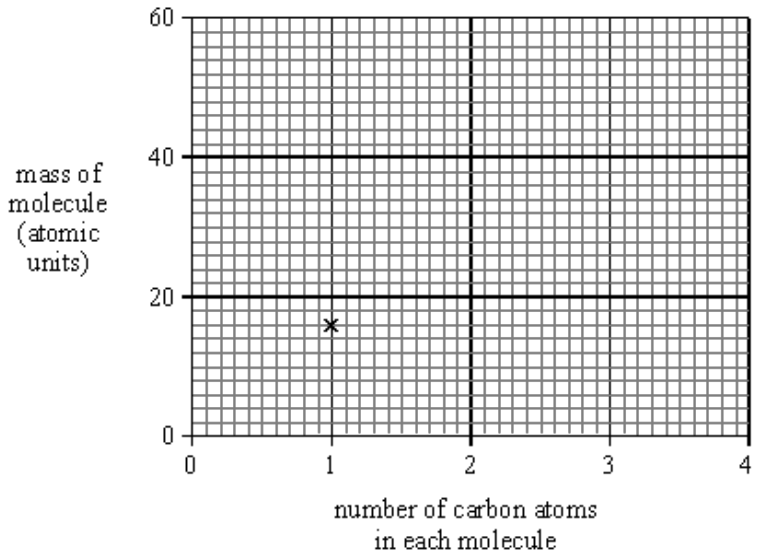
##

The table gives some information about a family of molecules in crude oil.

NUMBER OF CARBON ATOMS IN MOLECULE	MASS OF MOLECULE (atomic units)
1	16
2	30
4	58

(a) Show information from the table in the most appropriate way on the grid.



(3)

(b) What is the mass of a molecule with three carbon atoms?

.....

(1)

(c) The other atoms in each molecule are all hydrogen atoms.
What family of substances do all the molecules belong to?

.....

(1)

(d) The mass of a carbon atom is 12 atomic units.
The mass of a hydrogen atom is 1 atomic unit.

So the molecule with one carbon atom has four hydrogen atoms.
Its formula is CH_4.

Write down the formula:

(i) of the molecule with two carbon atoms .....

(ii) of a molecule from the same family with five carbon atoms .....

(2)

(Total 7 marks)

Q2. The formula for the compound hydrogen peroxide is H_2O_2.

Write down everything that the formula tells you about each molecule of hydrogen peroxide.

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(Total 4 marks)

Q3. Here is the word equation for a chemical reaction.

magnesium + zinc oxide → magnesium oxide + zinc

Write down everything that the word equation tells you about the reaction.

.....

.....

.....

.....

(Total 4 marks)

Q4. Choose gases from this list to complete the word equations below.

carbon dioxide hydrogen nitrogen

oxygen sulphur dioxide

(a) sodium + water → sodium hydroxide + ...

(1)

(b) magnesium + ...→ magnesium oxide.

(1)

(Total 2 marks)

Q5. Here is the word equation for a chemical reaction.

methane + oxygen → water + carbon dioxide

Write down everything that the word equation tells you about the reaction.

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(Total 4 marks)

Q6. (a) Sulphur is a yellow element. It is a non-metal.

(i) Complete the sentence.

In an element, all the atoms .....

.....

(1)

(ii) Give **two** properties you would expect sulphur to have because it is a non-metal.

1. .....

.....

2. .....

.....

(2)

(b) Use the names of metals from the box to complete the table.

copper	**iron**	**magnesium**	**manganese**	**zinc**

Use	Name of metal
for electric wiring in a house	.....
for manhole covers	.....
to galvanise iron	.....

(3)

(c) Copper is used to make hot water pipes. Both iron and steel are cheaper.

Suggest **two** reasons why copper is used rather than iron or steel.

1. .....

.....

2. .....

.....

(2)

(d) The drawing shows a container of a compound called sodium chloride.

(i) Which other element has combined with sodium to form this compound?

.....

(1)

(ii) For every atom of sodium, how many atoms of the other element have combined with it?

.....

(1)

(Total 10 marks)

Q7. Use the Periodic Table of Elements on the Data Sheet to help you to answer this question.

(a) Describe, in as much detail as you can, the structure of a fluorine atom.

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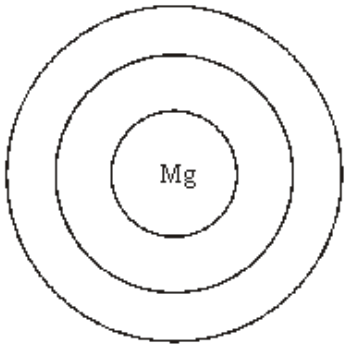
(3)

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



(1)
(Total 4 marks)

Q8. One definition of an element is:

"A substance that cannot be broken down into simpler substances by chemical methods"

The table below shows some of the 'substances' which Antoine Lavoisier thought were elements. He divided the 'substances' into four groups. He published these groups in 1789.

The modern names of some of the 'substances' are given in brackets.

ACID-MAKING ELEMENTS	GAS-LIKE ELEMENTS	METALLIC ELEMENTS		EARTHY ELEMENTS
sulphur	light	cobalt	mercury	lime (calcium oxide)
phosphorus	caloric (heat)	copper	nickel	magnesia (magnesium oxide)
charcoal (carbon)	oxygen	gold	platina (platinum)	barytes (barium sulphate)
	azote (nitrogen)	iron	silver	argilla (aluminium oxide)
	hydrogen	lead	tin	silex (silicon dioxide)
		magnese	tungsten	
		zinc		

(a) Name **one** 'substance' in the list which is **not** a chemical element or compound.

.....

(1)

(b) (i) Name **one** substance in the list which is a compound.

.....

(1)

(ii) Suggest why Lavoisier thought that this substance was an element.

.....

.....

.....

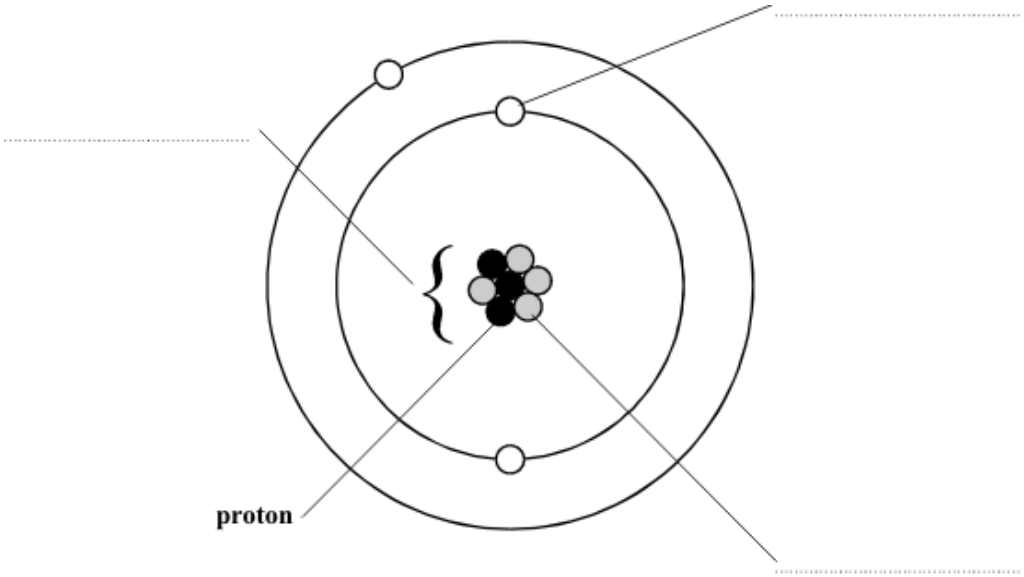
.....

(1)

(Total 3 marks)

Q9. The diagram represents an atom. Choose words from the list to label the diagram.

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



(Total 3 marks)

Q10. (a) The list below gives six substances.

- aluminium
- beer
- copper
- milk
- pure water
- sodium chloride

Put each substance in the correct column of the table.

ELEMENTS	COMPOUNDS	MIXTURES

(3)

(b) Elements can be divided into two groups, metals and non-metals.

The list below gives some properties of elements.

- brittle
- can be hammered into shape
- dull
- good conductors of electricity
- poor conductors of electricity
- shiny

Put each property into the correct column.

PROPERTIES OF METALS	PROPERTIES OF NON-METALS

(3)
(Total 6 marks)

Q11. One step in the manufacture of lead is the reduction of lead oxide with carbon. Lead and carbon dioxide are the products of this reaction.

(a) Write a word equation for this reaction.

.....

(1)

(b) What is meant by “reduction”?

.....

(1)
(Total 2 marks)

Q12. There are millions of different substances that make up our world. All these substances are made from chemical elements.

(a) What is an element?

.....

.....

.....

.....

(1)

(b) Many substances are compounds. What is a compound?

.....

.....

.....

.....

(2)

(Total 3 marks)

Q13. Atoms are made up of three main particles called protons, neutrons and electrons.

Use the periodic table on the data sheet to help you to answer these questions.

(a) Sodium is in Group 1 of the periodic table.

(i) Why are potassium and sodium in the same Group of the periodic table?

.....

.....

(1)

(ii) How many protons are in an atom of sodium? .....

(1)

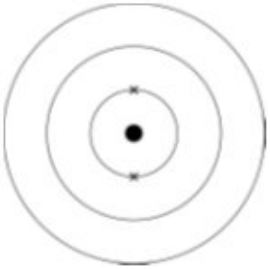
(iii) The atomic number of sodium is 11.

How many neutrons are in an atom of sodium with mass number 23?

.....

(1)

(iv) Each sodium atom has 11 electrons. Complete the electronic structure of sodium.



(2)

(b) The chemical equation for a reaction of sodium is shown below.

$$2Na + Cl_2 \rightarrow 2NaCl$$

Describe this reaction of sodium in terms of the names of the substances and the numbers of the atoms involved.

.....

.....

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.....

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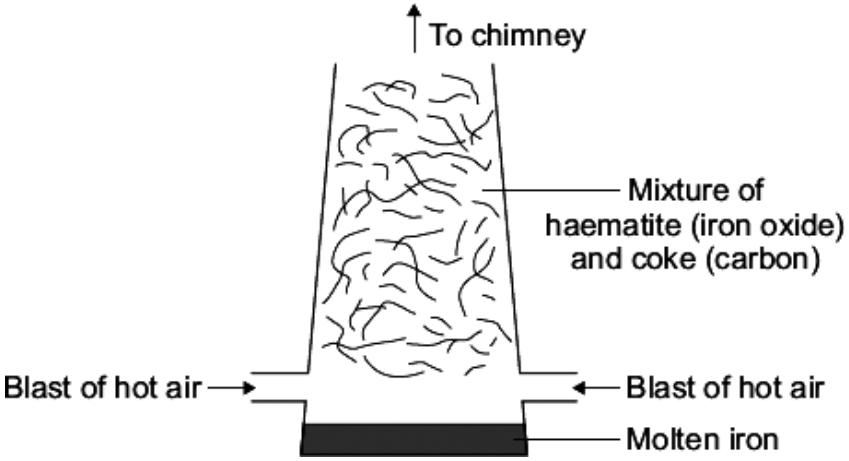
(3)
(Total 8 marks)

Q14. Iron is produced by reacting a mixture of haematite and coke in a blast furnace.
Haematite is an ore of iron containing iron oxide (Fe_2O_3).

Coke is made from coal and is almost pure carbon.



(a) (i) The coke burns in air. This reaction heats the furnace to above 1300 °C.

Complete the chemical equation for carbon reacting with oxygen to form carbon dioxide.

..... + O_2 → CO_2

(1)

(ii) Carbon monoxide is also formed in the furnace. Carbon monoxide reacts with iron oxide to produce iron and carbon dioxide.

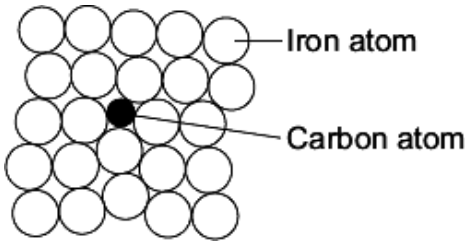
iron oxide + carbon monoxide → iron + carbon dioxide

Complete and balance the chemical equation for the production of iron.

Fe_2O_3 + 3CO → ..... + ...

(2)

(iii) Iron from a blast furnace is called cast iron and contains about 4% carbon.



Why is pure iron softer than cast iron?

.....

.....

(1)

(b) Steel is made by reducing the percentage of carbon in cast iron and then adding different metals to form the type of steel required.

In the UK we use about 1.8 billion steel cans every year but only 30% of these are recycled. Recycling reduces waste. Producing steel from recycled cans requires only 25% of the energy needed to make steel from iron ore.

Give **three** environmental benefits of recycling a higher percentage of used steel cans.

1 .....

.....

2 .....

.....

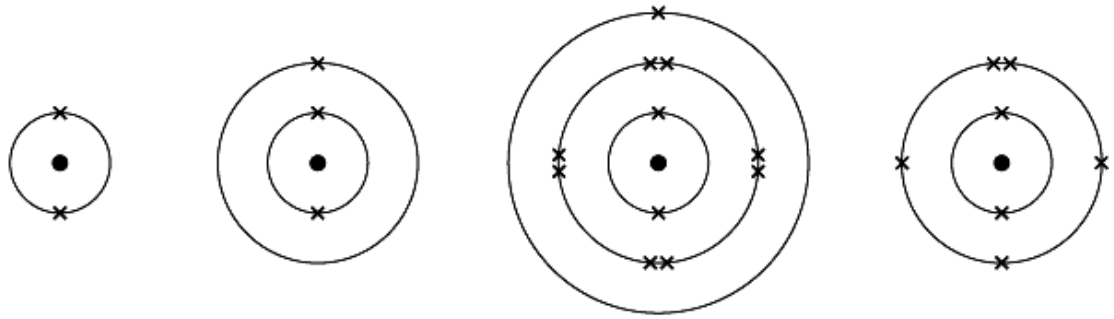
3 .....

.....

(3)

(Total 7 marks)

Q15. 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.

.....

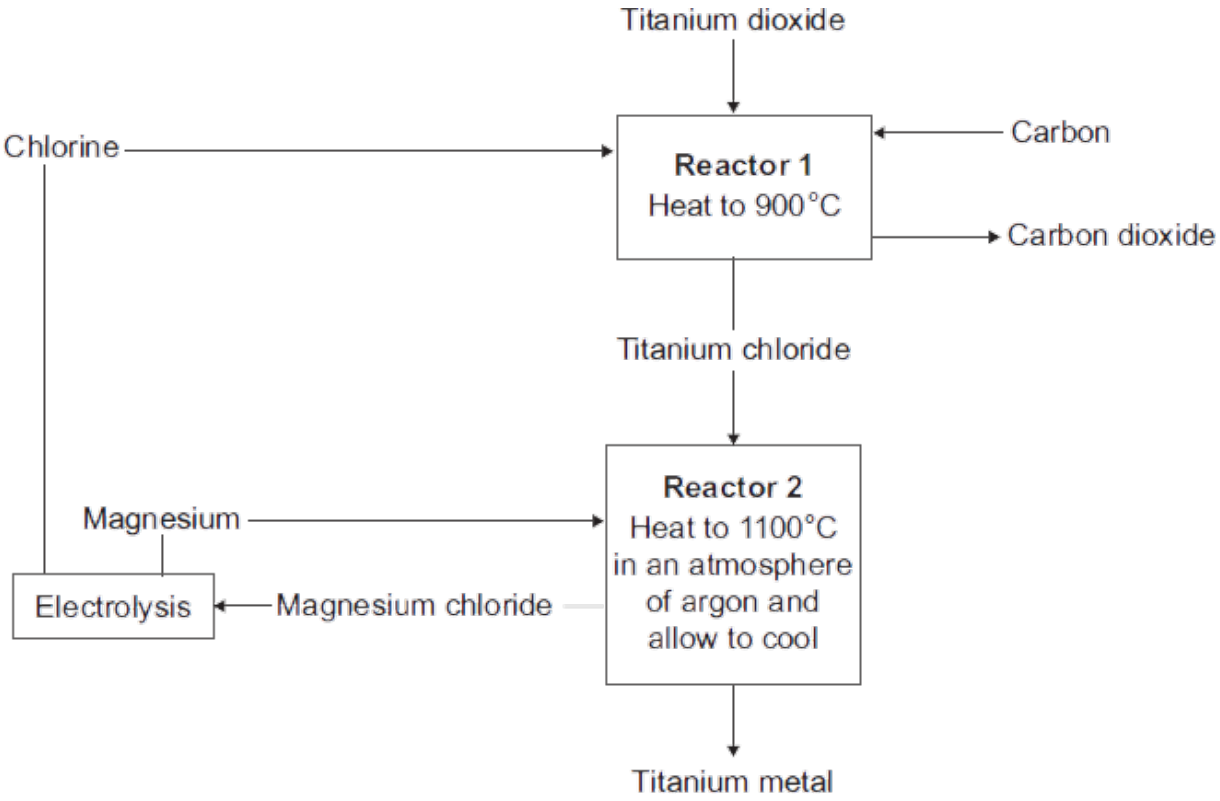
.....

.....

.....

(2)
(Total 5 marks)

Q16. Rutile is an ore of titanium. Rutile contains titanium dioxide.
The flow chart shows how titanium metal is extracted from titanium dioxide.



(a) Titanium is much more expensive than iron.

Give **one** reason why.

.....

.....

(1)

(b) Name the only waste product shown on the flow chart.

.....

(1)

(c) Describe the example of recycling shown on the flow chart.

.....

.....

.....

.....

(2)

(d) The air is removed from **Reactor 2**. An atmosphere of argon is used for the reaction between titanium chloride and magnesium metal.

Explain why.

.....

.....

.....

.....

(2)

(e) Titanium metal is produced by reacting titanium chloride with magnesium.

950 kg of titanium chloride was mixed with 240 kg of magnesium metal. The mixture was heated and produced 950 kg of magnesium chloride.

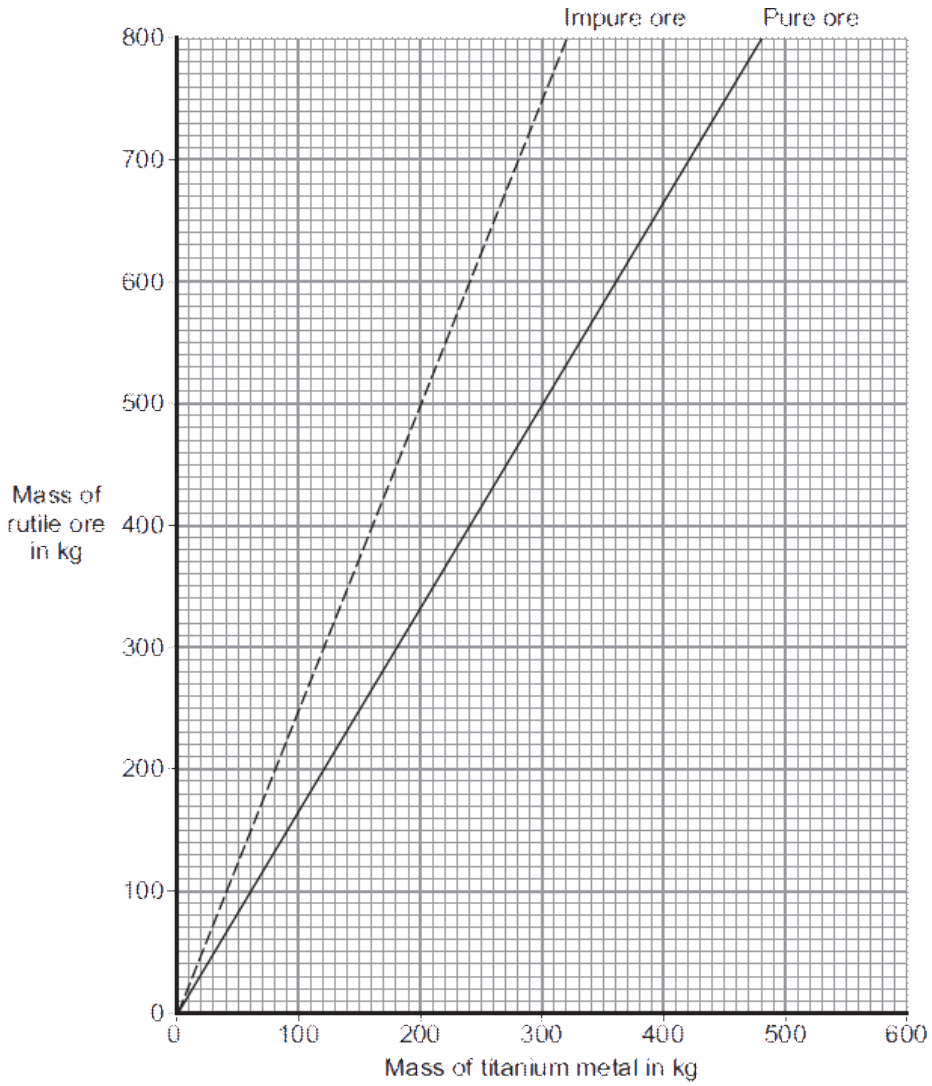
Calculate the mass of titanium metal produced.

.....

Mass = ... kg

(1)

(f) The graph shows the mass of titanium metal produced from a pure rutile ore and from an impure rutile ore.



The difference between the two lines represents the amount of waste rock in the impure ore.

300 kg of titanium metal was produced from the impure ore.

Calculate the mass of waste rock in the impure ore.

.....

Mass = ... kg

(1)

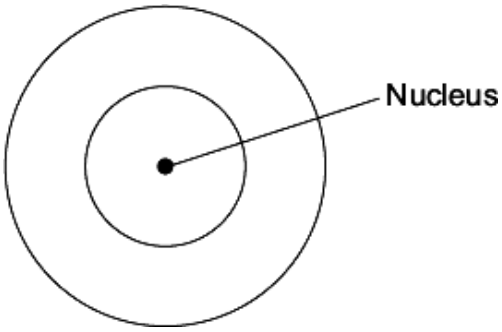
(Total 8 marks)

Q17. 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)

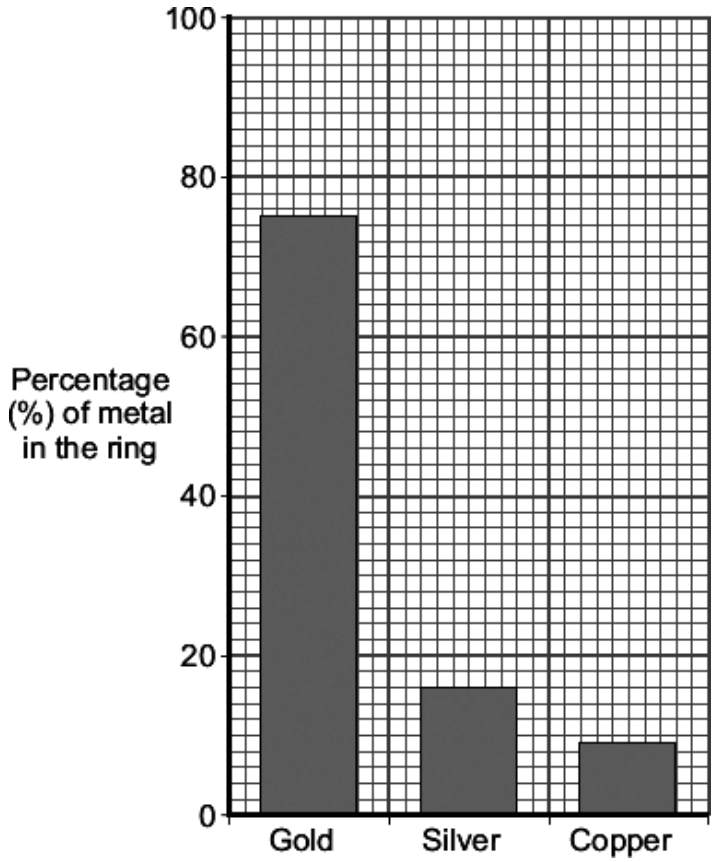
(b) A gold atom has an atomic number of 79 and a mass number of 197.

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 .....

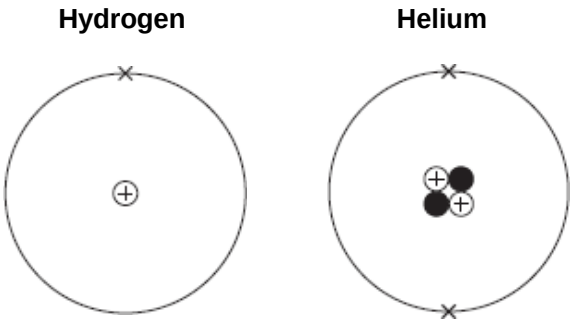
.....

.....

(2)

(Total 7 marks)

Q18. 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.

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.....

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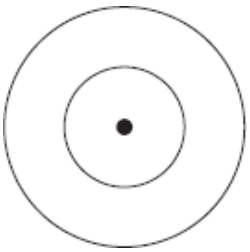
(3)

(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?

.....

.....

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(1)
(Total 5 marks)