide?

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Tick **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

(1)

(g) Calculate the relative formula mass (M_r) of lithium oxide (Li_2O).

Relative atomic masses (A_r): Li = 7 O = 16

_____

_____

_____

Relative formula mass = _____

(2)

(Total 9 marks)

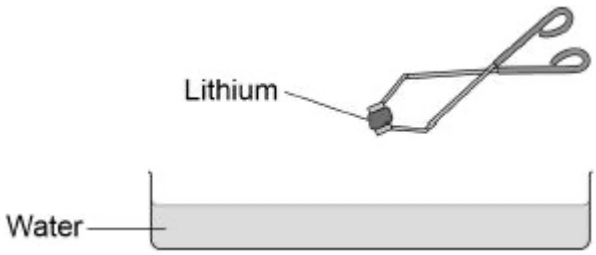
Q7.

This question is about Group 1 elements.

A teacher demonstrated the reaction of Group 1 elements with water.

Figure 1 shows the apparatus.

Figure 1



(a) What name is given to Group 1 elements?

Tick **one** box.

Alkali metals ☐

Halogens ☐

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Noble gases ☐

Non-metals ☐

(1)

(b) The teacher wore safety glasses and used tongs to handle the elements.

Suggest **one** other safety precaution the teacher should take.

_____

_____

(1)

Table 1 shows the teacher's results.

Table 1

Element	**Observations**
Lithium	• bubbles form • lithium moves slowly on surface
Sodium	• bubbles form • sodium moves quickly on surface • sodium melts to form a ball
Potassium	• bubbles form • potassium moves very quickly on surface • potassium melts to form a ball • a lilac flame is seen

(c) Describe the trend in reactivity in Group 1.

Give **two** observations from **Table 1** which provide evidence for the trend.

_____

_____

_____

_____

_____

_____

(3)

(d) Rubidium is a Group 1 element.

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Rubidium is below potassium in the periodic table.

Suggest why the teacher did **not** demonstrate the reaction between rubidium and water.

_____

_____

(1)

(e) Complete the balanced equation for the reaction between sodium and water.

_____ Na + _____ H_2O ⟶ _____ NaOH + H_2

(1)

(f) What is the name of the compound with the formula NaOH?

Tick **one** box.

Sodium dioxide ☐

Sodium hydrate ☐

Sodium hydroxide ☐

Sodium oxide ☐

(1)

Table 2 shows the diameter of atoms of Group 1 elements.

Element	**Diameter of atom in nanometres**
Lithium	0.304
Sodium	0.372
Potassium	**X**
Rubidium	0.496
Caesium	0.530

(g) Predict value **X** in **Table 2**.

X = _____ nanometres

(1)

(h) 1 nanometre is 10^{-9} metres.

What is the diameter of a lithium atom in metres?

Tick **one** box.

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3.04×10^{-8} m ☐

3.04×10^{-9} m ☐

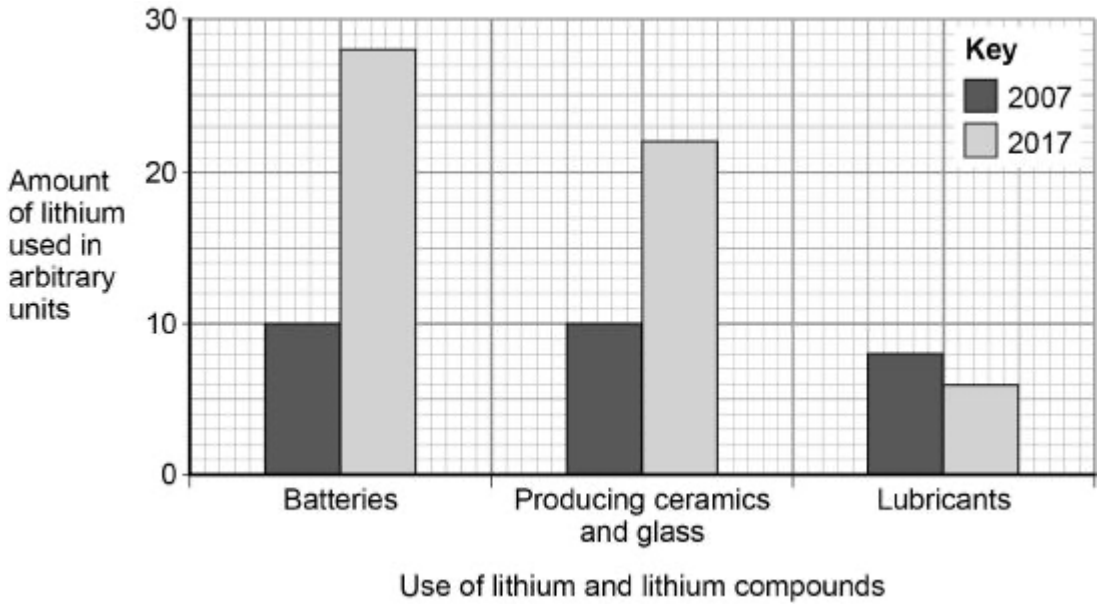
3.04×10^{-10} m ☐

3.04×10^{-11} m ☐

(1)

Figure 2 shows the use of lithium and lithium compounds in 2007 and 2017.

Figure 2



(i) Describe how the use of lithium and lithium compounds changed between 2007 and 2017.

You must include data from **Figure 2** in your answer.

_____

_____

_____

_____

_____

_____

(3)

(Total 13 marks)

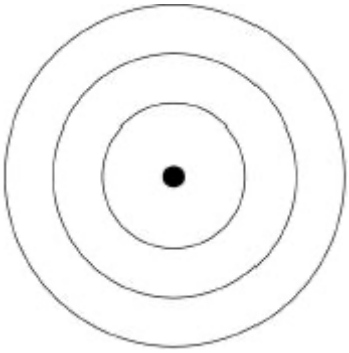
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Q8.

This question is about Group 1 elements.

(a) A sodium atom is represented as $^{23}_{11}Na$

Complete the diagram below to show the electronic structure of a sodium atom.



(1)

A teacher demonstrated the reaction between lithium and water.

The teacher repeated the demonstration using sodium and then potassium with water.

(b) The teacher wore eye protection.

Suggest **two** other safety precautions the teacher should take.

1. _____

_____

2. _____

_____

(2)

(c) Universal indicator is added to the solution formed in the reaction between potassium and water. The universal indicator becomes purple in colour.

Which ion causes universal indicator to turn purple?

Tick **one** box.

H^+ ☐

K^+ ☐

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OH^- ☐

O^{2-} ☐

(1)

(d) The table below gives the diameter of atoms of Group 1 elements.

Element	**Diameter of atom in nm**
Lithium	0.304
Sodium	0.372
Potassium	0.454
Rubidium	0.496
Caesium	0.530

Explain how the diameter of the atom affects the reactivity of Group 1 elements.

(4)

(Total 8 marks)

Q9.

This question is about atoms and chemical elements.

Mendeleev's periodic table has groups of elements with similar properties.

Figure 1 shows part of Mendeleev's periodic table.

Figure 1

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1	1 H							
2	7 Li	9.4 Be	11 B	12 C	14 N	16 O	19 F	
3	23 Na	24 Mg	27.3 Al	28 Si	31 P	32 S	35.5 Cl	
4	39 K	40 Ca	44	48 Ti	51 V	52 Cr	55 Mn	56 59 59 63 Fe, Co, Ni, Cu

(a) Compare Mendeleev's periodic table with the modern periodic table.

Which group is missing from Mendeleev's periodic table?

Tick **one** box.

Group 1 ☐

Group 2 ☐

Group 7 ☐

Group 0 ☐

(1)

(b) In the early periodic tables some elements were placed in the wrong groups.

Mendeleev overcame some of these problems in his periodic table.

Give **two** ways Mendeleev did this.

1. _____

_____

2. _____

_____

(2)

Atoms were thought to be tiny spheres that could not be divided.

(c) Draw **one** line from each scientist to the discovery the scientist made.

Scientist	**Discovery the scientist made**
	Discovered electrons

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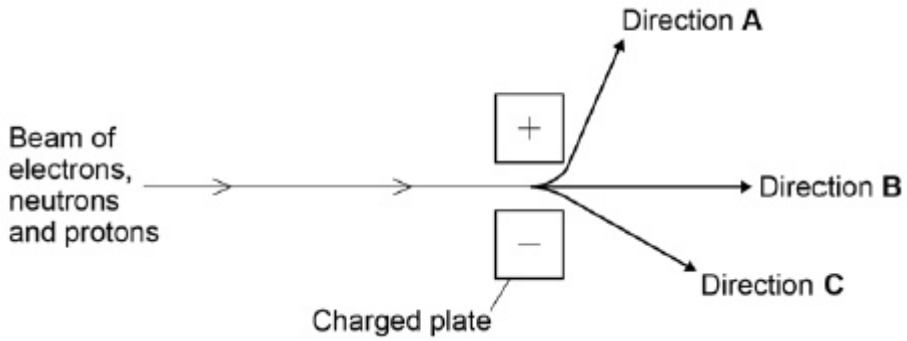
Neils Bohr	Electrons orbit the nucleus
	Existence of neutrons
James Chadwick	Mass of atom concentrated at centre
	Proton found in nucleus

(2)

(d) A beam of electrons, neutrons and protons can be separated by passing them through an electric field.

Figure 2 shows the directions of the three particles after entering the electric field.

Figure 2



Charged particles are attracted to the oppositely charged plate in the electric field.

Which direction, **A**, **B** or **C**, does each particle follow?

Complete the table.

Particle	**Direction**
Electron	
Neutron	
Proton	

(2)

(e) Calculate the mass of one atom of sodium.

Use the equation:

$$\text{mass of one atom of sodium} = \frac{\text{relative atomic mass}}{\text{Avogadro constant}}$$

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Avogadro constant = 6.02×10^{23}

Give your answer to 2 significant figures.

_____

_____

_____

_____

_____

Mass = _____ g

(3)

(f) The radius of a sodium atom is 227 picometres.

1 picometre = 10^{-12} metres (m)

The radius of a nucleus is $\frac{1}{10\,000}$ of that of the atom.

Which calculation shows the radius of a sodium atom's nucleus?

Tick **one** box.

$227 \times 10\,000$ m ☐

$227 \times \frac{1}{10\,000}$ m ☐

$227 \times 10^{-12} \times 10\,000$ m ☐

$227 \times 10^{-12} \times \frac{1}{10\,000}$ m ☐

(1)

(Total 11 marks)

Q10.

This question is about the periodic table.

In 1864 John Newlands suggested an arrangement of elements.

Figure 1 shows the arrangement Newlands suggested.

Figure 1

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1	2	3	4	5	6	7
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca				

(a) Give **two** differences between column 1 in **Figure 1** and Group 1 in the modern periodic table.

Use the periodic table to help you.

1. _____

_____

2. _____

_____

(2)

(b) In 1869 Mendeleev produced his periodic table.

Complete the sentence.

Choose the answer from the box.

insoluble	**magnetic**	**undiscovered**	**unreactive**

Mendeleev left gaps in his periodic table for elements that were

_____ .

(1)

(c) How are the elements ordered in the modern periodic table?

Tick **one** box.

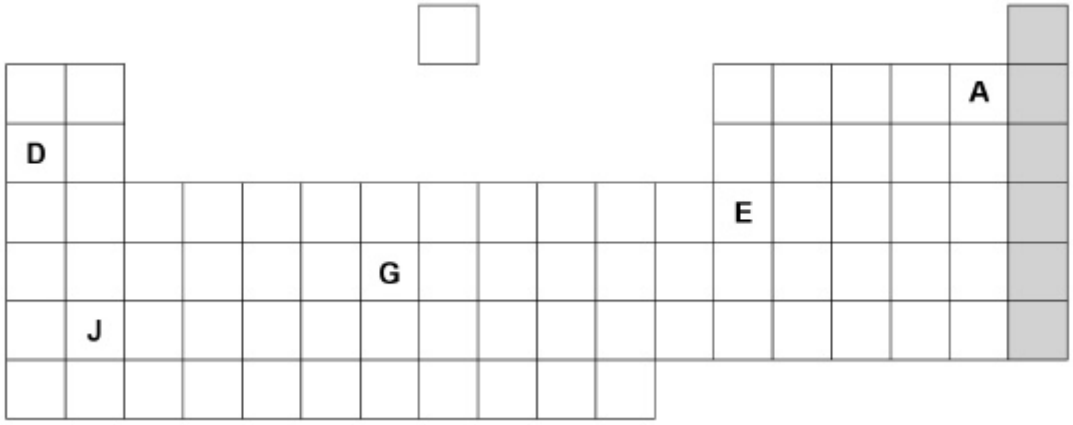
- Atomic mass ☐
- Atomic number ☐
- Melting point ☐
- Reactivity ☐

(1)

Figure 2 shows part of the modern periodic table.

Figure 2

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(d) Complete the sentences about the elements in **Figure 2**.

Choose the answers from the box.

A	D	E	G	J

Sodium is an alkali metal and is represented by the letter _____.

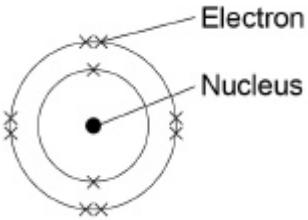
An element in group 3 is represented by the letter _____.

A gaseous non-metal element is represented by the letter _____.

(3)

(e) **Figure 3** shows the electronic structure of an atom.

Figure 3



This element is in the shaded group on **Figure 2**.

Why is this element unreactive?

_____

_____

(1)

(f) Name the group of elements in the shaded column on **Figure 2**.

_____

(1)

(Total 9 marks)

Q11.

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This question is about beryllium.

(a) Beryllium is in Group 2.

What does this tell you about the electronic structure of beryllium?

_____

_____

(1)

Beryllium is found in beryllium aluminium silicate.

The formula of beryllium aluminium silicate is $Be_3Al_2(SiO_3)_6$

(b) What is the ratio of atoms of each element in beryllium aluminium silicate?

_____

Ratio of Be : Al : Si : O = ___ : ___ : ___ : ___

(1)

(c) What percentage by mass of beryllium is in beryllium aluminium silicate?

Give your answer to 2 significant figures.

Relative atomic mass (A_r) of Be = 9

Relative formula mass (M_r) of $Be_3Al_2(SiO_3)_6$ = 537

_____

_____

Percentage of beryllium = _____ %

(2)

Beryllium can be extracted from beryllium chloride.

Beryllium chloride ($BeCl_2$) is heated with potassium to produce beryllium and potassium chloride (KCl).

(d) Complete the equation for the reaction.

Your equation should be balanced.

$$BeCl_2 + _____ \rightarrow _____ + _____$$

(2)

(e) Explain why beryllium is produced when potassium is heated with beryllium chloride.

You should refer to reactivity in your answer.

_____

_____

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_____

_____

(2)

(f) Describe a test to show that beryllium is a metal.

Give the result of the test.

Test _____

_____

Result _____

_____

(2)

(Total 10 marks)

Q12.

This question is about the periodic table.

In 1864 John Newlands suggested an arrangement of elements.

Figure 1 shows the arrangement Newlands suggested.

Figure 1

1	2	3	4	5	6	7
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe

(a) Give **two** differences between the groupings in **Figure 1** compared with the modern periodic table.

1. _____

_____

2. _____

_____

(2)

In 1869 Mendeleev produced his periodic table.

(b) Why was Mendeleev's table called a periodic table?

_____

_____

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(1)

(c) When Mendeleev was developing his periodic table he changed the order of some of the elements.

Explain why.

_____

_____

_____

_____

(2)

(d) Explain why the elements are ordered differently in the modern periodic table.

You should refer to isotopes.

_____

_____

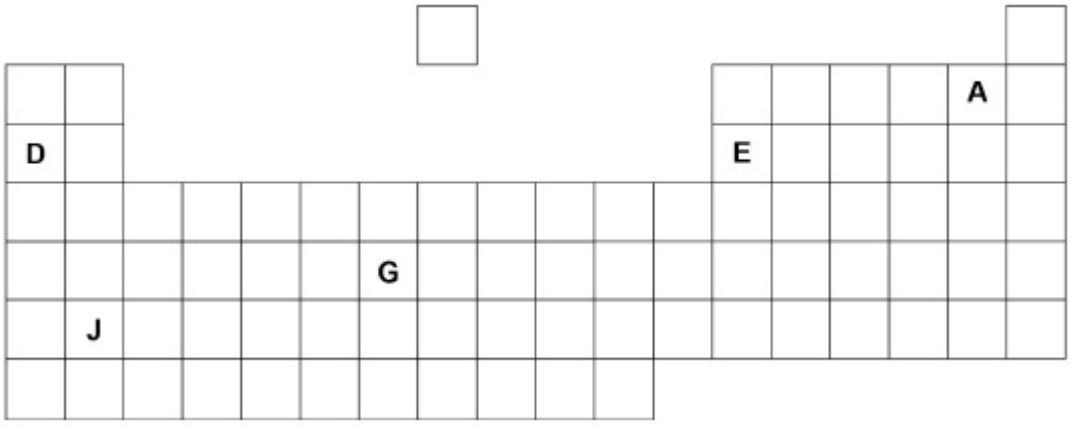
_____

_____

(2)

(e) **Figure 2** shows part of the modern periodic table.

Figure 2



Draw **one** line from each statement about an element to the letter representing that element.

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Statement	Letter representing element
An alkali metal	A
An element consisting of molecules	D
An element that has atoms with the electronic structure 2.8.3	E
	G
	J

(3)

(Total 10 marks)

Q13.

John Newlands arranged the known elements into a table in order of atomic weight.

Figure 1 shows part of Newlands' table.

Figure 1

Group	1	2	3	4	5	6	7
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca				

(a) What are the names of the elements in Group 5 of Newlands' table?

Tick **one** box.

Calcium and sulfur ☐

Carbon and silicon ☐

Chlorine and silver ☐

Chromium and tin ☐

(1)

(b) In what order is the modern periodic table arranged?

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Tick **one** box.

Atomic mass ☐

Atomic number ☐

Atomic size ☐

Atomic weight ☐

(1)

(c) Give **two** differences between Group 1 of Newlands' table and Group 1 of the periodic table.

_____

_____

_____

_____

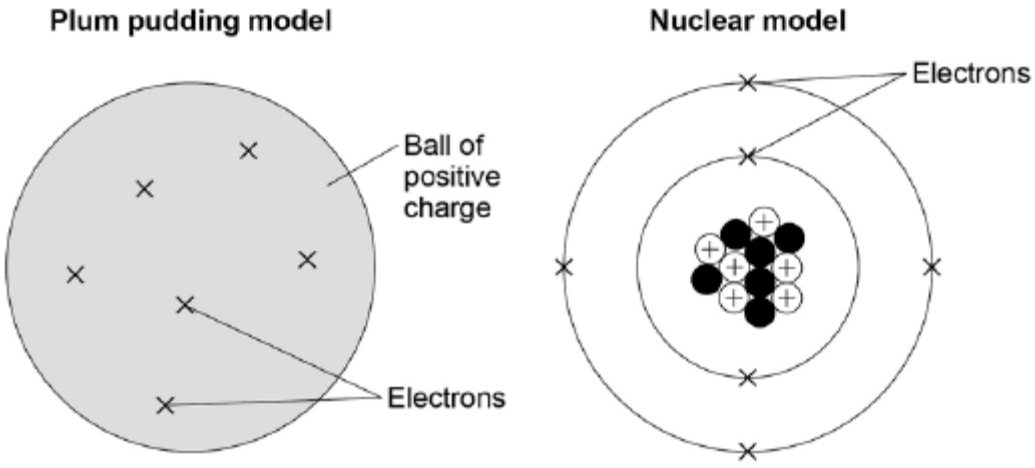
(2)

(d) In 1864, atoms were thought to be particles that could not be divided up into smaller particles.

By 1898, the electron had been discovered and the plum pudding model of an atom was proposed.

Figure 2 shows the plum pudding model of an atom of carbon and the nuclear model of an atom of carbon.

Figure 2



Compare the position of the subatomic particles in the plum pudding model with the nuclear model.

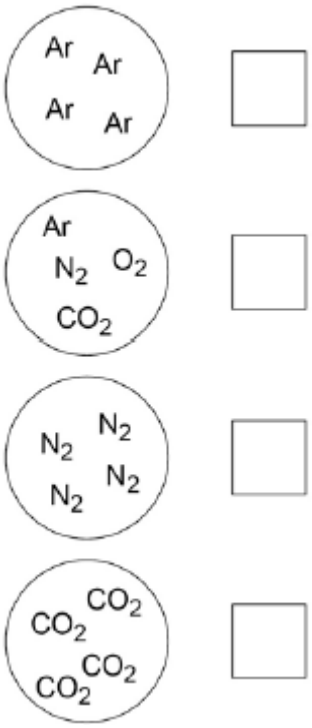
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(4)

(e) Models are used to show the differences between elements, compounds and mixtures.

Which circle shows a model of a mixture?

Tick **one** box.



(1)

(f) **Figure 3** shows a model of carbon dioxide.

Figure 3

O = C = O

What does each line between the atoms in **Figure 3** represent?

Tick **one** box.

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Covalent bond	☐
Intermolecular force	☐
Ionic bond	☐
Metallic bond	☐

(1)
(Total 10 marks)

Q14.

The three states of matter are solid, liquid and gas.

(a) Lithium reacts with water to produce lithium hydroxide solution and hydrogen.

Use the correct state symbols from the box to complete the chemical equation.

aq	g	l	s

$2Li(s) + 2H_2O(l) \rightarrow 2LiOH(____) + H_2(____)$

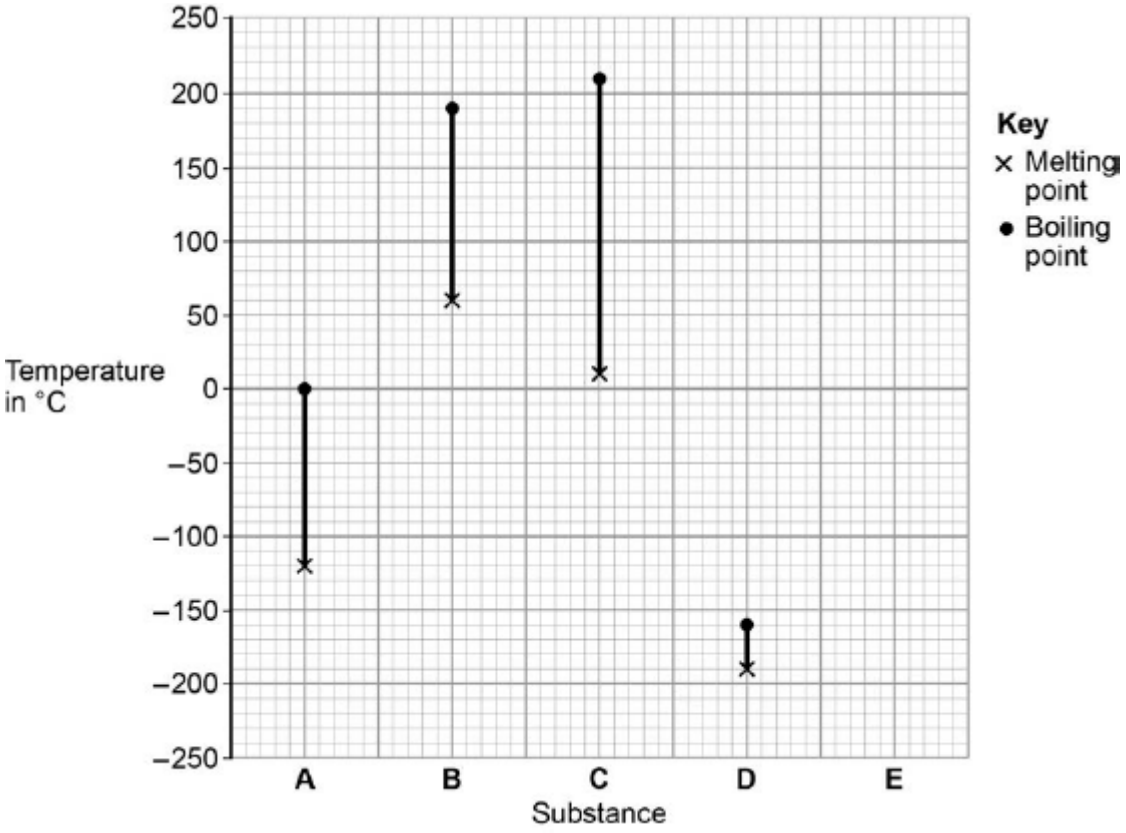
lithium + water → lithium hydroxide + hydrogen

(2)

(b) **Figure 1** shows the melting points and the boiling points of four substances, **A**, **B**, **C** and **D**.

Figure 1

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Which substance is liquid over the greatest temperature range?

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

(1)

(c) Which **two** substances are gases at 50 °C?

Tick **one** box.

A and **B** ☐

B and **C** ☐

C and **D** ☐

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A and **D** ☐

(1)

(d) A different substance, **E**, has:

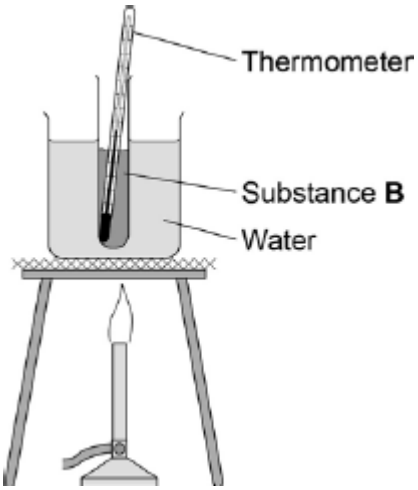
- a melting point of −50 °C
- a boiling point of +120 °C

Plot these two values on **Figure 1**.

(2)

(e) **Figure 2** shows the apparatus a student used to determine the melting point and the boiling point of substance **B** in **Figure 1**.

Figure 2



Explain why the student could not use this apparatus to determine the boiling point of substance **B**.

_____

_____

_____

_____

(2)

(f) Suggest **one** reason why the student could not use this apparatus to determine the exact melting point of substance **B**.

_____

_____

(1)

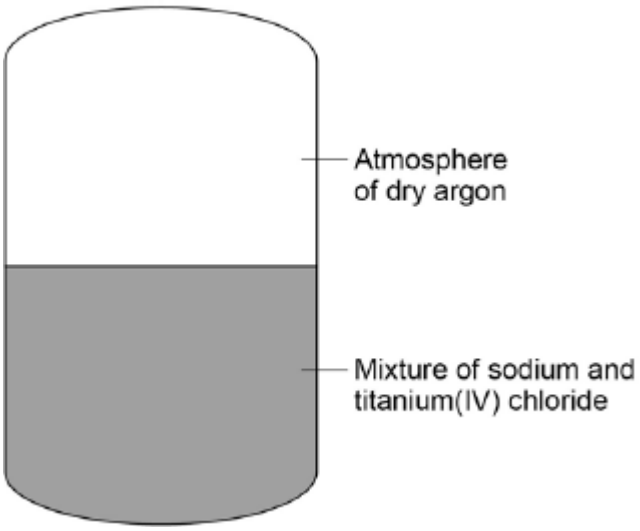
(Total 9 marks)

Q15.

Figure 1 shows a reactor used to produce titanium from titanium(IV) chloride.

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Figure 1



The chemical equation for the reaction of titanium(IV) chloride with sodium is:

$$TiCl_4 + 4Na \rightarrow Ti + 4NaCl$$

titanium(IV) chloride + sodium → titanium + sodium chloride

(a) For one reaction:

- 1615 kg titanium(IV) chloride reacted completely with 782 kg sodium
- 1989 kg sodium chloride was produced.

Calculate the mass of titanium produced from this reaction.

_____

_____

Mass of titanium = _____ kg

(1)

(b) The table below shows the solubility of sodium chloride in 100 cm^3 of aqueous solution at different temperatures.

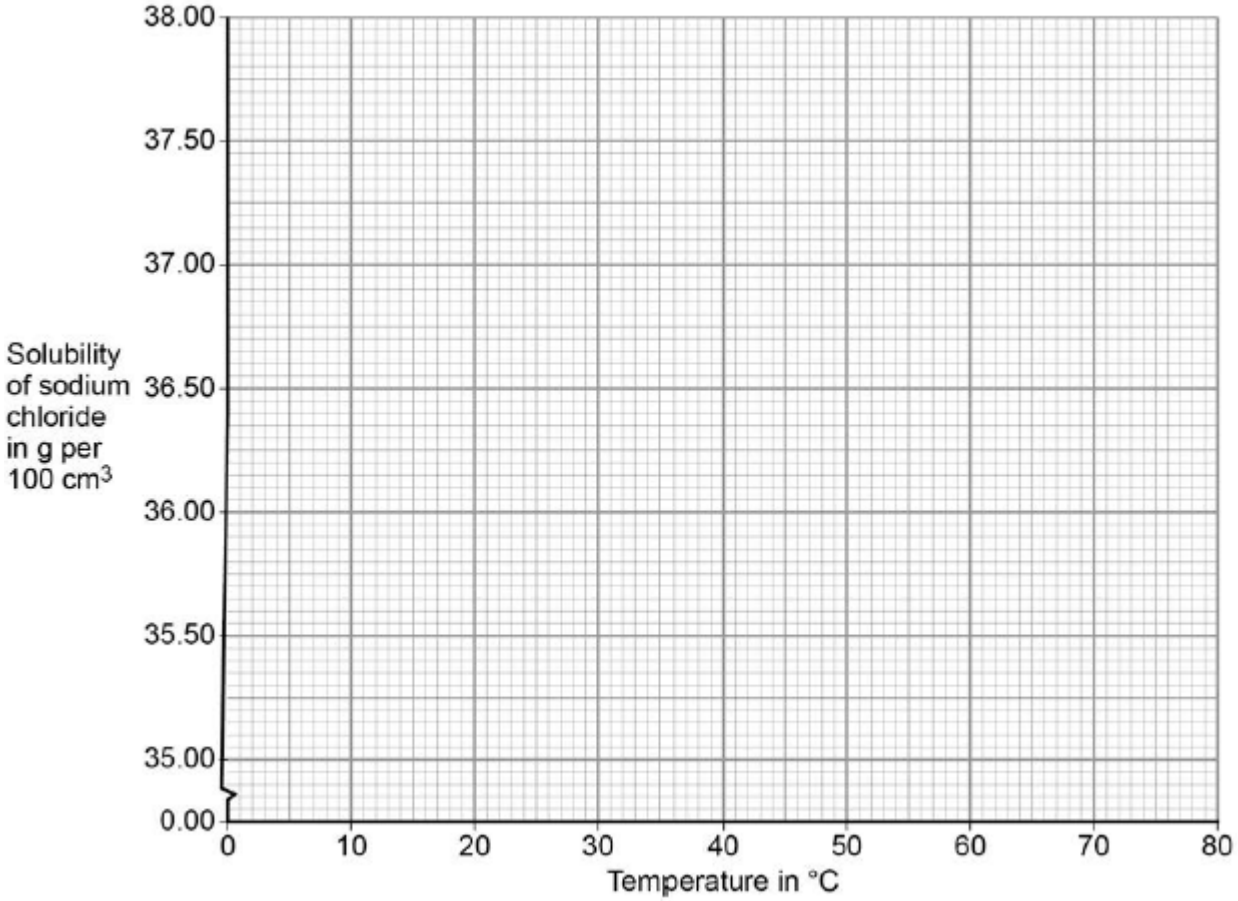
Solubility of sodium chloride in g per 100cm^3	**Temperature in °C**
35.72	10
35.89	20
36.09	30
37.37	40
36.69	50
37.04	60

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On **Figure 2**:

- plot this data on the grid
- draw a line of best fit.

Figure 2



(3)

(c) The product sodium chloride is dissolved in water to separate it from titanium.

At 30 °C the solubility of sodium chloride is 36 kg per 100 dm^3.

Calculate the minimum volume of water in dm^3, at 30 °C, needed to dissolve 1989 kg sodium chloride.

_____

_____

_____

_____

Volume of water = _____ dm^3

(2)

(d) Calculate the percentage by mass of titanium in titanium(IV) chloride ($TiCl_4$).

Give your answer to 3 significant figures.

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Relative atomic masses (A_r): Cl = 35.5; Ti = 48

Percentage of titanium by mass = _____ %

(3)

(e) Suggest why the reaction is done in an atmosphere of dry argon instead of air containing water vapour.

(3)

(f) Explain why titanium conducts electricity.

(3)

(Total 15 marks)

Q16.

Elements are made up of atoms.

(a) What is the approximate radius of an atom?

Tick **one** box.

1 × 10 m ☐

1 × 10^{-1} m ☐

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1×10^{-10} m ☐

1×10^{-100} m ☐

(1)

(b) The figure below shows the atoms of five elements.

$^{6}_{3}R$ $^{7}_{3}S$ $^{23}_{11}T$ $^{39}_{19}U$ $^{85}_{37}V$

The letters are **not** the symbols of these elements.

Complete the sentence.

All of the elements in the figure above are in Group

_____ of the periodic table.

(1)

(c) Which **two** atoms in the figure above are isotopes of the same element?

Explain your answer fully.

_____

_____

_____

_____

_____

(3)

(d) The halogens are in Group 7 of the periodic table.

Explain the trend in reactivity of the halogens.

_____

_____

_____

_____

_____

_____

_____

_____

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_____

_____

(6)

(Total 11 marks)

Q17.

This question is about drinking water.

(a) Name **two** methods of treating water from rivers, lakes or the sea to produce drinking water.

Tick **two** boxes.

Anaerobic digestion ☐

Cracking ☐

Desalination ☐

Electrolysis ☐

Sterilising ☐

(2)

(b) The table below shows the amounts of dissolved ions in a sample of drinking water.

Dissolved ion	**Mass in mg per dm^3**
Cl^-	250
Na^+	200
NO_3^+	40

What is the name of the ion with the symbol Cl^-?

Tick **one** box.

Calcium ion ☐

Carbonate ion ☐

Chloride ion ☐

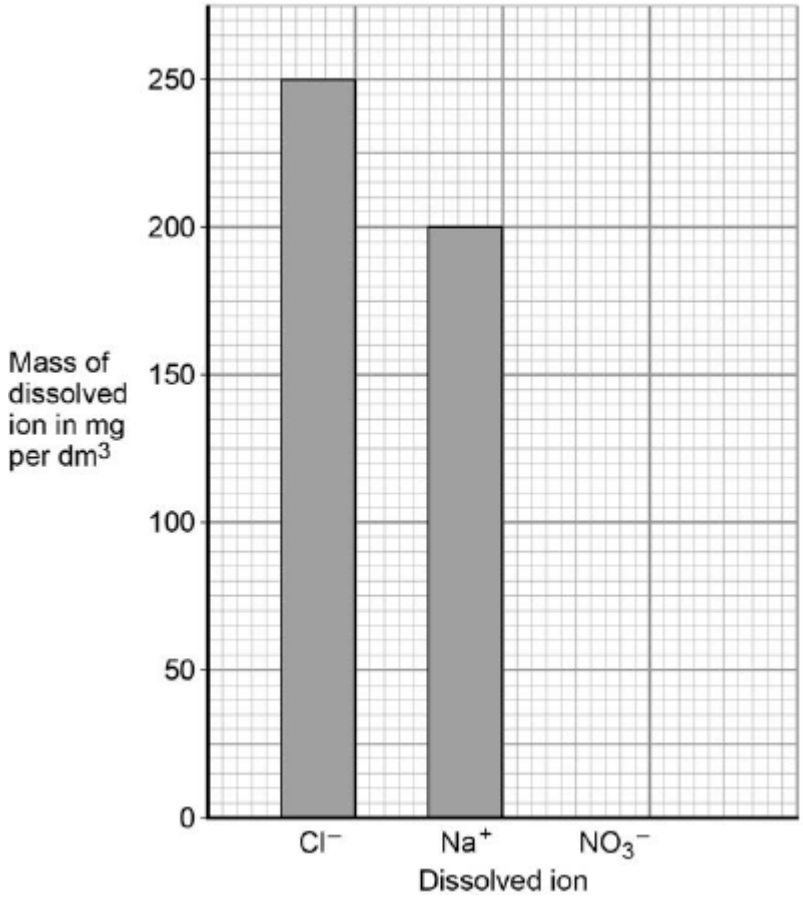
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Chlorine ion ☐

(1)

(c) Use the information in the table above to complete the bar chart in **Figure 1**.

Figure 1



(1)

(d) Look at the questions labelled **A, B, C, D**.

A How many substances are there in drinking water?

B How much fluoride is in drinking water?

C Is fluoride soluble in drinking water?

D Should fluoride be added to drinking water?

Which **one** of the questions cannot be answered by science alone?

Tick **one** box.

A		**B**		**C**		**D**	

(1)

(e) Give **two** reasons why the answer you have chosen cannot be answered by science alone.

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1. _____

_____

2. _____

_____

(2)

(f) A sample of drinking water contains 1.5 mg of fluoride per dm^3 of water.
A person drinks 1 dm^3 of this water.

The recommended daily amount of fluoride is 4.0 mg.

Which calculation gives the percentage of the recommended daily amount of fluoride in 1 dm^3 of this water?

Tick **one** box.

$\frac{1.5}{4.0} \times 100$ ☐

$\frac{1.5}{100} \times 4.0$ ☐

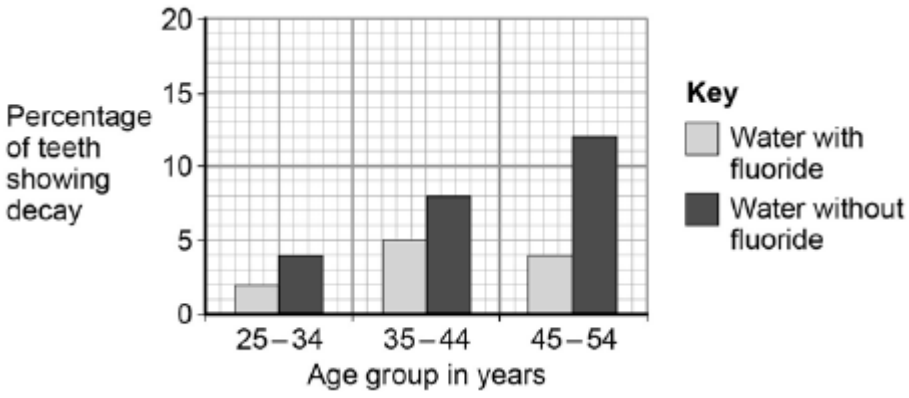
$\frac{4.0}{1.5} \times 100$ ☐

$\frac{100}{1.5} \times 4.0$ ☐

(1)

(g) **Figure 2** shows the effect of fluoride in drinking water on tooth decay in different age groups.

Figure 2



Describe the pattern of tooth decay in **Figure 2** for water without fluoride.

Use data to justify your answer.

_____

_____

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_____

_____

(2)

(h) Describe the effect of adding fluoride to drinking water for the age groups in **Figure 2**.

_____

_____

_____

_____

(2)

(Total 12 marks)

Q18.

In 1869 there were 60 known elements.

Mendeleev arranged the elements in order of their atomic mass (atomic weight).

He realised that elements with similar properties occurred at regular intervals.

(a) Suggest why one of the groups that is on today's periodic table was not in Mendeleev's periodic system.

_____

_____

_____

(1)

(b) Explain the arrangement of the first 20 elements in today's periodic table.

You should answer in terms of atomic structure.

_____

_____

_____

_____

(2)

(c) A student put some potassium bromide solution in a test tube.

She added a few drops of chlorine solution and observed the result.

She repeated the process using different potassium halide salts and different halogens.

The table below shows the student's results.

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Solution of halogen	Potassium chloride solution	Potassium bromide solution	Potassium iodide solution
Chlorine		Orange colour forms	Brown colour forms
Bromine	No reaction		Brown colour forms
Iodine	No reaction	No reaction	

Give the order of reactivity of the halogens from the results in the table above.

Explain how you used the results to show this order of reactivity.

Order _____

Explanation _____

_____

_____

_____

(2)

(d) Write a balanced ionic equation for the reaction of chlorine with bromide ions in solution.

_____

(3)

(e) Explain the order of reactivity of Group 7 elements.

Include information about atomic structure.

_____

_____

_____

_____

_____

(2)

(Total 10 marks)

Q19.

The table below shows information about some elements.

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Element	Melting point in °C	Boiling point in °C
Fluorine	–202	–188
Chlorine	–101	–35
Bromine	–7	59
Iodine	114	184
Astatine		

(a) Look at the table above.

Describe the trend in melting point from fluorine to astatine.

_____

_____

(1)

(b) Estimate the boiling point of astatine.

Use the table above to help you.

Boiling point of astatine = _____ °C

(1)

(c) Room temperature is 20 °C.

Which element in the table above is a liquid at room temperature?

_____

(1)

(d) To which group of the periodic table do the elements in the table above belong?

Tick **one** box.

Group 0 ☐

Group 1 ☐

Group 5 ☐

Group 7 ☐

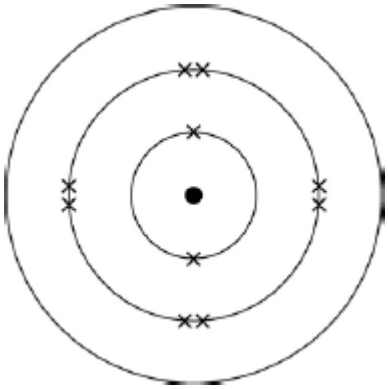
(1)

(e) A chlorine atom has 17 electrons.

On the figure below, use crosses to show the arrangement of electrons in the outer

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shell of a chlorine atom.



(1)

(f) Chlorine reacts with sodium bromide solution to produce bromine and sodium chloride solution.

Complete the symbol equation for the reaction.

___Cl_2 + _____ NaBr ⟶ _____ + _____

(2)

(g) Which element in the table above will react with sodium chloride solution?

Give a reason for your answer.

_____

_____

_____

_____

_____

_____

(2)

(Total 9 marks)

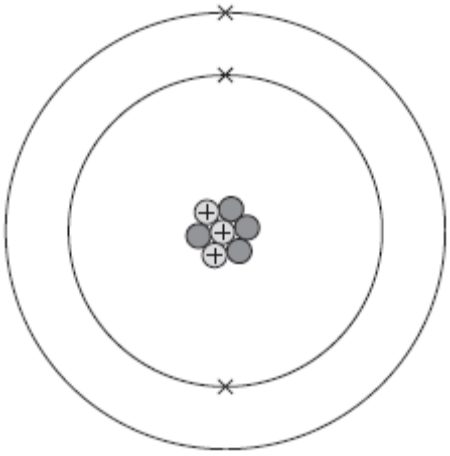
Q125.

(a) The structure in the diagram represents an atom of lithium.

The atom contains three types of particles:

- protons
- neutrons
- electrons.

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Describe the atomic structure of lithium.

Use the diagram to help you.

Include in your answer:

- the number of each type of particle
- where in the atom each particle is found.

(4)

(b) Use the Chemistry Data Sheet to help you answer this question.

Which element is in the same group as lithium?

Draw a ring around the correct answer.

beryllium **magnesium** **sodium**

(1)
(Total 5 marks)

Q126.

This question is about lithium.

(a) A lithium atom has an atomic number of 3 and a mass number of 7.

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Describe the atomic structure of lithium.

Include in your answer:
- the number of each type of particle
- where in the atom each particle is found.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(b) (i) Name **one** other element with similar chemical properties to lithium.

Use the Chemistry Data Sheet to help you name the element.

_____

(1)

(ii) Why are lithium and the element you named in part (i) classed as different elements?

_____

_____

(1)

(Total 6 marks)

Q127.

Helium is found underground. Scientists think that the helium reserves will last for a further 50 years. Helium is much lighter than air and escapes from the Earth's atmosphere when released.

Helium has many uses. Helium is used in medical scanners and space telescopes to keep them cool. Divers and some hospital patients breathe a mixture of helium and oxygen. Party balloons are filled with helium gas.

A party balloon and a diver are shown in **Figure 1**.

Figure 1

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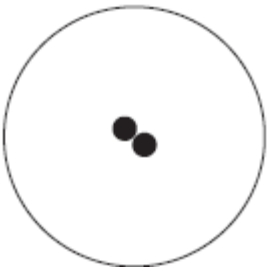
(a) Helium has a mass number of 4 and an atomic number of 2.

Figure 2 shows an incomplete diagram of the structure of a helium atom. A proton is shown as ●

Complete **Figure 2** to show the atomic structure of helium.

Represent an electron as **x** and a neutron as ○

Figure 2



(3)

(b) Helium is in Group 0 of the periodic table.

Why are the elements in Group 0 unreactive?

_____

_____

(1)

(c) Many scientists think that helium should **not** be used in party balloons.

Suggest **two** reasons why.

1. _____

_____

2. _____

_____

(2)

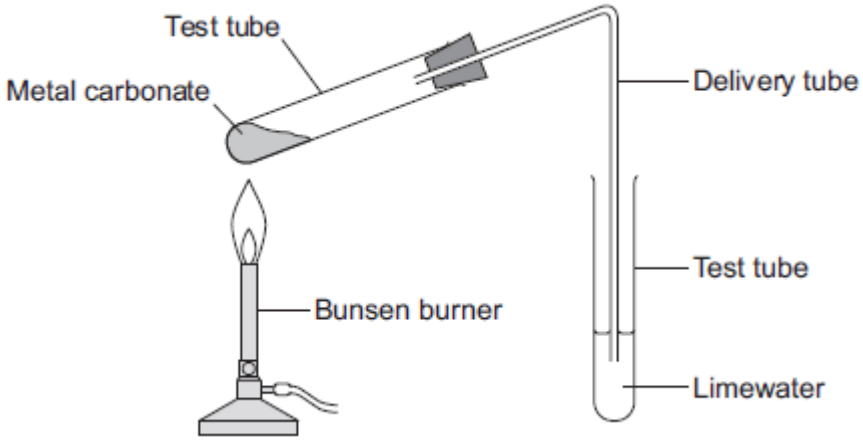
(Total 6 marks)

Q128.

A student investigated heating metal carbonates.

The student used the apparatus in the figure below.

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The student's results are shown in the table below.

Metal carbonate	**Colour before heating**	**Colour after heating**	**Mass before heating in g**	**Mass after heating in g**	**Limewater**
Copper carbonate	Green	Black	12.4	8.0	Turns cloudy
Potassium carbonate	White	White	13.8		
Zinc carbonate	White	White	12.5	8.1	

(a) Explain the observations seen when heating copper carbonate.

Include the names of the substances produced.

(3)

(b) (i) Potassium carbonate did **not** decompose when heated.

State why.

(1)

(ii) Complete the table above to show the results you would expect the student

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to obtain.

(3)

(Total 7 marks)

Q129.

Lithium batteries are used in laptops.



The batteries contain a lithium compound.
The formula of the compound is $LiCoO_2$

(a) Complete the table to show the number of atoms of each element in the formula, $LiCoO_2$

Lithium has been completed for you

Element	Number of atoms in the formula $LiCoO_2$
Lithium, Li	1
Cobalt, Co	
Oxygen, O	

(2)

(b) Some laptops have caught fire.

Scientists think sparks caused the fires.
The sparks caused small particles of lithium in the batteries to react with oxygen.

(i) Suggest where the oxygen reacting with the lithium came from.

_____

_____

(1)

(ii) Name the product of the reaction between lithium and oxygen.

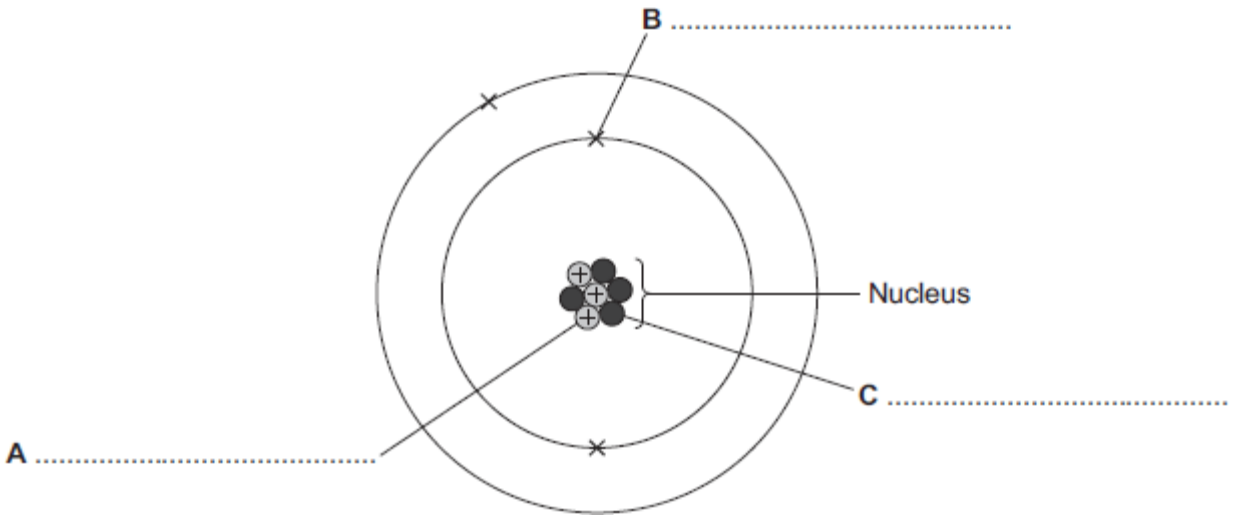
_____

(1)

(c) The diagram below shows the structure of a lithium atom.

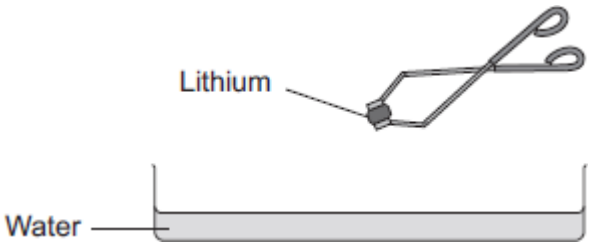
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Name the particles labelled **A**, **B** and **C** on the diagram.



(3)

(d) Lithium hydroxide and hydrogen are produced when lithium reacts with water.



(i) Describe what you would **see** when lithium is added to water.

_____

_____

_____

_____

(2)

(ii) Complete the word equation for the reaction between lithium and water.

lithium + water ⟶ _____ + _____

(1)

(Total 10 marks)

Q130.

Lithium batteries are used in laptops.

The batteries contain a lithium compound, $LiCoO_2$

The batteries are sealed to stop water and air entering them.

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(a) Some laptops have caught fire.

Scientists concluded sparks caused the fires. The sparks caused small particles of lithium in the batteries to react with oxygen. Lithium oxide (Li_2O) was produced.

(i) Write a balanced symbol equation for the reaction between lithium and oxygen.

_____ + _____ → _____

(2)

(ii) The batteries were sealed.

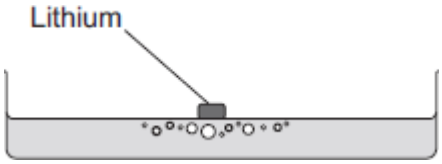
Suggest where the oxygen that reacted with the lithium came from.

_____

_____

(1)

(b) A teacher demonstrated how lithium reacts with water.



The students observed:

- the lithium reacting on the surface of the water
- bubbles of gas where lithium was in contact with the water.

The solution remaining in the trough was tested and found to be alkaline.

(i) Explain the students' observations, naming the substances produced.

_____

_____

_____

_____

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_____

_____

(3)

(ii) The teacher then investigated the reaction of sodium with water.

Suggest how sodium would react with water.

Explain why.

_____

_____

_____

_____

(2)

(Total 8 marks)

Q131.

Use the periodic table on the Chemistry Data Sheet to help you answer these questions.

The following is a list of elements.

calcium	**carbon**	**chlorine**	**copper**

Complete the sentences.

Choose your answers **only** from the elements shown in the box above.

The element with the chemical symbol C is _____ .

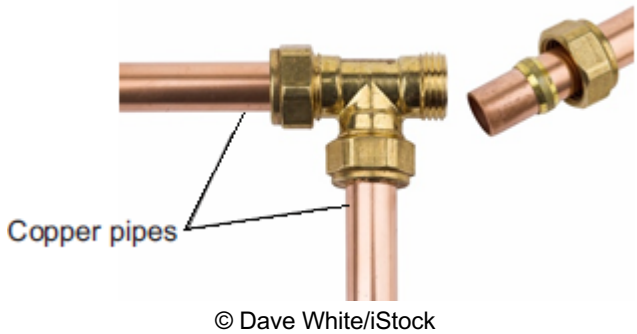
The element in the same group as fluorine is _____ .

The element with the atomic number of 20 is _____ .

(Total 3 marks)

Q132.

Copper is used in plumbing.



© Dave White/iStock

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(a) Complete the following sentence.

Elements in the central block of the periodic table, eg copper, iron and zinc, are called _____ metals.

(1)

(b) State three properties that make copper suitable for use in plumbing.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Copper can be extracted from copper ores by two methods:

Method 1 or	mining and smelting
Method 2	phytomining.

The main stages in the two methods are shown in the flow diagrams.

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Mining and smelting



© Dale Baxter/iStock

The copper ore is mined from the earth.

↓

The copper ore is heated in a furnace with carbon (smelting).

This produces impure copper.

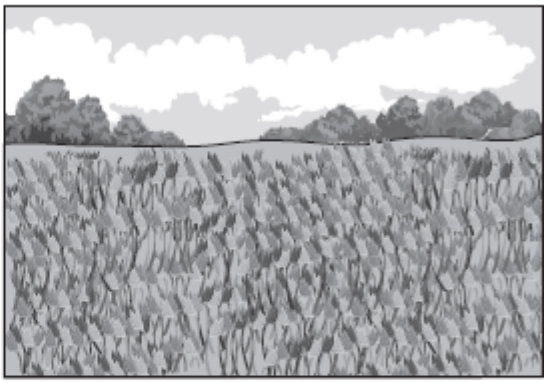
↓

The copper is purified by electrolysis.

↓

Pure copper is produced.

Phytomining



Plants are grown on soil containing low grade ores.

↓

The plants absorb copper compounds from the soil.

↓

The plants are burned.

The ash contains copper compounds.

↓

Copper is extracted from a solution made from the ash by electrolysis.

↓

Pure copper is produced.

Use information from the flow diagrams and your own knowledge to evaluate **both** methods of copper extraction.

Give the advantages **and** disadvantages of **both** methods.

Remember to include a conclusion in your answer.

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(6)

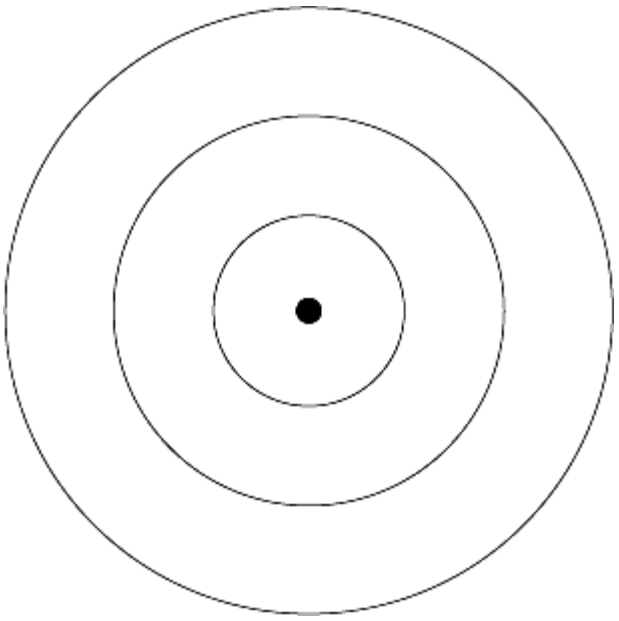
(Total 10 marks)

Q133.

Sodium is a reactive element.

(a) Complete the diagram to show the electronic structure of a sodium atom.

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(2)

(b) Sodium reacts with chlorine to form sodium chloride.

Explain how in terms of electrons, atoms and ions.

_____

_____

_____

_____

_____

_____

_____

_____

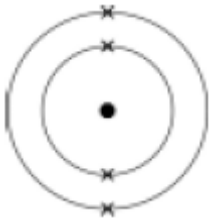
(4)

(Total 6 marks)

Q134.

A substance made of only one type of atom is called an element.

(a) The diagram represents the structure of an atom.



(i) What does the diagram tell you about this atom?

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_____

_____

_____

_____

_____

_____

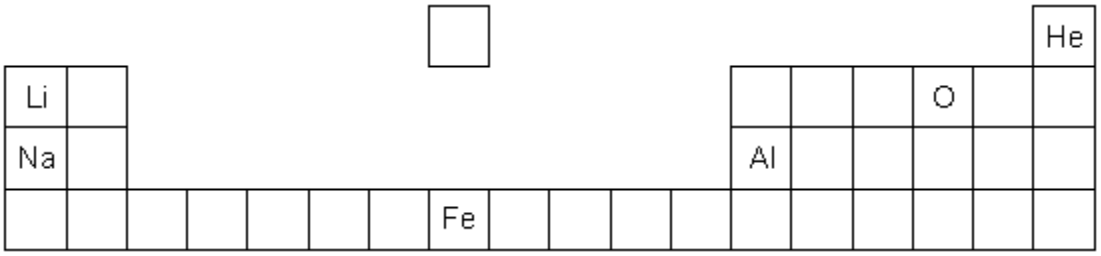
(3)

(ii) The atom of a different element has an atomic number of 5 and a mass of 11.
How many neutrons are in this atom?

_____

(1)

(b) The chemical symbols and positions of six elements in the periodic table are shown.



Draw a straight line from each description to its correct symbol.

Description	Symbol
A metal with a low density that does not corrode easily	Al
It has properties similar to those of sodium, Na	Fe
It is a transition metal	He
It is a noble gas	Li
	O

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(4)

(Total 8 marks)

Q135.

Atoms are made up of three main particles.

(a) Complete the table to show the names and charges of the particles in an atom.

Name of particle	Charge
proton	
	0
electron	–1

(2)

Use the periodic table on the Data Sheet to help you answer these questions.

(b) Why are lithium and sodium in the Group 1 of the periodic table?

_____

_____

(1)

(c) Helium is in Group 0 of the periodic table.

(i) Give **one** property of helium that is the same as other gases in Group 0.

_____

(1)

(ii) Give **one** property of helium that is different from other gases in Group 0.

_____

(1)

(Total 5 marks)

Q136.

There was little or no nitrogen in Earth's early atmosphere, but a gaseous compound of nitrogen was present in small amounts.

(a) Name this gaseous compound.

_____

(1)

(b) In 1892, Lord Rayleigh compared nitrogen from the air with very pure nitrogen obtained from nitrogen compounds. The density of the nitrogen was:

nitrogen from the air = 1.2572 grams per litre

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nitrogen from nitrogen compounds = 1.2511 grams per litre.

Rayleigh and Sir William Ramsay proved that atmospheric nitrogen was not pure but contained five other gases, which together made up about 1 % of the Earth's atmosphere.

The gases were argon (0.94 %) and traces of helium, neon, krypton and xenon. The five gases are similar in that they show no chemical reactions but have different physical properties, eg density, melting point, boiling point.

(i) Suggest **one** reason why scientists did **not** find these five gases in the atmosphere at an earlier date.

_____

_____

(1)

(ii) Give **one** way of separating the five gases from each other.

_____

_____

(1)

(iii) From the information given in the question, which prediction can be safely made?

Tick (✓) **one** box.

Nitrogen makes up about 78 % of the atmosphere.	☐
Argon has a density greater than the density of nitrogen.	☐
Neon, krypton and xenon have a density lower than the density of nitrogen.	☐
Nitrogen from nitrogen compounds must contain a very light gas such as hydrogen.	☐

(1)

(Total 4 marks)

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