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

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

$$Ca(s) + 2H_2O(l) \rightarrow Ca(OH)_2(s) + H_2(g)$$

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

(2)

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(b) Magnesium reacts very slowly with cold water but it reacts faster with steam, H_2O, and forms magnesium oxide, MgO, and hydrogen.

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

(2)

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(c) 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)

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(d) 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)

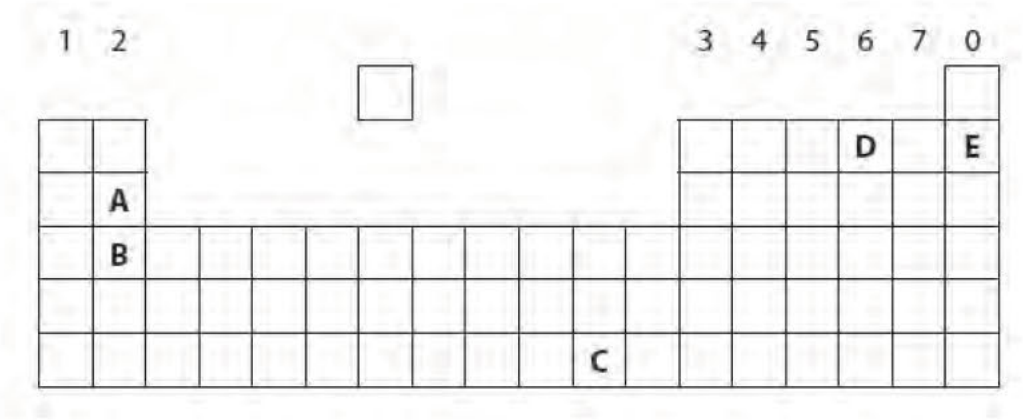
(3)

empirical formula = ...

(Total for Question 1 = 9 marks)

2 The positions of five elements, **A**, **B**, **C**, **D** and **E**, are shown in the periodic table.

These letters are not the atomic symbols of these elements.



(a) Use only elements **A**, **B**, **C**, **D** and **E** to answer (i) and (ii).

(i) Give the letters of **all** the elements that are metallic.

(1)

.....

(ii) Give the letters of the **two** elements that have the most similar chemical properties.

(1)

.....

(b) An atom of element **B** contains more protons than an atom of element **A**.

State how many more protons there are in an atom of element **B** than in an atom of element **A**.

(1)

.....

(c) An atom of element **E** has atomic number 10 and mass number 22.

(i) How many electrons does this atom contain?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** 10

☐ **B** 12

☐ **C** 22

☐ **D** 32

(ii) 10% of the atoms in a sample of element **E** have a mass number of 22.
All the other atoms in this sample have a mass number of 20.

Calculate the relative atomic mass of element **E**.

(3)

relative atomic mass = ...

(d) The element below **E** in the periodic table is used to fill filament light bulbs.

Explain why this element is suitable for this use.

(2)

(Total for Question 2 = 9 marks)

3 The elements in group 3 of the periodic table are boron, aluminium, gallium, indium and thallium.

(a) Elements can be classified as metals or non-metals.

Explain, using its position in the periodic table, whether indium is a metal or a non-metal.

(2)

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(b) Each aluminium atom has 13 electrons.

State the electronic configuration of an aluminium atom.

(1)

.....

(c) Boron has an atomic number of 5.
There are two isotopes of boron, boron-10 and boron-11.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Every boron atom contains

(1)

☒ **A** five protons

☒ **B** five neutrons

☒ **C** eleven electrons

☒ **D** eleven neutrons

(ii) Explain what is meant by the term **isotopes**.

(2)

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(iii) A sample of boron contains the two isotopes, boron-10 and boron-11.
The relative atomic mass of boron is 10.8

Give the reason why the relative atomic mass is closer to 11 than 10.

(1)

.....

.....

(Total for Question 3 = 7 marks)

4 (a) Atoms contain protons, neutrons and electrons.

Complete the table to show the relative mass and relative charge of each particle and its position in an atom.

(3)

	relative mass	relative charge	position in atom
proton		+1	
neutron	1		in nucleus
electron			

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

An atom of an element **always** contains

(1)

☒ **A** more protons than neutrons

☒ **B** equal numbers of protons and neutrons

☒ **C** more electrons than protons

☒ **D** equal numbers of protons and electrons

(c) The symbols for some atoms are given in the box

Ca	Cl	K	N	Ne	O

From the box, choose the symbol of

(i) an atom in group 2 of the periodic table

(1)

.....

(ii) an atom that readily forms an ion with a charge of 2–

(1)

.....

(d) The formula of aluminium nitrate is $Al(NO_3)_3$

(i) State the total number of atoms in the formula $Al(NO_3)_3$

(1)

.....

(ii) What is the most likely formula of aluminium nitride?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** $Al(NO_3)_2$

☐ **B** $AlNO_3$

☐ **C** $AlNO_2$

☐ **D** AlN

(Total for Question 4 = 8 marks)

5 (a) The table shows the number of electrons, neutrons and protons in particles P, Q, R, S, T and V.

particle	number of		
	electrons	neutrons	protons
P	1	0	1
Q	3	4	3
R	8	8	8
S	13	14	13
T	18	16	16
V	18	20	20

(i) Which particle is a negatively charged ion?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** P

☒ **B** S

☒ **C** T

☒ **D** V

(ii) Which particles are atoms of metals?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** P and R

☒ **B** Q and R

☒ **C** Q and S

☒ **D** Q, S and V

(b) Each element has an atomic number.

(i) State what is meant by **atomic number**.

(1)

.....

.....

(ii) The atomic number of boron is 5.
Boron exists as two isotopes boron-10 and boron-11.

Use this information to explain why boron-10 and boron-11 are isotopes.

(2)

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(c) (i) Explain what is meant by the term relative atomic mass.

(2)

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(ii) A sample of boron contains
19.7% of boron-10.
80.3% of boron-11.

Use this information to calculate the relative atomic mass of boron.

(3)

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(Total for Question 5 = 10 marks)