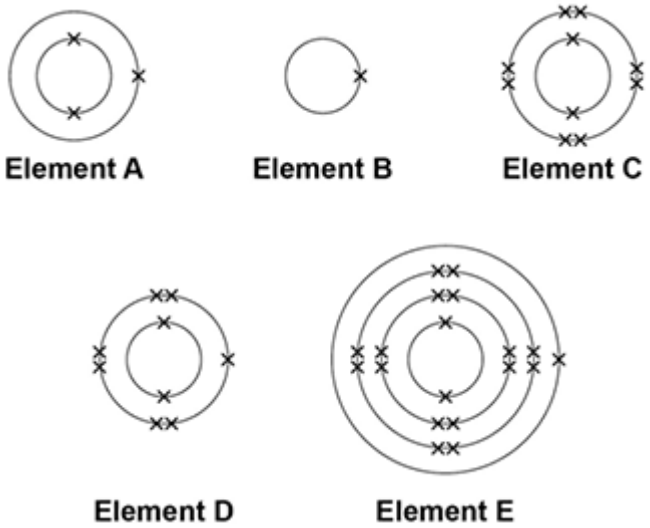
Q1. The electronic structure of the atoms of five elements are shown in the figure below.

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



Choose the element to answer the question. Each element can be used once, more than once or not at all.

Use the periodic table to help you.

(a) Which element is hydrogen?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

(b) Which element is a halogen?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

(c) Which element is a metal in the same group of the periodic table as element **A**?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

(d) Which element exists as single atoms?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

(e) There are two isotopes of element **A**. Information about the two isotopes is shown in the table below.

Mass number of the isotope	6	7
Percentage abundance	92.5	7.5

Use the information in the table above above to calculate the relative atomic mass of element **A**.
Give your answer to 2 decimal places.

.....

.....

.....

.....

.....

.....

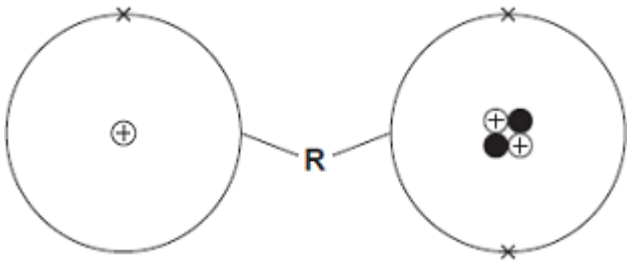
.....

Relative atomic mass = ...

(4)
(Total 8 marks)

Q2. The Sun is mainly hydrogen and helium.
The diagrams show an atom of hydrogen and an atom of helium.

Hydrogen **Helium**



(a) Draw a ring around the correct answer to complete each sentence.

(i) The centre of each atom is called the

molecule.
nucleus.
shell.

(1)

(ii) The circle (labelled **R**) around the centre of each atom is called

a bond.
an electrical charge.
an energy level (shell).

(1)

(b) Use the diagrams in part (a) to help you to answer these questions.

Draw **one** line from each question to its correct answer.

Question	Answer
How many protons are there in the hydrogen atom?	1
How many electrons are there in the helium atom?	2
What is the mass number of the helium atom?	3
	4

(3)

(c) The Sun is 73% hydrogen and 25% helium. The rest is other elements.

What is the percentage of other elements in the Sun?

..... %

(1)

(d) One of the other elements in the Sun is neon.
Neon is in the same group of the periodic table as helium.

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

(i) How many protons are there in a neon atom?

.....

(1)

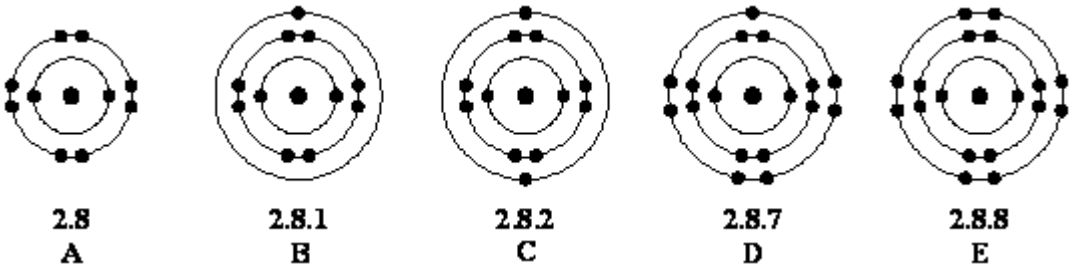
(ii) Which group of the periodic table are helium and neon in?

.....

(1)
(Total 8 marks)

Q3. Use the Data Sheet to help you answer this question.

When sodium reacts with water it forms sodium ions.
The diagrams below represent the electron arrangements of some atoms and ions.



Which of the diagrams, **A** to **E**, represents the electron arrangement of each of the following?

(i) A sodium atom, Na .....

(ii) A sodium ion, Na^+ .....

(Total 2 marks)

Q4. You will find it helpful to use the information on the Data Sheet when answering this question.

In the nucleus of an aluminium atom are:

13 protons
and 14 neutrons.

(a) Complete these sentences.

(i) The mass number of the aluminium atom is ..... .

(ii) In an atom of aluminium there are ..... electrons.

(2)

(b) Why is an aluminium atom electrically neutral?

.....

.....

.....

(2)

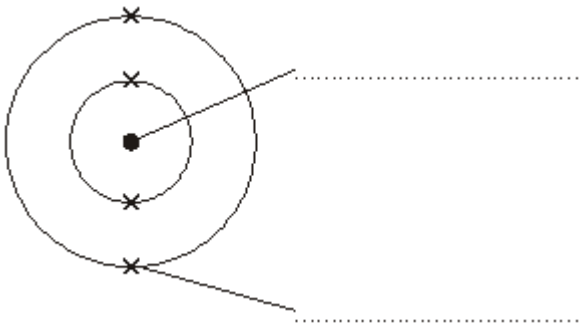
(c) Complete the table for the element fluorine.

PARTICLE	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
Fluorine atom	9		9
Fluoride atom		10	

(3)
(Total 7 marks)

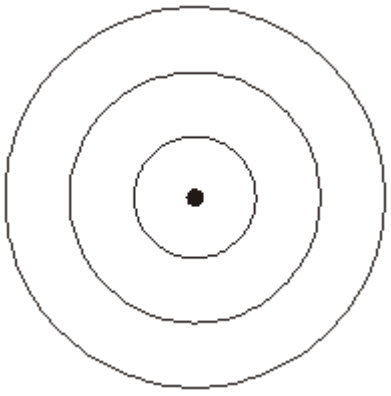
Q5. (a) The diagram represents an atom of beryllium. Use words from the box to label the diagram.

electron	**ion**	**isotope**	**molecule**	**nucleus**



(2)

(b) Use crosses (*x*) to complete the diagram to show the electronic structure of a magnesium atom. The atomic (proton) number of magnesium is 12.



(2)
(Total 4 marks)

Q6. This question is about the structure of atoms.

(a) Choose words from the list to complete the sentences below.

electrons ions neutrons protons

In an atom, the particles with a negative charge are called .....

Particles in the nucleus with no charge are called .....

An atom has no overall charge because is has the same number of electrons and

.....

(3)

(b) Two isotopes of the element carbon are:

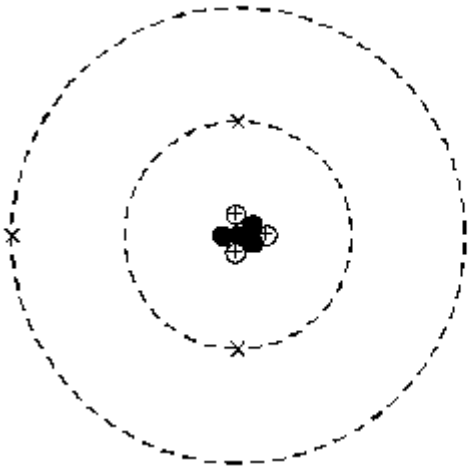
$^{12}_{6}C$ and $^{14}_{6}C$

Complete the table of information for these two isotopes.

	ATOMIC NUMBER	MASS NUMBER	NUMBER OF PROTONS	NUMBER OF NEUTRONS
Isotope $^{12}_{6}C$	6	12	6	6
Isotope $^{12}_{6}C$	6		6	

(2)
(Total 5 marks)

Q7. The diagram shows the structure of a lithium atom.



KEY

⊕ = proton

× = electron

(a) (i) What is represented by ● .....

(ii) What is represented by  .....

(2)

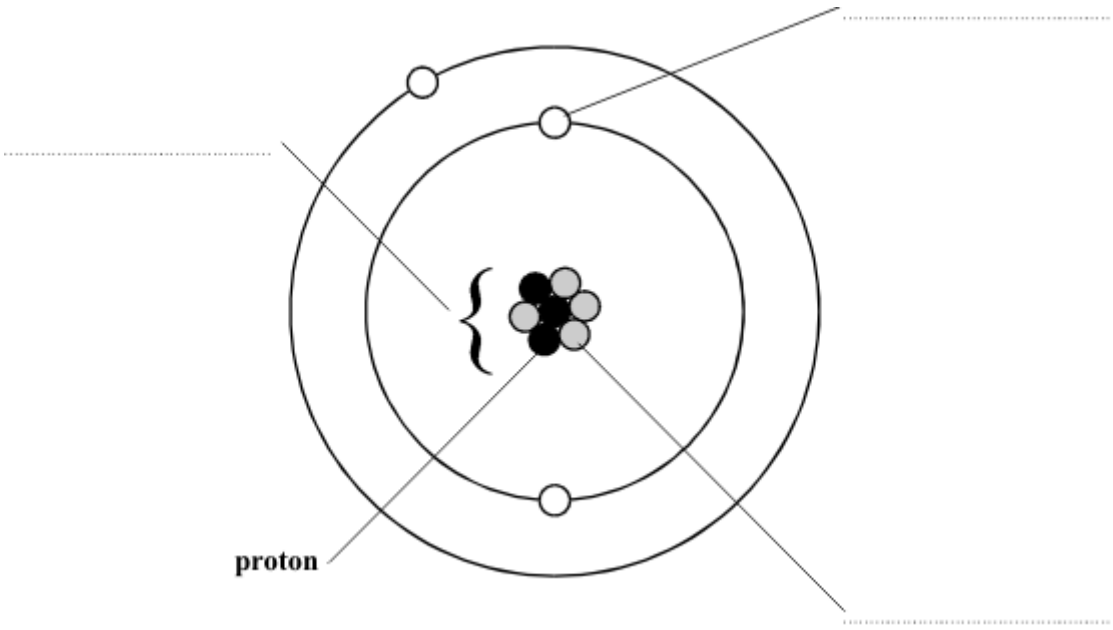
(b) What is the symbol for lithium? .....

(1)

(Total 3 marks)

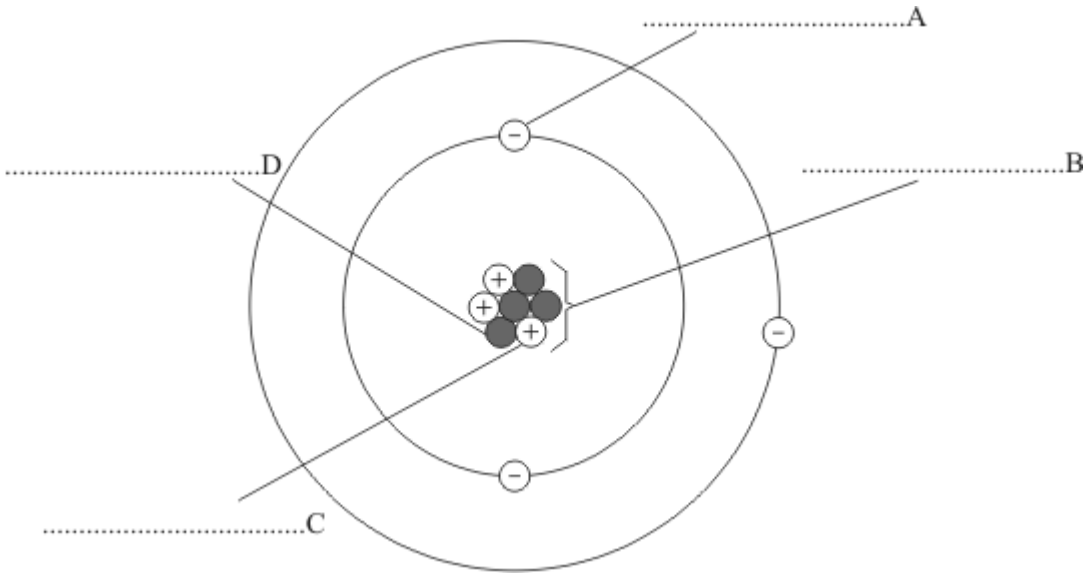
Q8. The diagram represents an atom. Choose words from the list to label the diagram.

electron **ion** **neutron** **nucleus**



(Total 3 marks)

Q9. The diagram shows an atom.



(a) On the diagram, write the names of structures **A**, **B**, **C** and **D**.

(4)

(b) To which Group of the periodic table does this atom belong?

.....

Give **one** reason for your answer.

.....

.....

(2)

(c) Name the element which is made up of this type of atom.

.....

(1)

(Total 7 marks)

Q10. An atom of aluminium has the symbol $^{27}_{13}Al$

(a) Give the number of protons, neutrons and electrons in this atom of aluminium.

Number of protons .....

Number of neutrons .....

Number of electrons .....

(3)

(b) Why is aluminium positioned in Group 3 of the periodic table?

.....

.....

(1)

(c) In the periodic table, the transition elements and Group 1 elements are metals.

Some of the properties of two transition elements and two Group 1 elements are shown in the table below.

	Transition elements		**Group 1 elements**	
	Chromium	Iron	Sodium	Caesium
Melting point in °C	1857	1535	98	29
Formula of oxides	CrO Cr_2O_3 CrO_2 CrO_3	FeO Fe_2O_3 Fe_3O_4	Na_2O	Cs_2O

Use your own knowledge **and** the data in the table above to compare the chemical and physical properties of transition elements and Group 1 elements.

.....

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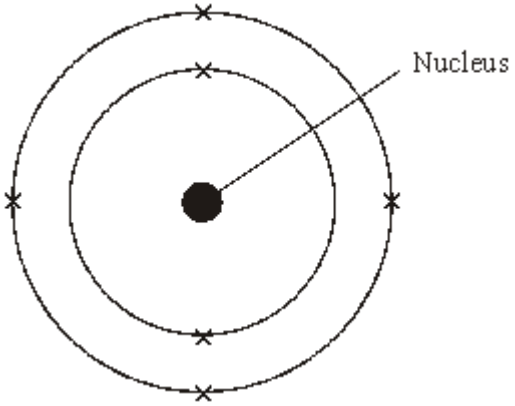
.....

.....

(6)
(Total 10 marks)

Q11. The diagram represents the electronic structure of an atom of an element.



The periodic table on the Data Sheet may help you with this question.

(a) Name this element.

.....

(1)

(b) Complete this sentence.

The nucleus of an atom contains neutrons and .....

(1)
(Total 2 marks)

Q12. Sando-K is a medicine. It is given to people whose bodies contain too little of a particular element.

Sando-K is a mixture of two compounds. The formulae of the two compounds are given below.

$KHCO_3$ **KCl**

(a) Use the Data Sheet to help you to name all the elements in these compounds.

.....

.....

.....

.....

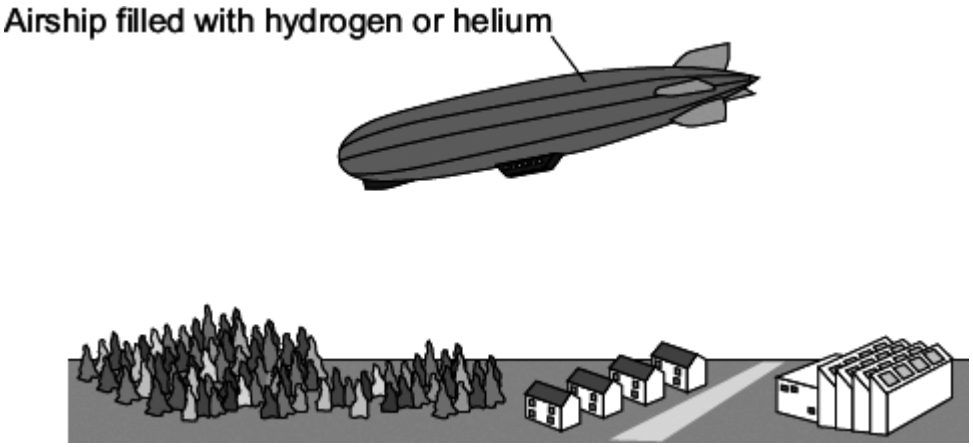
(3)

(b) Which metal do people given Sando-K need?

.....

(1)
(Total 4 marks)

Q13. Hydrogen and helium have both been used in airships.



(a) Tick (✓) the property which both hydrogen and helium have that makes an airship float in air.

Property	Tick (✓)
Colourless	
Less dense than air	
More dense than air	

(1)

(b) (i) Hydrogen is no longer used in airships because it burns in oxygen.

The chemical equation for this reaction is shown.

$2H_2 + O_2 \rightarrow 2H_2O$

Complete the word equation for this reaction

hydrogen + oxygen → .....

(1)

(ii) Helium is safer than hydrogen because it does **not** burn in oxygen.

Draw a ring around the correct answer to complete the sentence.

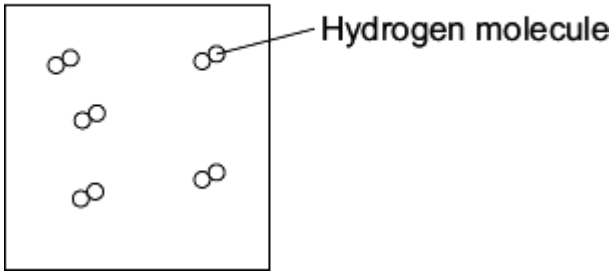
Helium is now used in airships because it is

a fuel.
already in the air.
unreactive.

(1)

(c) **Diagram 1** represents hydrogen molecules.

Diagram 1



Draw a ring around the correct answer to complete the sentence.

Each hydrogen molecule is made up of two hydrogen

atoms.
compounds.
elements.

(1)

(d) **Diagram 2** shows the parts of a helium atom.

Use words from the box to label **diagram 2.**

bond	**electron**	**nucleus**

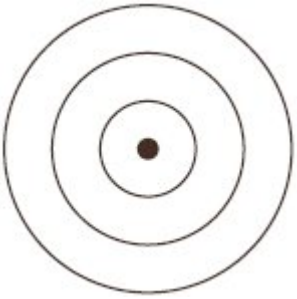
Diagram 2

(2)
(Total 6 marks)

Q14. Aluminium is a useful metal.

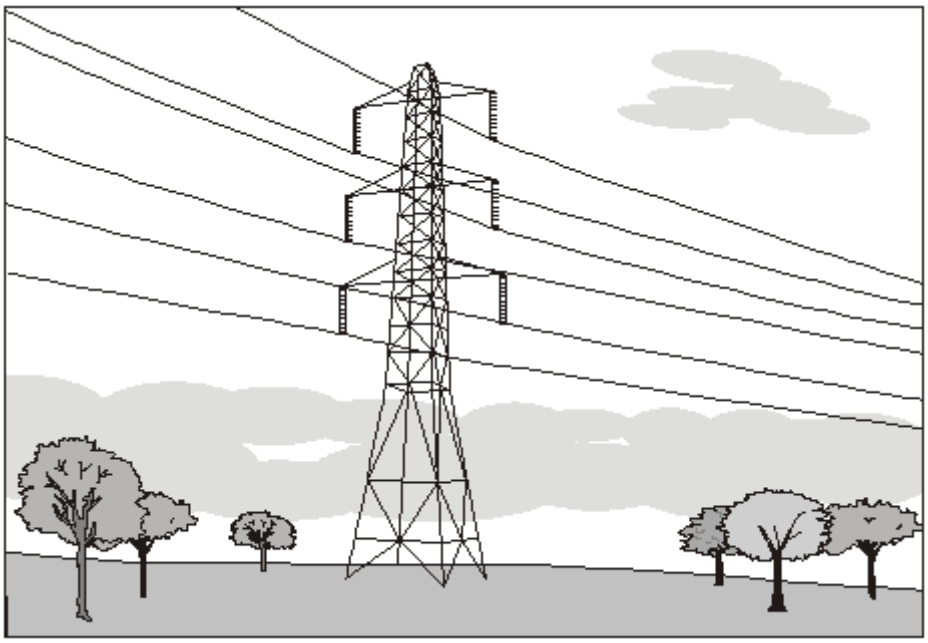
(a) The atomic number (proton number) of aluminium is 13.

Complete the diagram to show the electronic structure of an aluminium atom. Use crosses (x) to represent the electrons.



(1)

(b) Aluminium is used as the electrical conductor for overhead power cables.



Explain why metals are good conductors of electricity.

.....

.....

.....

.....

(2)

(Total 3 marks)

Q15. John Dalton wrote these statements in 1808.

- "All substances are made of a vast number of extremely small particles called atoms."
- "Every particle of water is like every other particle of water, every particle of hydrogen is like every other particle of hydrogen, etc."

(a) "Every particle of water is like every other particle of water." Use Dalton's ideas and your knowledge of water to explain why.

.....
.....

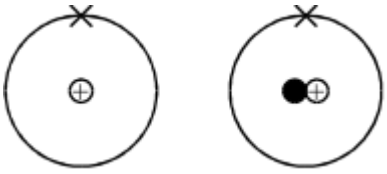
.....
.....

.....
.....

.....
.....

(2)

(b) Dalton thought that all atoms of an element are exactly the same. We now know that it is possible to have atoms of the same element but with different mass numbers. The diagrams represent two atoms of hydrogen.



Atom **A** Atom **B**

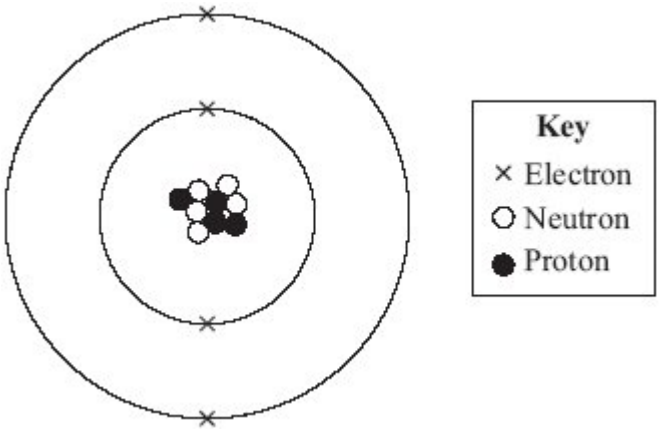
State, in terms of particles, how these two atoms are different.

.....
.....

.....
.....

(1)
(Total 3 marks)

Q16. The diagram represents an atom of beryllium.



Use a number from the box to complete each sentence.

4	**7**	**9**	**12**

(a) The atomic number (proton number) of this atom is ☐.

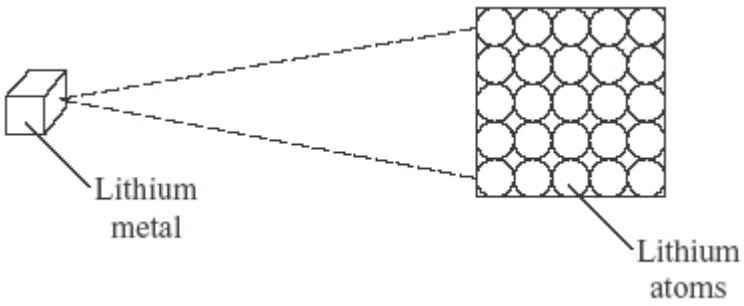
(1)

(b) The mass number of this atom is ☐.

(1)
(Total 2 marks)

Q17. Lithium metal is used in alkaline batteries.

(a) The diagram shows the atoms in lithium metal.



Why is lithium metal described as an element?

.....

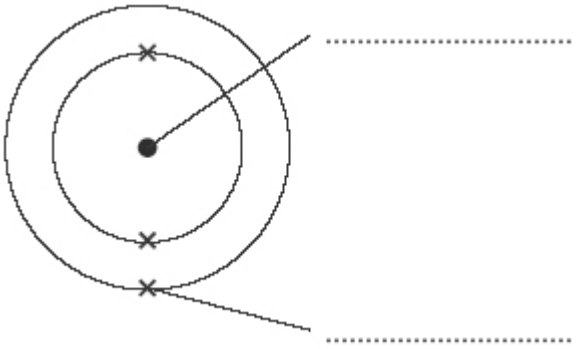
.....

(1)

(b) The diagram below represents a lithium atom.

Choose words from the box to label parts of the atom.

bond	electron	molecule	nucleus

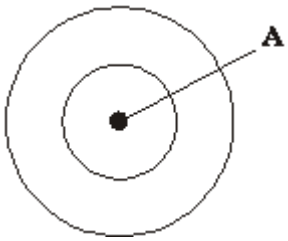


(2)
(Total 3 marks)

Q18. This question is about oxygen atoms. The periodic table on the Data Sheet may help you to answer this question.

(a) (i) Oxygen atoms have 8 electrons.

Complete the diagram to represent the arrangement of electrons in an oxygen atom.
Use crosses (×) to represent the electrons.



(1)

(ii) Name the part of the oxygen atom that is labelled **A** on the diagram.

.....

(1)

(b) Two isotopes of oxygen are oxygen-16 and oxygen-18.

$^{16}_{8}O$ **oxygen-16**

$^{18}_{8}O$ **oxygen-18**

Explain, in terms of particles, how the nucleus of an oxygen-18 atom is different from the nucleus of an oxygen-16 atom.

.....

.....

.....

.....

(2)

(Total 4 marks)

Q19. This question is about metals.

(a) Which unreactive metal is found in the Earth as the metal itself?

Tick (✓) **one** box.

aluminium ☐

gold ☐

magnesium ☐

(1)

(b) Complete the sentence.

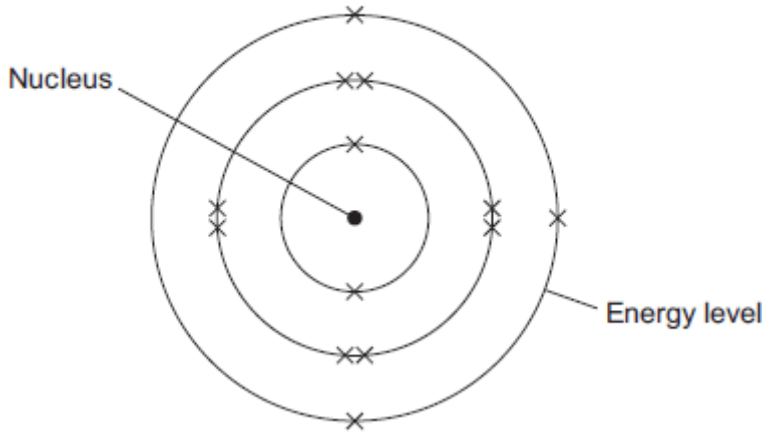
Aluminium is an element because aluminium is made of

only one type of ..... .

(1)

(c) **Figure 1** shows the electronic structure of an aluminium atom.

Figure 1



(i) Use the correct words from the box to complete the sentence.

electrons	**ions**	**protons**	**neutrons**	**shells**

The nucleus of an aluminium atom contains ..... and ..... .

(2)

(ii) Complete the sentence.

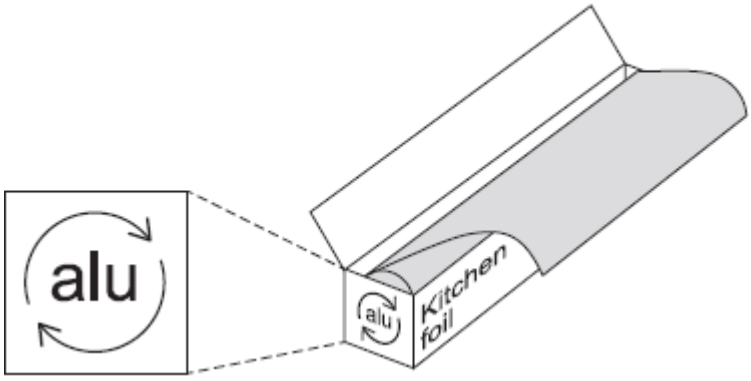
In the periodic table, aluminium is in Group ..... .

(1)

(d) Aluminium is used for kitchen foil.

Figure 2 shows a symbol on a box of kitchen foil.

Figure 2



The symbol means that aluminium can be recycled. It does not show the correct

chemical symbol for aluminium.

(i) What is the correct chemical symbol for aluminium?
..... .

(1)

(ii) Give **two** reasons why aluminium should be recycled.

.....

.....

.....

.....

(2)

(e) Aluminium has a low density, conducts electricity and is resistant to corrosion.

Which **one** of these properties makes aluminium suitable to use as kitchen foil?
Give a reason for your answer.

.....

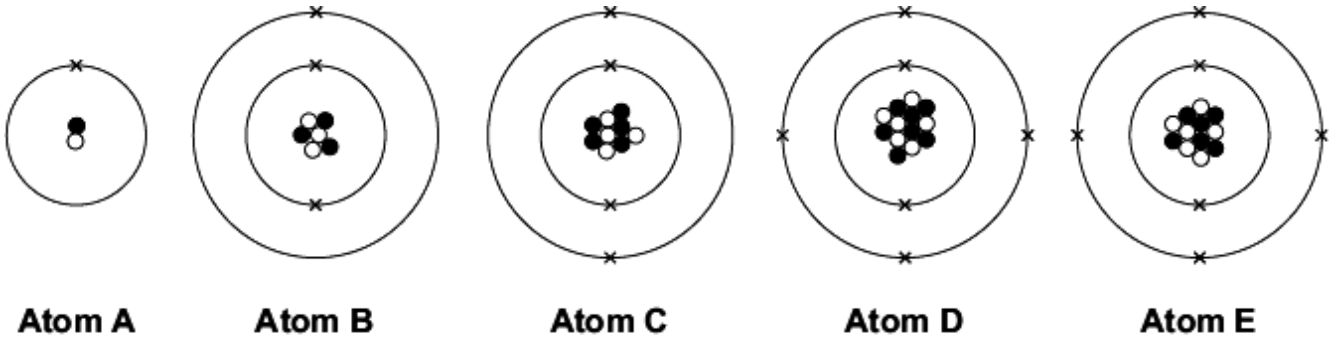
.....

.....

.....

(2)
(Total 10 marks)

Q20. The diagrams show five different atoms, **A**, **B**, **C**, **D** and **E**.



Key
○ represents a proton
● represents a neutron
× represents an electron

(a) Which atom, **A**, **B**, **C**, **D** or **E**:

(i) has an atomic number (proton number) of 3 **Atom** ☐

(1)

(ii) has a mass number of 2 **Atom** ☐

(1)

(iii) is in Group 2 of the periodic table? **Atom** ☐

(1)

(b) Which **two** atoms from **A**, **B**, **C**, **D** and **E** are isotopes of the same element?

Atom ☐ and **Atom** ☐

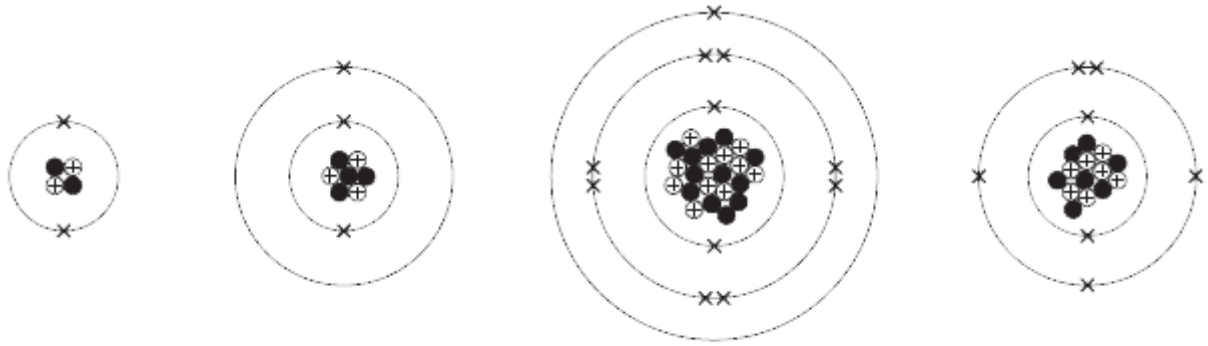
(1)

(c) Which particle in an atom has a negative charge? .....

(1)

(Total 5 marks)

Q21. The diagrams show the sub-atomic particles in four different atoms.



Atom A Atom B Atom C Atom D

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

(a) Draw a ring around the correct answer to complete each sentence.

(i) The centre of each atom is called the

energy level.

molecule.

nucleus.

(1)

(ii) The centre of each atom contains neutrons and

bonds.

electrons.

protons.

(1)

(b) Complete the sentence.

There is no overall electrical charge on each atom because the number of ..... is equal to the number of .....

(1)

(c) What is the name of the element represented by atom **D**? .....

(1)

(d) Which **two** of the atoms, **A**, **B**, **C** and **D**, are in the same group of the periodic table?

Give a reason for your answer.

Atom ☐ and atom ☐

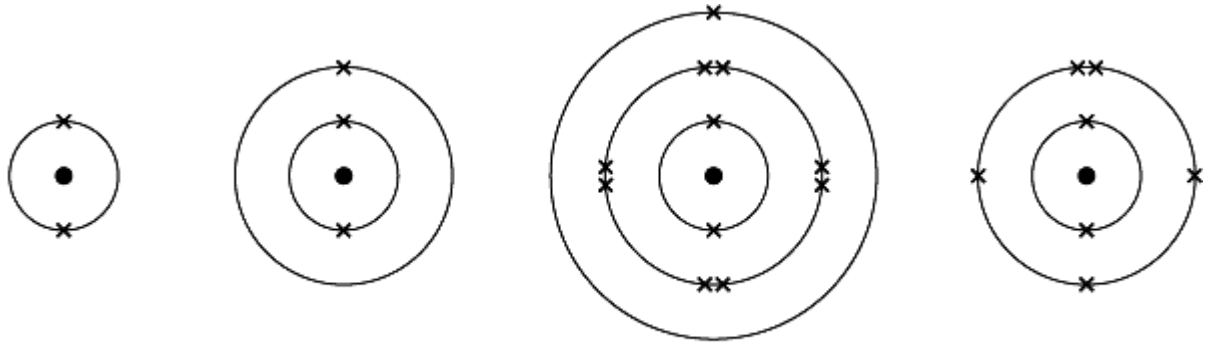
Reason .....

.....

(2)

(Total 6 marks)

Q22. The diagrams show the electronic structure of four different atoms.



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

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

(a) Name the two sub-atomic particles in the nucleus of an atom.

.....

(1)

(b) Why is there no overall electrical charge on each atom?

.....

.....

(1)

(c) Why is **Atom A** unreactive?

.....

(1)

(d) Which **two** of these atoms have similar chemical properties?
Give a reason for your answer.

.....

.....

.....

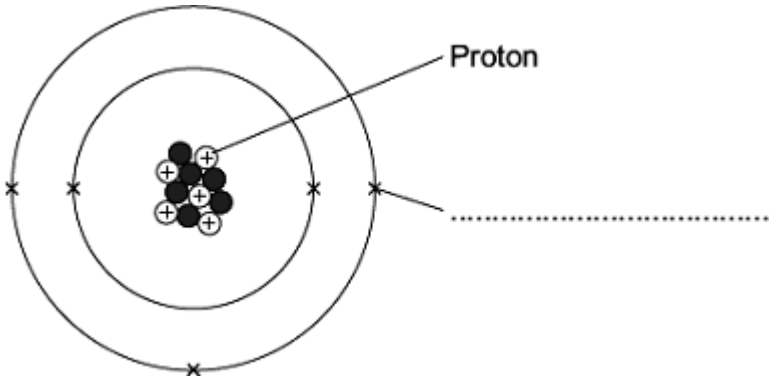
.....

(2)
(Total 5 marks)

Q23. The diagram represents an atom of an element.

(a) Choose **one** word from the box to complete the label on the diagram.

electron	neutron	nucleus



(1)

(b) (i) What is the atomic (proton) number of this atom? .....

(1)

(ii) Name the element.

Use the periodic table on the Data Sheet to help you answer this question.

The name of the element is ..... .

(1)

(c) (i) Draw a ring around the mass number of this atom.

5	11	16

(1)

(ii) Another atom of this element has a different mass number.

Draw a ring around the correct word in the box to complete the sentence.

Atoms of the same element with different numbers of

electrons
neutrons
protons

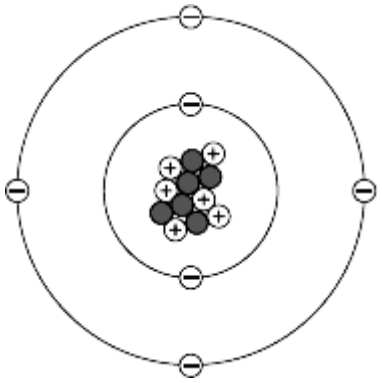
are called isotopes.

(1)
(Total 5 marks)

Q24. The picture shows a diamond ring.

Photograph supplied by Comstock/Thinkstock

(a) Diamond is a form of carbon. The diagram represents a carbon atom.



Complete the table to show the name and charge of each type of particle in the carbon atom.

Name of particle	Charge
proton	
neutron	0
	-1

(2)

(b) Use the Chemistry Data Sheet to help you to answer these questions.

(i) Draw a ring around the correct answer to complete the sentence.

Gold and carbon are

compounds.
elements.
mixtures.

(1)

(ii) Complete the sentence.

Gold and carbon have different properties because gold is a metal and carbon is a .....

(1)

(c) Draw a ring around the correct answer to complete each sentence.

Pure gold is not used to make the ring because pure gold is too

hard.

reactive.

soft.

The gold ring is made by mixing pure gold with other metals to form

a compound.

an atom.

an alloy.

(2)

(d) The data in the table shows some information about the three metals in the gold ring.

Name of metal	Atomic number	Percentage (%) of metal
gold	79	
silver	47	16
copper	29	9

Draw **one** line from each question to its correct answer.

Question	Answer
What is the percentage of gold in this ring?	29
	61
How many electrons are there in a copper atom?	75
How many neutrons are in an atom of silver with a mass number of 108?	79

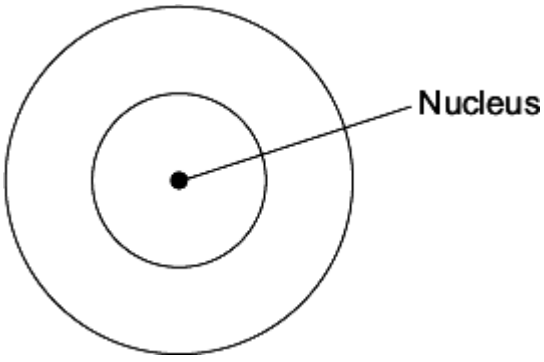
(3)
(Total 9 marks)

Q25. The picture shows a diamond ring.

Photograph supplied by Comstock/Thinkstock

(a) Diamond is a form of carbon. A carbon atom has six electrons.

Draw the electronic structure of a carbon atom.



(1)

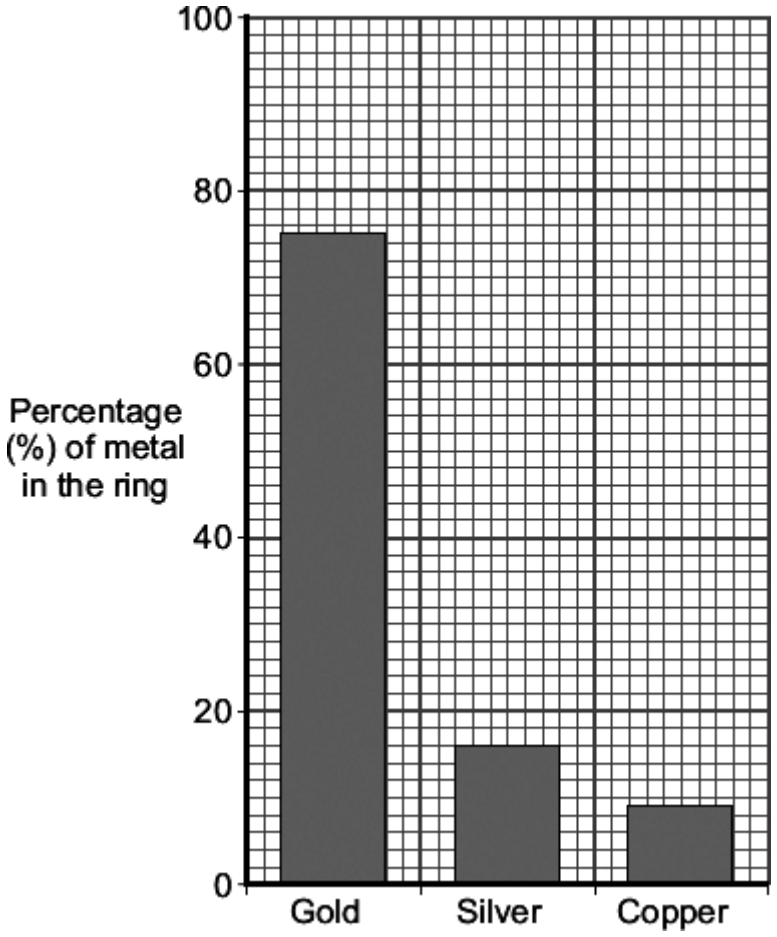
(b) A gold atom has an atomic number of 79 and a mass number of 197.

Complete the table to show the name and number of each sub-atomic particle in this gold atom.

Name	Number
Proton	79
Electron	.....
.....	.....

(3)

(c) The bar chart shows the composition of this gold ring.



(i) Give the percentage of the other two metals in this gold ring.

Silver is ..... % and copper is ..... %

(1)

(ii) This gold ring is not made from 100% gold.

Give **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2)

(Total 7 marks)

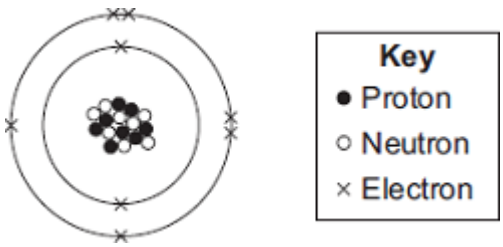
Q26. This question is about atoms and molecules.

(a) Complete the table to show the relative masses of the particles in atoms.

Name of particle	Relative mass
Proton	.....
Neutron	1
Electron	.....

(2)

(b) The diagram shows an oxygen atom.



Use the correct number to complete each sentence.

8	16	18	24

The atomic (proton) number of the oxygen atom shown above is ..... .

The mass number of the oxygen atom shown above is ..... .

(2)

(c) (i) Draw a ring around the correct answer to complete each sentence.

Oxygen atoms with different numbers of neutrons are called

isotopes.

molecules.

polymers.

(1)

(ii) An oxygen atom with a different number of neutrons has 10 neutrons.

Draw a ring around the symbol which represents this atom.

$^{16}_{8}O$ $^{18}_{10}O$ $^{18}_{8}O$

(1)

(d) A water molecule contains hydrogen and oxygen atoms.

(i) Use the correct answer to complete the sentence.

a compound	an element	a mixture

Water is ..... .

(1)

(ii) Draw a ring around the correct structure of a water molecule.

H – O – H **O – H – H** **O – H – O**

(1)

(iii) Draw a ring around the type of bonding in a water molecule.

covalent **ionic** **metallic**

(1)

(iv) Draw a ring around the correct answer to complete each sentence.

The bonds in a water molecule are formed by [gaining / losing / sharing] electrons.

(1)
(Total 10 marks)

Q27.(a) Which sub-atomic particles are present in the nucleus of an atom?

..... and .....

(2)

(b) There are two isotopes of the element chlorine:

$^{35}_{17}Cl$ $^{37}_{17}Cl$

Describe, in terms of sub-atomic particles, **one** similarity and **one** difference between atoms of the two isotopes of chlorine.

Similarity .....

.....

Difference .....

.....

(2)

(c) Chlorine reacts with hydrogen to produce hydrogen chloride.

(i) The table shows the values of some bond dissociation energies.

Bond	**H—H**	**Cl—Cl**	**H—Cl**
Dissociation	436	242	431

energy in kJ per mole			

Use the values in the table to calculate the enthalpy change (ΔH) for the reaction.

$$H_2(g) + Cl_2(g) \longrightarrow 2\,HCl(g)$$

.....

.....

.....

.....

.....

Enthalpy change (ΔH) = ... kJ per mole

(3)

(ii) Hydrogen also reacts with fluorine.

$$H_2(g) + F_2(g) \longrightarrow 2\,HF(g) \qquad \Delta H = -538 \text{ kJ per mole}$$

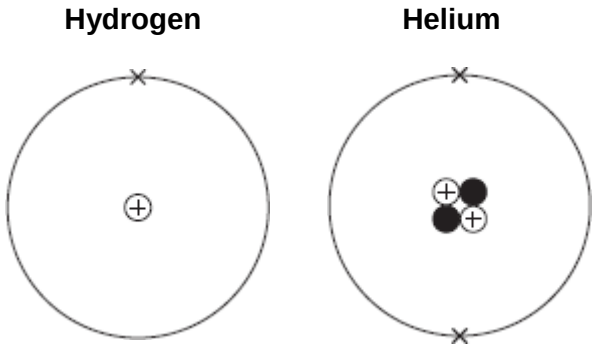
Draw an energy level diagram for this reaction.

Include on your diagram labels to show:

- the reactants and the products
- the overall enthalpy change (ΔH)
- the activation energy.

(3)
(Total 10 marks)

Q28. The Sun produces helium atoms from hydrogen atoms by nuclear fusion reactions.



(a) Describe the differences in the atomic structures of a hydrogen atom and a helium atom.

.....

.....

.....

.....

.....

.....

.....

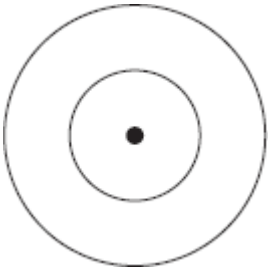
.....

(3)

(b) The Sun consists of 73% hydrogen and 25% helium.
The rest is other elements.
One of the other elements in the Sun is neon.

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

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



(1)

(ii) Why is neon in the same group of the periodic table as helium?

.....

.....

.....

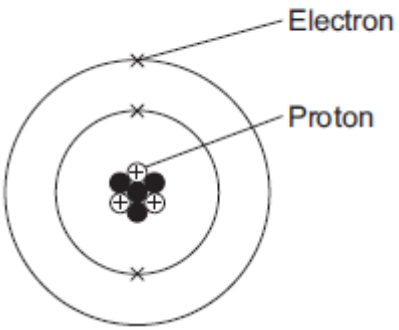
(1)

(Total 5 marks)

Q29. There are eight elements in the second row (lithium to neon) of the periodic table.

(a) **Figure 1** shows a lithium atom.

Figure 1



(i) What is the mass number of the lithium atom in **Figure 1**?

Tick (✔) **one** box.

3 ☐

4 ☐

7 ☐

(1)

(ii) What is the charge of an electron?

Tick (✔) **one** box.

–1 ☐

0 ☐

+1 ☐

(1)

(iii) Protons are in the nucleus.

Which other sub-atomic particles are in the nucleus?

Tick (✔) **one** box.

ions ☐

molecules ☐

neutrons ☐

(1)

(b) What is **always** different for atoms of different elements?

Tick (✔) **one** box.

number of neutrons ☐

number of protons ☐

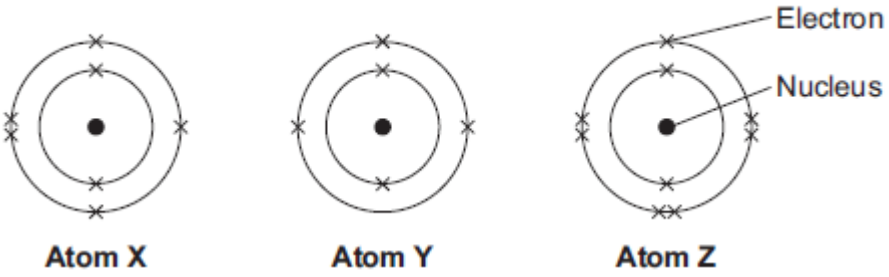
number of shells ☐

(1)

(c) **Figure 2** shows the electron arrangements of three different atoms, **X**, **Y** and **Z**.

These atoms are from elements in the second row (lithium to neon) of the periodic table.

Figure 2



Which atom is from an element in Group 3 of the periodic table?

Tick (✔) **one** box.

Atom X ☐

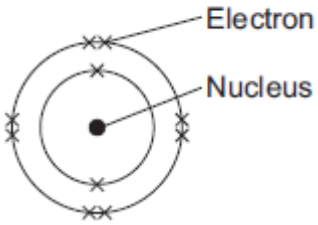
Atom Y ☐

Atom Z ☐

(1)

(d) **Figure 3** shows the electron arrangement of a different atom from an element in the second row of the periodic table.

Figure 3



(i) Give the chemical symbol of this element.

.....

(1)

(ii) Why is this element unreactive?

.....

.....

(1)

(Total 7 marks)

Q30. This question is about atomic structure and elements.

(a) Complete the sentences.

(i) The atomic number of an atom is the number of .....

(1)

(ii) The mass number of an atom is the number of .....

.....

(1)

(b) Explain why an atom has no overall charge.

Use the relative electrical charges of sub-atomic particles in your explanation.

.....

.....

.....

.....

(2)

(c) Explain why fluorine and chlorine are in the same group of the periodic table.

Give the electronic structures of fluorine and chlorine in your explanation.

.....

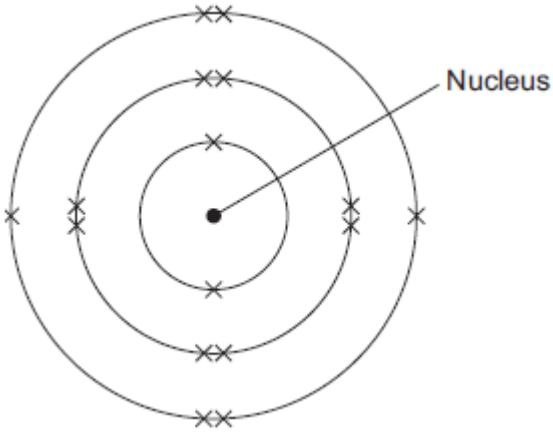
.....

.....

.....

(2)

(d) The diagram shows the electronic structure of an atom of a non-metal.



What is the chemical symbol of this non-metal?

Tick (✓) **one** box.

Ar ☐

O ☐

S ☐

Si ☐

(1)

(e) When elements react, their atoms join with other atoms to form compounds.

Complete the sentences.

(i) Compounds formed when non-metals react with metals consist of particles called ..... .

(1)

(ii) Compounds formed from only non-metals consist of particles called ..... .

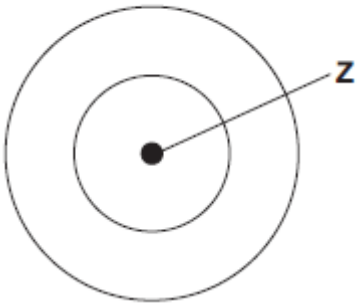
(1)

(Total 9 marks)

Q31. There are eight elements in the second row (lithium to neon) of the periodic table.

(a) **Figure 1** shows an atom with two energy levels (shells).

Figure 1



(i) Complete **Figure 1** to show the electronic structure of a boron atom.

(1)

(ii) What does the central part labelled **Z** represent in **Figure 1**?

.....

(1)

(iii) Name the sub-atomic particles in part **Z** of a boron atom.

Give the relative charges of these sub-atomic particles.

.....

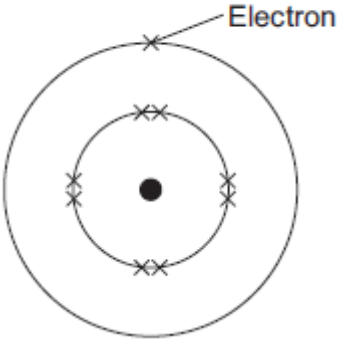
.....

.....

(3)

(b) The electronic structure of a neon atom shown in **Figure 2** is **not** correct.

Figure 2



Explain what is wrong with the electronic structure shown in **Figure 2**.

.....

.....

.....

.....

.....

.....

(3)
(Total 8 marks)