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 ☒.

Metal atoms

1 The table shows some information about four metals.

metal	atomic number	electronic configuration
lithium	3	2.1
sodium	11	
magnesium	12	2.8.2
calcium	20	2.8.8.2

(a) State the electronic configuration of sodium.

(1)

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(b) Magnesium and calcium are in the same group of the periodic table.

Explain why they are both in the same group.

(2)

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

The atomic number of an element is equal to the number of

(1)

☒ **A** neutrons in the nucleus of its atom

☒ **B** electrons in the nucleus of its atom

☒ **C** protons in the nucleus of its atom

☒ **D** protons and neutrons in the nucleus of its atom

(d) Which of these statements is correct about the particles in atoms?

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

(1)

☒ **A** a proton has the same mass as an electron

☒ **B** an electron is heavier than a proton

☒ **C** a neutron is lighter than an electron

☒ **D** a neutron has the same mass as a proton

(e) A lithium atom contains charged particles and yet the atom has no overall charge.

Explain why.

(2)

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(Total for Question 1 = 7 marks)

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 ☒.

Group 3

1 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)

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(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)

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.....

(Total for Question 1 = 7 marks)

Atoms and isotopes

4 (a) An atom of copper has an atomic number of 29 and a mass number of 63.

(i) Complete the table to show the numbers of protons, neutrons and electrons in this atom of copper.

(2)

particle	number
proton	
neutron	
electron	

(ii) Copper is in period 4 of the periodic table.

State what information this gives about the number of shells that contain electrons, in a copper atom.

(1)

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(iii) Copper exists as isotopes.

Explain what is meant by the term **isotopes**.

(2)

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.....

(iv) A sample of copper contains

70% of copper-63 atoms and

30% of copper-65 atoms.

Use this information to calculate the relative atomic mass of copper in this sample.

(3)

relative atomic mass of copper = ...

(b) Copper nitrate contains copper ions, Cu^{2+}, and nitrate ions, NO_3^-.

(i) Describe, in terms of electrons, how a copper atom, Cu, becomes a copper ion, Cu^{2+}.

(2)

(ii) Write the formula for copper nitrate.

(1)

(Total for Question 4 = 11 marks)

Elements

5 (a) Argon is an element in Group 0 of the periodic table.
It is used as the gas in filament lamps.

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

Argon is used in filament lamps because it

(1)

☒ **A** has a low density

☒ **B** is a good conductor of electricity

☒ **C** is flammable

☒ **D** is inert

(b) Metals are malleable.

Explain, in terms of their structures, why metals are malleable.

(2)

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(c) In an experiment, 3.1 g of phosphorus reacted with 24 g of bromine to form phosphorus bromide.

Calculate the empirical formula of the phosphorus bromide.

You must show your working.

(relative atomic masses: P = 31, Br = 80)

(3)

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.....

empirical formula .....

*(d) Group 1 of the periodic table contains the alkali metals lithium, sodium and potassium.
The alkali metals show a pattern in their reactivity with water.
This pattern is shown when small pieces of lithium, sodium and potassium are added separately to water.

Describe the reactions and what would be seen and explain the pattern in reactivity.

You may include equations as part of your answer.

(6)

Alkali metals

2 Lithium, sodium and potassium are metals in group 1 of the periodic table.
They are good conductors of heat and electricity.
The freshly-cut metals are shiny.

(a) (i) Give another physical property of all three of these metals.

(1)

.....

(ii) Explain, in terms of electrons in their atoms, why lithium, sodium and potassium are in group 1 of the periodic table.

(2)

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(b) A small piece of potassium is added to water.

(i) Describe what you would **see** in this reaction.

(2)

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.....

(ii) Which of these is the balanced equation for this reaction?

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

(1)

☒ **A** $2K + 2H_2O \rightarrow K_2O + 2H_2$

☒ **B** $2K + H_2O \rightarrow K_2O + H_2$

☒ **C** $4K + 3H_2O \rightarrow 4KOH + H_2$

☒ **D** $2K + 2H_2O \rightarrow 2KOH + H_2$

(c) There is an increase in reactivity of these group 1 metals from lithium to potassium.

Explain this increase in reactivity.

(2)

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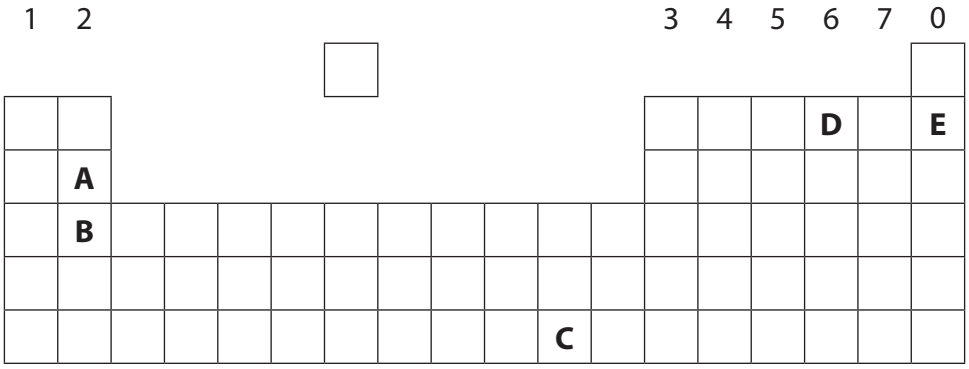
(Total for Question 2 = 8 marks)

Elements in the periodic table

3 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 3 = 9 marks)

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 ☒.

Particles and formulae

1 (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 1 = 8 marks)

Metals

3 There are many metallic elements in the periodic table.

(a) Which row of the table correctly shows two metals that are in group 1 and two metals that are transition metals?

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

(1)

	group 1	transition metals
☒ **A**	lithium and zinc	calcium and copper
☒ **B**	potassium and caesium	copper and iron
☒ **C**	sodium and potassium	copper and magnesium
☒ **D**	sodium and magnesium	manganese and nickel

(b) (i) Describe the structure of metals in terms of the particles present in their structures.

(2)

.....

.....

.....

(ii) Explain how metals conduct electricity.

(2)

.....

.....

.....

(c) (i) Describe what you would **see** when a small piece of sodium is added to water.

(2)

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.....

.....

(ii) Write the balanced equation for the reaction of sodium with water to form sodium hydroxide and hydrogen.

(3)

.....

(Total for Question 3 = 10 marks)