Questions are for both separate science and combined science students unless indicated in the question

1 The Periodic Table is shown on page 2.

(a) In the Periodic Table, which number increases from 3 to 10 in Period 2?

(1)

.....

(b) In the Periodic Table, which number increases from 9 to 226 in Group 2?

(1)

.....

(c) An atom of boron contains protons, neutrons and electrons.

Use words from the box to complete the sentences.

Your may use each word once, more than once or not at all.

protons	neutrons	electrons

(i) The particles with the smallest mass are ..... .

(1)

(ii) The particles with a negative charge are ..... .

(1)

(iii) The two types of particle in the nucleus of a boron atom

(1)

are ..... and ..... .

(iv) In a boron atom there are equal numbers of

(1)

..... and ..... .

(v) The element boron has isotopes.

(1)

These isotopes have different numbers of ..... .

(Total for Question 1 = 7 marks)

2 The diagram shows the positions of some elements in the Periodic Table.

1	2											3	4			7	0
							H										He
																F	
Na																Cl	
K																Br	

(a) Complete the following sentence.

(1)

The elements in the Periodic Table are arranged in order of .....

.....

(b) Name an element shown in the diagram that is:

(2)

(i) a metal .....

(ii) a halogen .....

(c) (i) Name **two** elements in the diagram that react together to form an ionic compound.

(1)

..... and .....

(ii) Draw a dot and cross diagram for the ions in the compound formed in (c)(i).
Show only the outer electrons. Include the charge on each ion.

(3)

(d) Chlorine reacts quickly with hot iron to form iron(III) chloride.
Bromine reacts less quickly with hot iron to form iron(III) bromide.

Suggest how fluorine reacts with hot iron and name the compound formed.

(2)

.....

.....

(e) When chlorine gas is bubbled through an aqueous solution of sodium bromide, a displacement reaction takes place.

The ionic equation for the reaction is:

$$Cl_2(g) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$$

State the colour change that you would observe in the solution during this reaction.

(2)

Colour at start .....

Colour at end .....

(Total for Question 2 = 11 marks)

3 Use the the Periodic Table on page 2 to answer this question.

(a) (i) The symbol for silver is

(1)

☒ **A** Ag ☒ **B** As ☒ **C** S ☒ **D** Si

(ii) The element with an atomic number of 40 is

(1)

☒ **A** Al ☒ **B** Ar ☒ **C** Ca ☒ **D** Zr

(b) An atom of an element has the electronic configuration 2.8.3

(i) State the number of the group in the Periodic Table in which this element is found.

(1)

.....

(ii) Explain your answer in terms of the atom's electronic configuration.

(1)

.....

.....

(iii) State the number of the period in the Periodic Table in which this element is found.

(1)

.....

(iv) Explain your answer in terms of the atom's electronic configuration.

(1)

.....

.....

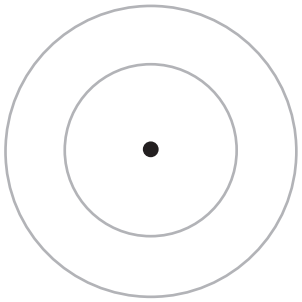
(v) Identify the element.

(1)

.....

(c) Complete the diagram to show the electronic configuration of an atom of fluorine, using x to represent an electron.

(1)



(Total for Question 3 = 8 marks)

4 This question is about bonding, structures and properties.

(a) The box gives four types of structure.

giant covalent	giant ionic	giant metallic	simple molecular

The table shows some properties of four substances, A, B, C and D.

Complete the table by giving the correct type of structure for each substance.

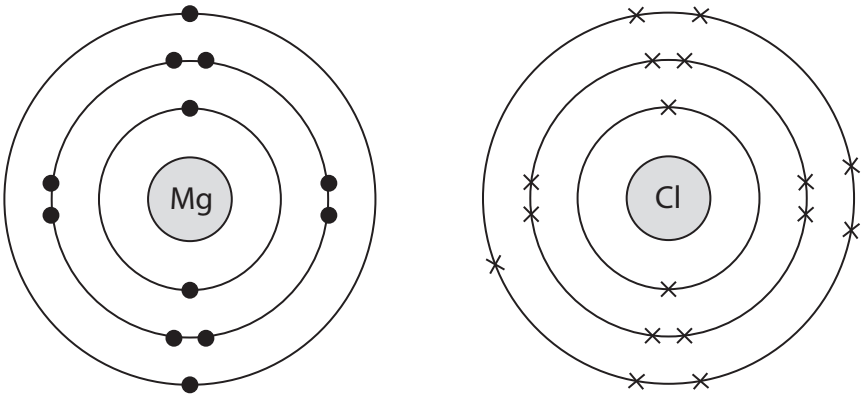
You may use each structure once, more than once or not at all. **(separate only)**

(4)

Substance	Electrical conductivity		Melting point	Type of structure
	of the solid	of the liquid		
A	poor	poor	low	
B	poor	poor	high	
C	good	good	high	
D	poor	good	high	

(b) Magnesium chloride ($MgCl_2$) is an ionic compound.

The diagram shows the electronic configurations of atoms of magnesium and chlorine.



(i) Describe how magnesium atoms and chlorine atoms form magnesium ions and chloride ions.

(3)

.....

.....

.....

.....

.....

.....

(ii) Draw a diagram to represent the electronic configurations of each of the ions in magnesium chloride.

Show the charge on each ion.

(3)

(c) A molecule of carbon dioxide contains double covalent bonds.

Complete the diagram, using dots and crosses, to show the arrangement of the outer electrons in a molecule of carbon dioxide.

O C O

(2)

(d) Indium is a metal in Group 3 of the Periodic Table.

(i) Describe the structure and bonding in indium. **(separate only)**

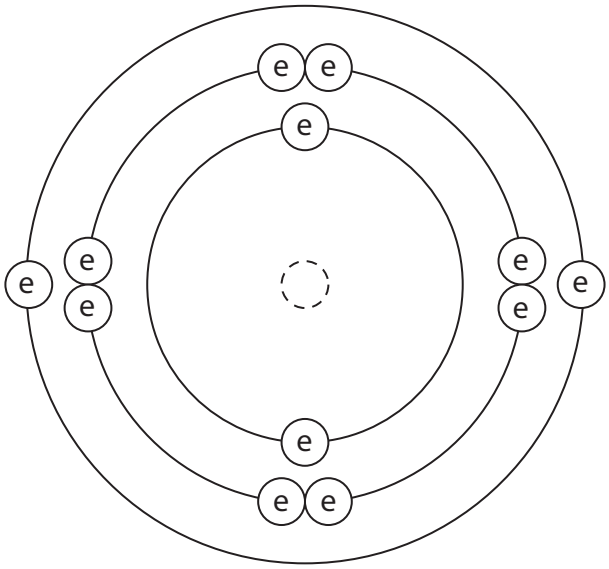
(3)

(ii) Explain why indium is malleable. **(separate only)**

(2)

(Total for Question 4 = 17 marks)

5 The diagram shows the electronic configuration of an atom of element X.



(a) (i) How many protons does the nucleus of the atom contain?

(1)

.....

(ii) Which group of the Periodic Table contains element X?

Give a reason for your choice.

(2)

.....

.....

.....

.....

(iii) Give the formula of the ion formed by element X in its compounds.

(1)

.....

(b) Element X has three isotopes.

The table gives the mass number of each isotope and its percentage abundance in a sample of element X.

Mass number	Percentage abundance (%)
24	79.0
25	10.0
26	11.0

Calculate the relative atomic mass (A_r) of element X.

Give your answer to one decimal place.

(3)

relative atomic mass of X = ...

(Total for Question 5 = 7 marks)

6 Boron is an element in Group 3 of the Periodic Table.

An atom of boron can be represented as $^{11}_{5}B$

(a) Use numbers from the box to complete the sentences about this atom of boron.

3	5	6	11	16

Each number may be used once, more than once or not at all.

(i) The atomic number of boron is .....

(1)

(ii) The mass number of boron is .....

(1)

(iii) This atom of boron contains ..... protons.

(1)

(iv) This atom of boron contains ..... neutrons.

(1)

(v) This atom of boron contains ..... electrons.

(1)

(b) Aluminium is another element in Group 3 of the Periodic Table.

Select a word or phrase from the box to complete each sentence about an atom of aluminium.

fewer	m e	the same number of

Each word or phrase may be used once, more than once or not at all.

(i) Compared to an atom of boron, an atom of aluminium has

..... protons.

(1)

(ii) Compared to an atom of boron, an atom of aluminium has

..... neutrons.

(1)

(iii) Compared to an atom of boron, an atom of aluminium has

..... electrons in its **outer** shell.

(1)

(c) The electronic configuration of aluminium is

(1)

- ☒ **A** 2.3
- ☒ **B** 2.2.3
- ☒ **C** 2.2.8
- ☒ **D** 2.8.3

(Total for Question 6 = 9 marks)

7 This question is about bromine and some of its compounds.

(a) Atoms of bromine can be represented as ^{79}Br and ^{81}Br

(i) State the number of protons, neutrons and electrons in an atom of ^{79}Br

(2)

Protons .....

Neutrons .....

Electrons .....

(ii) What name is used for atoms of bromine that have different numbers of neutrons?

(1)

.....

(iii) Why do all atoms of bromine have the same chemical properties?

(1)

.....

.....

(iv) The relative atomic mass of bromine is given in the Periodic Table as 80, but a more accurate value is 79.9

Suggest, with a reason, which of the atoms ^{79}Br and ^{81}Br exists in greater numbers in a sample of bromine.

(2)

.....

.....

.....

.....

(b) Hydrogen bromide (HBr) and sodium bromide (NaBr) are compounds of bromine.

(i) Draw a dot and cross diagram to represent a hydrogen bromide molecule.

Show only the outer electrons in each atom.

(2)

(ii) Explain how the atoms are held together in a hydrogen bromide molecule.

(2)

.....

.....

.....

(iii) Explain why sodium bromide has a higher melting point than hydrogen bromide.

(3)

.....

.....

.....

.....

.....

.....

(c) A compound has the percentage composition 13.8% sodium, 47.9% bromine and 38.3% oxygen by mass.

Calculate its empirical formula.

(3)

Empirical formula = ...

(Total for Question 7 = 16 marks)