

- Q1.** (a) Copper is a metal.  
Explain how it conducts electricity.

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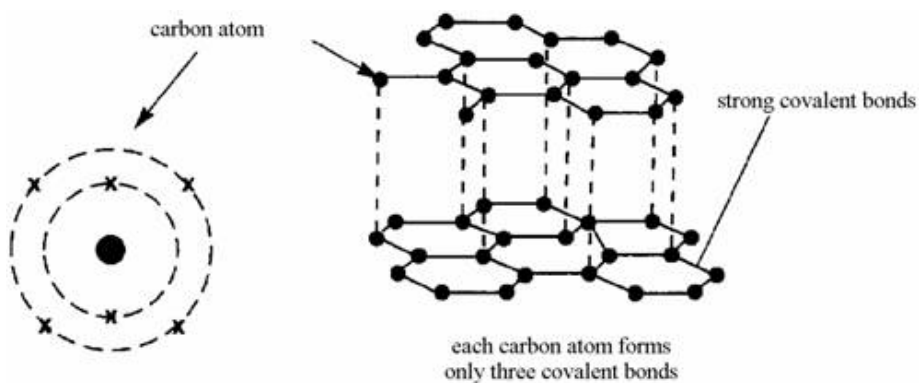
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(2)

- (b) Graphite is a non-metal.



Use the information to explain why graphite conducts electricity.

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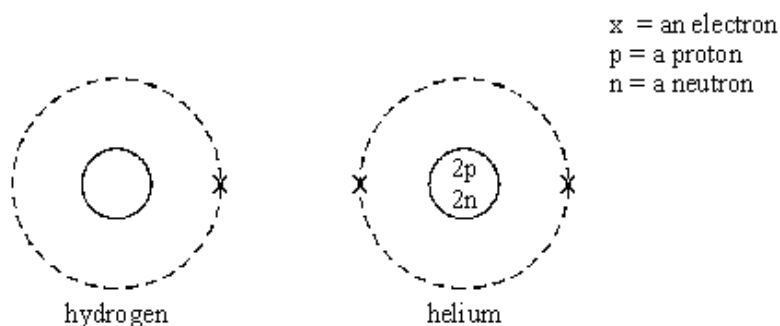
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(3)

(Total 5 marks)

- Q2.** (a) The diagrams represent the atomic structures of two gases, hydrogen and helium.



Hydrogen gas is made up of diatomic molecules (molecules with two atoms).  
Helium gas exists as single atoms.

- (i) How is a molecule of hydrogen formed from two hydrogen atoms?  
(You may use a diagram as part of your answer)

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(2)

- (ii) Why does helium exist only as single atoms?

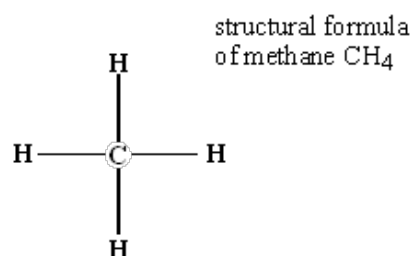
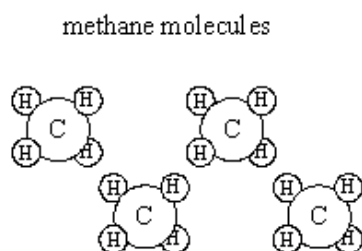
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(2)

- (b) Hydrogen combines with carbon to form methane.  
Each molecule contains four hydrogen atoms strongly bonded to a carbon atom.



Explain why methane has a low boiling point.

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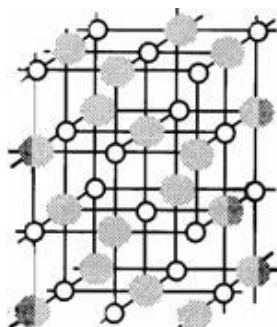
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(2)

(Total 6 marks)

- Q3.** The diagrams show the giant structures of sodium chloride and diamond.



sodium chloride (melting point  $801^\circ\text{C}$ )



diamond (melting point  $4800^\circ\text{C}$ )

- (a) The equation shows how sodium chloride could be formed.

Balance the equation.



(1)

- (b) By reference to the detailed structure of sodium chloride explain fully why:

- (i) sodium chloride has a quite high melting point,

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(1)

- (ii) solid sodium chloride melts when it is heated strongly,

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(2)

- (iii) molten sodium chloride will conduct electricity.

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(1)

- (c) By reference to the detailed structure of diamond, explain why the melting point of diamond, is higher than that of sodium chloride.

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(2)

(Total 7 marks)

**Q4.** The diagram shows the elements in Group 4 of the periodic table.

12	C
6	
28	Si
14	
73	Ge
32	
119	Sn
50	
207	Pb
82	

Carbon is a non-metal and silicon is usually considered to be a non-metal.

Tin and lead have all the usual properties of metals.

Germanium has these properties:

- grey-white shiny solid
- melting point  $937^{\circ}\text{C}$
- semi-conductor
- reacts with chlorine to form the chloride ( $\text{GeCl}_4$ ) which is a liquid molecular compound
- germanium oxide reacts with acids to form a salt solution and water. It also reacts with alkalis.

- (a) With reference to their structure, explain why tin and lead are good conductors of electricity.

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(3)

- (b) Would you classify germanium as a metal or as a non-metal? Give your reasons.

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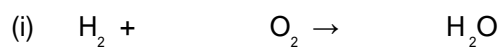
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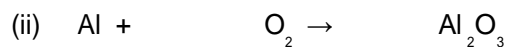
(3)

(Total 6 marks)

- Q5.** (a) Balance these chemical equations.



(1)



(1)

- (b) Briefly explain why an unbalanced chemical equation cannot fully describe a reaction.

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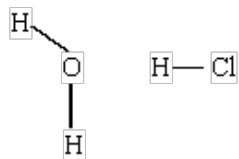
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(2)

- (c) Explain, as fully as you can, why a water molecule contains two hydrogen atoms but a hydrogen chloride molecule contains only one.



(You may use a diagram in your answer if you wish).

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(3)  
(Total 7 marks)

- Q6.** (a) The formula for ammonia is  $\text{NH}_3$ . What does the formula tell you about each molecule of ammonia?

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(3)

- (b) Ammonia is used to make nitric acid ( $\text{HNO}_3$ ). Calculate the formula mass (Mr) for nitric acid. (Show your working).

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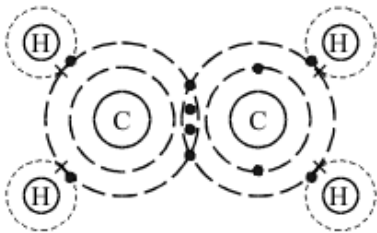
(3)  
(Total 6 marks)

**Q7.** The questions which follow refer to the element hydrogen.

- (a) Draw a diagram to show the bonding in one molecule of hydrogen.

(2)

- (b) The table gives information about two compounds which contain hydrogen.

NAME	FORMULA	STRUCTURE
dilute sulphuric acid	$\text{H}_2\text{SO}_4$	$[\text{H}]^+[\text{SO}_4]^{2-}[\text{H}]^+$
ethene	$\text{C}_2\text{H}_4$	

Use the information in the table to explain why it is difficult to classify hydrogen as a metal or a non metal.

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(4)

(Total 6 marks)

**Q8.** Sodium carbonate reacts with acids.

(i) Complete the word equation.

sodium carbonate + hydrochloric acid → sodium chloride + ..... + water

(1)

(ii) Name the salt produced if sodium carbonate reacts with dilute nitric acid.

.....

(1)

(Total 2 marks)

**Q9.** (a) By reference to their structure, explain how the particles in a piece of metal are held together and how the shape of the metal can be changed without it breaking.

(You may use a diagram in your answer.)

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(5)



- (b) Explain why metals are good conductors of electricity and suggest why this conductivity increases across the periodic table from sodium to magnesium to aluminium.

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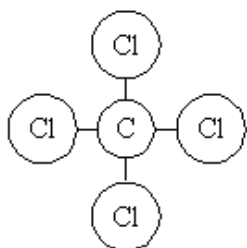
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(4)  
(Total 9 marks)

- Q10.** Chlorine will combine with the non-metal element, carbon, to form this molecular compound.



- (a) What is the type of bond in this molecule?

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(1)

- (b) Explain how these bonds are formed. (You may use a diagram).

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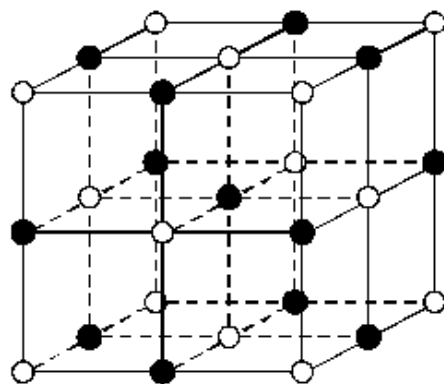
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(2)  
(Total 3 marks)

- Q11.** (a) The diagram shows part of the ionic lattice of a sodium chloride crystal.



- (i) Complete the spaces in the table to give information about **both** of the ions in this lattice.

Name of ion	Charge
.....	.....
.....	.....

(2)

- (ii) When it is solid, sodium chloride will not conduct electricity. However, molten sodium chloride will conduct electricity. Explain this difference.

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 .....  
 .....  
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(2)

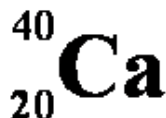
- (iii) Complete the sentence.

Sodium chloride conducts electricity when it is molten and when it is

.....

(1)

- (b) The symbol for a calcium atom can be shown like this:



- (i) What is the mass number of this atom?

.....

(1)

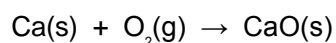
(ii) What information is given by the mass number?

.....  
.....

(1)

(c) Calcium burns in oxygen with a brick-red flame. The product is a white solid. It is calcium oxide and its formula is CaO.

(i) Balance the chemical equation for the reaction.



(1)

(ii) Describe, in terms of electrons, what happens to a calcium atom when it becomes a calcium ion.

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(2)

(Total 10 marks)

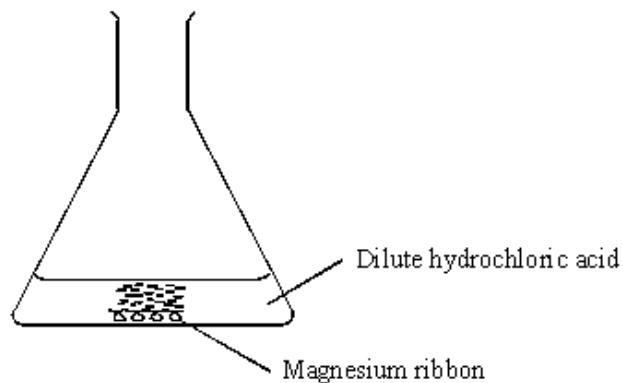
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In this question you will need to use the following information:

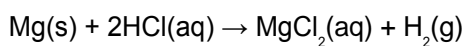
Relative atomic masses: H 1; O 16; Mg 24.

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and atmospheric pressure.

The diagram shows a chemical reaction taking place in a conical flask.



The balanced equation for this reaction is:



- (a) Write a balanced ionic equation for this reaction.

.....

(2)

- (b) Calculate the mass of magnesium required to produce 0.50 g of hydrogen. Show clearly how you work out your final answer and give the unit.

.....

.....

Mass = .....

(2)

- (c) (i) Draw a diagram to show how the electrons are arranged in a hydrogen molecule.

(1)

- (ii) What is the name of the type of chemical bond between the hydrogen atoms in a hydrogen molecule?

.....

(1)

- (d) The chemical formula for hydrogen peroxide is  $\text{H}_2\text{O}_2$ .

Calculate, to the nearest whole number, the percentage, by mass, of hydrogen in hydrogen peroxide. Show clearly how you work out your answer.

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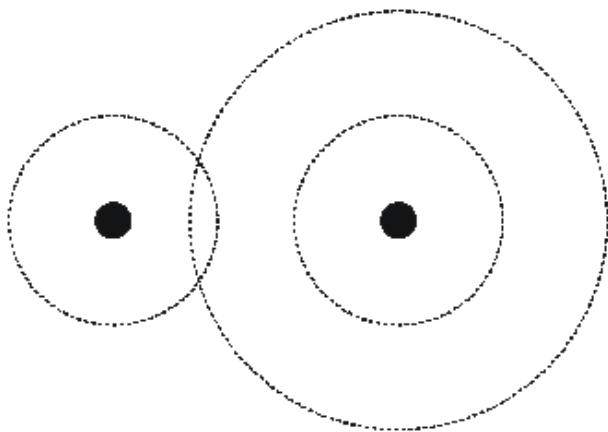
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Percentage = ..... %

(2)

(Total 8 marks)

- Q13.** (i) Complete the drawing to show the electron structure of a hydrogen fluoride molecule.  
Draw electrons as dots or crosses.



(1)

- (ii) Explain why hydrogen fluoride is a gas at room temperature.

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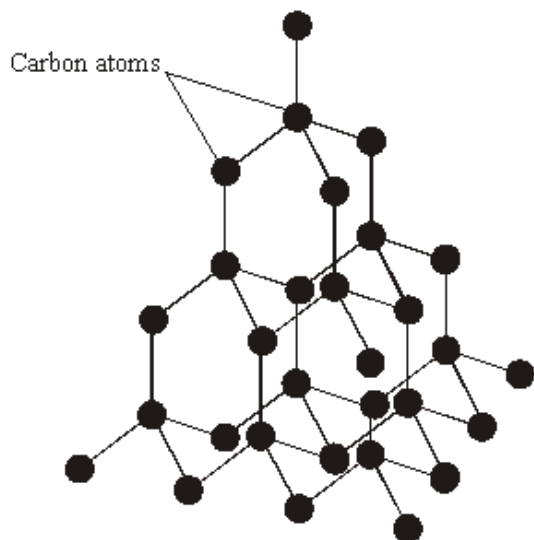
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(2)

(Total 3 marks)

**Q14.** The diagram shows the structure of diamond.



- (a) *To gain full marks for this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Explain, as fully as you can, why diamond has a high melting point.

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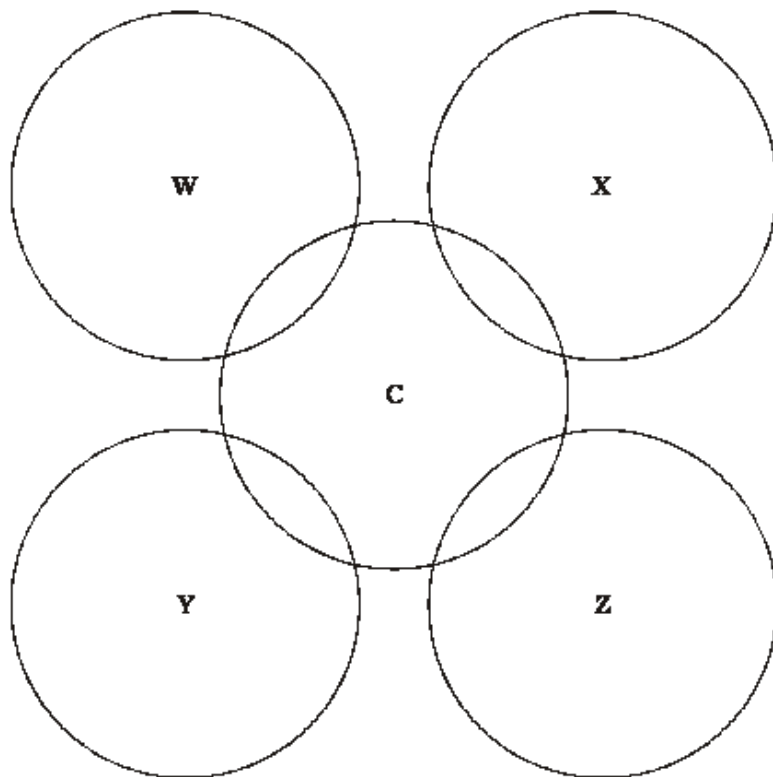
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**(3)**

- (b) The diagram below shows the outer electron shells of five carbon atoms in the giant lattice of diamond.

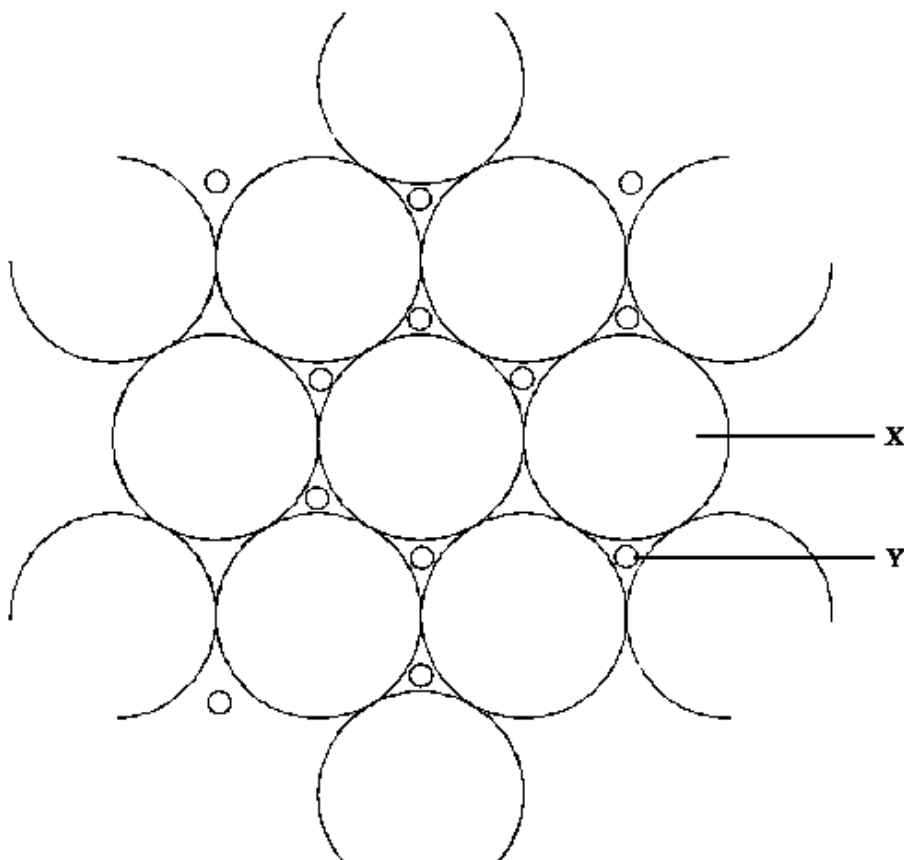
Carbon atom **C** forms bonds with each of the carbon atoms **W**, **X**, **Y** and **Z**.

Draw the positions of all the electrons in the outer shells of each of carbon atoms **C**, **W**, **X**, **Y** and **Z**.



(3)  
(Total 6 marks)

**Q15.** The diagram shows a model of part of the giant lattice of a metal.



(a) Name particles **X** and **Y**.

**X** .....

**Y** .....

(2)

(b) Explain, in terms of the giant structure above, why is it possible to bend a piece of metal.

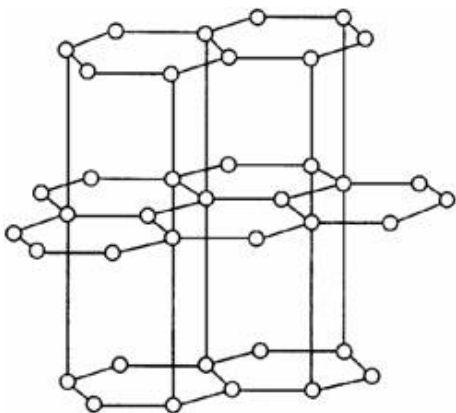
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(2)

(Total 4 marks)



**Q16.** The diagram represents the structure of graphite.



Use your knowledge and understanding of the structure of graphite to explain why graphite can be used:

(a) in the 'leads' of pencils;

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.....

(b) as an electrical conductor.

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(Total 5 marks)

**Q17.** Iron is used (as steel) to make the body panels for cars.



The iron panels have to be bendable so that they can be pressed into the shape required, but must also be strong. The panels must also be able to conduct electricity because they form part of the electrical circuits of the car.

- (a) Iron is a typical metal. Describe the structure and bonding in a metal such as iron. You may use a diagram if you wish.

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(4)

- (b) Explain how the structure and bonding of iron:

- (i) allows the body panels to conduct electricity;

.....

(2)

- (ii) allows the body panels to be bent into shape;

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(1)

- (iii) gives the body panels strength.

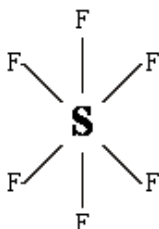
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(1)

(Total 8 marks)

- Q18.** Sulphur hexafluoride is a colourless, odourless, non-flammable gas, which is insoluble in water and extremely unreactive. It is used as an insulator in high voltage transformers and switchgear.

The diagram below represents a molecule of sulphur hexafluoride.



- (a) What type of chemical bond holds the sulphur and fluorine atoms together in sulphur hexafluoride molecules?

.....

(1)

- (b) Explain why sulphur hexafluoride has a low boiling point.

.....

.....

(2)

- (c) Explain how **three** of the properties of sulphur hexafluoride make it suitable for use as an insulator inside electrical transformers.

Property 1: .....

Explanation: .....

.....

Property 2: .....

Explanation: .....

.....

Property 3: .....

Explanation: .....

.....

(3)

(Total 6 marks)

##

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.



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

.....

(1)

- (b) Sando-K contains the ion,  $\text{CO}_3^{2-}$ . Which gas would be produced if a dilute acid was added to Sando-K? (The Data Sheet may help you to answer this question.)

.....

(1)

- (c) The compounds in Sando-K contain ions.

Complete the two sentences below.

Atoms change into positive ions by ..... one or more

.....

Atoms change into negative ions by ..... one or

more .....

(4)

- (d) Electricity can be used to show that an aqueous solution of Sando-K contains ions.

- (i) Draw a diagram of an apparatus that you could use to prove that Sando-K contains ions.

(4)

- (ii) Explain, as fully as you can, what would happen when the electricity is switched on.

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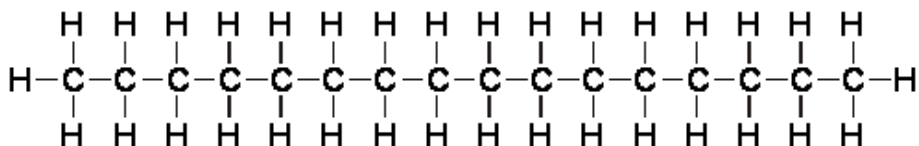
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(3)

(Total 13 marks)

- Q20.** Diesel oil is obtained from crude oil. It can be used as a fuel for car engines. The diagram below represents a compound found in diesel oil.



- (a) What is the formula of this compound?

.....

(1)

- (b) Each of the lines on the diagram above represents a covalent bond.

What is a covalent bond?

.....

.....

(2)

(Total 3 marks)

- Q21.** The following passage was taken from a chemistry textbook.

Germanium is a white, shiny, brittle element. It is used in the electronics industry because it is able to conduct a small amount of electricity.

It is made from germanium oxide obtained from flue dusts of zinc and lead smelters. The impure germanium oxide from the flue dusts is changed into germanium by the process outlined below.

**STEP 1** The germanium oxide is reacted with hydrochloric acid to make germanium tetrachloride. This is a volatile liquid in which the germanium and chlorine atoms are joined by covalent bonds.

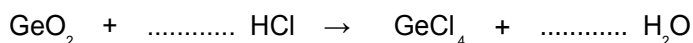
**STEP 2** The germanium tetrachloride is distilled off from the mixture.

**STEP 3** The germanium tetrachloride is added to an excess of water to produce germanium oxide and hydrochloric acid.

**STEPS 1 to 3** are repeated several times.

**STEP 4** The pure germanium oxide is reduced by hydrogen to form germanium.

- (a) Balance the equation below which represents the reaction in step 1.



(1)

- (b) Write a word equation for the reaction in step 3.

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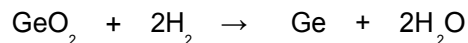
(1)

- (c) Suggest why steps 1 to 3 are repeated several times.

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(1)

- (d) The equation which represents the reaction in step 4 is shown below.



- (i) Explain what is meant by the term 'reduced'.

.....  
.....

(1)

- (ii) Calculate the mass of germanium which could be made from 525 g of germanium oxide. (Relative atomic masses: Ge = 73; O = 16).

.....  
.....  
.....  
.....

Mass ..... g

(3)

- (e) Germanium is difficult to classify as either a metal or a non-metal.

- (i) Give as much evidence as you can from the information in this question to support the view that germanium is a metal. Explain your answer as fully as you can.

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(3)

- (ii) Give as much evidence as you can from the information in this question to support the view that germanium is a non-metal. Explain your answer as fully as you can.

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(3)  
(Total 13 marks)

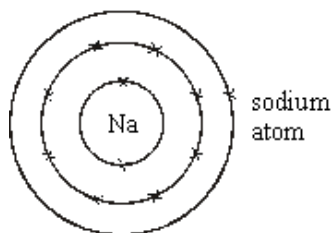
**Q22.**

- (a) The electronic structure of a sodium atom can be written 2,8,1.  
Write the electronic structure of a potassium atom in the same way.

.....

(1)

- (b) The electronic structure of a sodium atom can also be represented as in the diagram below.



- (i) Draw a similar diagram for a fluorine atom.

- (ii) Draw similar diagrams to show the electronic structure of the particles in sodium fluoride.

(4)  
(Total 5 marks)

- Q23.** The extract below was taken from a leaflet on the uses of platinum. One of the uses described was in making electrodes for spark plugs in car engines. The spark plug produces the spark which ignites the fuel in the engine.

**Spark Plugs**

The electrodes in a spark plug have to conduct electricity very well. Since they project into the combustion chamber of the engine, they must also be able to withstand extremely high temperatures in a very corrosive atmosphere.

Nickel-based plugs have been produced for many years. They only last a fairly short time. As the electrodes wear, combustion becomes less efficient and the petrol is not burnt completely.

Platinum and other precious metals can now be used in spark plugs. These last much longer and are more efficient. This can help to reduce air pollution.

The table below gives some information about platinum and nickel.

	MELTING POINT (° C)	BOILING POINT (° C)	POSITION IN REACTIVITY SERIES	COST (£/kg)
nickel	1455	2920	Higher than gold	2.5
platinum	1769	4107	below gold	6110

- (a) Compare nickel and platinum for use in making the electrodes in spark plugs.

A good answer should give advantages and disadvantages of each metal linking these to the properties of the metals. Marks will be given for the way in which you organise your answer.

***You will need a sheet of lined paper.***

(8)



- (b) (i) Describe the structure and bonding in metals.

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(3)

- (ii) Explain why metals such as nickel and platinum are good conductors of electricity.

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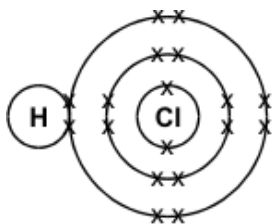
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(2)

(Total 13 marks)

**Q24.** The hydrogen halides (hydrogen fluoride, hydrogen chloride, hydrogen bromide and hydrogen iodide) are important chemicals.

The diagram below represents a molecule of hydrogen chloride.



- (i) What type of particles are represented by the crosses (X)?

.....

(1)

- (ii) What type of chemical bond holds the atoms in this molecule together?

.....

(1)

- (iii) Would you expect hydrogen chloride to be a gas, a liquid or a solid, at room temperature and pressure? Explain your answer.

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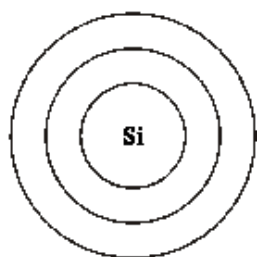
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(3)  
(Total 5 marks)

**Q25.** Silicon is an extremely important element. More than a million tonnes of silicon are produced each year. Silicon is made by reducing silicon oxide (sand) with carbon (coke).

- (a) (i) Complete the diagram below to show the arrangement of electrons in an atom of silicon. The Data Sheet may help you with this question.



(2)

- (ii) Which electrons in the silicon atom take part in chemical reactions with other atoms?

.....

.....

(1)

- (iii) What features of all the atoms of the elements in group 4 of the Periodic Table might give them similar chemical properties?

.....

.....

(1)

- (b) Silicon is difficult to classify as a metal or a non-metal because it has properties which resemble both. Some of the properties of silicon are listed below.

- Silicon is a shiny blue/grey solid.
- Silicon is placed in Group 4 of the Periodic Table.
- Silicon has a relative atomic mass of 28.
- Silicon has a very high melting point (1410°C).
- Silicon has a very high boiling point (2355°C).
- Silicon conducts electricity.
- Silicon oxide will neutralise alkalis.
- Silicon forms compounds in which the silicon atoms are bonded to other atoms by covalent bonds.

(i) Select **two** properties from the list above in which silicon resembles a metal.

1. ....

2. ....

(2)

(ii) Select **two** properties from the list above in which silicon resembles a non-metal.

1. ....

2. ....

(2)

(Total 8 marks)

**Q26.** Fluorine is a very useful element. It is placed in group 7 of the Periodic Table.

Use your knowledge of the elements in group 7 to help you answer these questions. You may find that information in the Data Sheet may help you with this question.

(a) Name another element in group 7 of the Periodic Table.

.....

(1)

(b) Cylinders filled with fluorine molecules are commercially available. What would you expect the formula of a fluorine molecule to be?

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(1)

(c) Fluoride ions are added to drinking water to help prevent tooth decay. What is the charge on fluoride ions in the water?

.....

(1)

(d) Fluorine reacts with the non-metal sulphur to make sulphur hexafluoride ( $\text{SF}_6$ ).

(i) What type of bonding would you expect in sulphur hexafluoride?

.....

(1)

(ii) Explain the reason for your answer to part (i).

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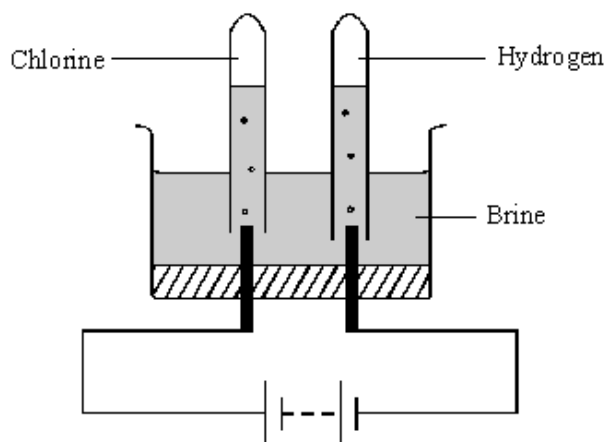
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(1)

(Total 5 marks)

**Q27.** Brine, a solution containing sodium chloride in water, can be used to manufacture chlorine, hydrogen and sodium hydroxide. A student sets up a simplified model of the industrial cell.



(a) The electron arrangements of some atoms are shown here.

H	1
O	2.6
Na	2.8.1
Cl	2.8.7

(i) Use the relevant electron arrangements to describe the bonding in water.

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.....

(2)

(ii) Use the relevant electron arrangements to describe the bonding in sodium chloride.

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(3)

- (b) Use the atomic structures of  $^{35}_{17}\text{Cl}$  and  $^{37}_{17}\text{Cl}$  to explain the meaning of the term *isotopes*.

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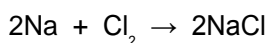
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(3)  
(Total 8 marks)

**Q28.** Sodium reacts with chlorine to form the compound sodium chloride.



Describe, in terms of electron arrangement, the type of bonding in:

- (i) a molecule of chlorine;

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.....

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(3)

- (ii) the compound sodium chloride.

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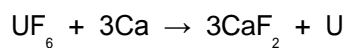
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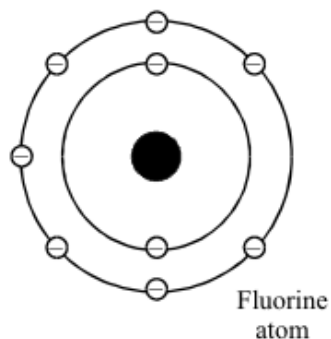
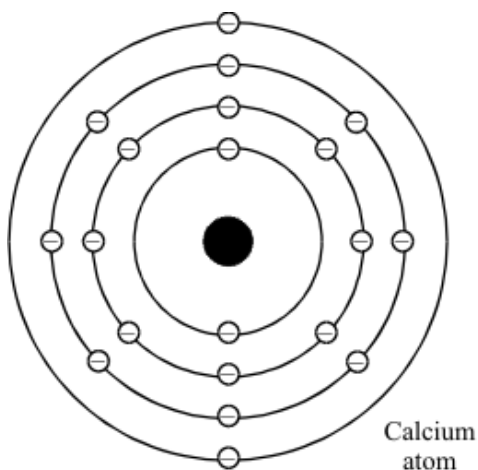
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(4)  
(Total 7 marks)

**Q29.** Uranium metal can be produced by reacting uranium hexafluoride with calcium.



- (a) Describe how calcium and fluorine bond together to form calcium fluoride. The electron arrangement of each atom is shown.



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(5)

- (b) Uranium has two main isotopes,  ${}_{92}^{235}\text{U}$  and  ${}_{92}^{238}\text{U}$ . Use these as examples to explain what is meant by the word isotope.

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(4)

- (c) At the start of a reaction there was 174.5 g of uranium hexafluoride,  $\text{UF}_6$ .

Relative atomic masses: F 19; U 235

- (i) Calculate the relative formula mass of uranium hexafluoride,  $\text{UF}_6$ .

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Relative formula mass  $\text{UF}_6 = \dots\dots\dots$  g

(1)

- (ii) Calculate the mass of uranium that would be produced from 134.5 g of uranium hexafluoride.

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Mass of uranium =  $\dots\dots\dots$  g

(2)

(Total 12 marks)

**Q30.** Millions of years ago the Earth formed as a giant ball of molten rock. The outer surface cooled forming a thin, solid outer crust. Volcanic activity on the surface produced an atmosphere containing the compounds carbon dioxide, ammonia, methane and water vapour.

Describe the bonding in any **one** of these compounds. You must include electronic structures in your explanation.

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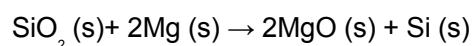
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(Total 4 marks)

**Q31.** Silicon is an important element used in the electronics industry.

- (a) Silicon can be made by heating a mixture of sand (silicon dioxide) with magnesium powder.

The equation for this reaction is shown below.



Calculate the mass of silicon dioxide needed to make 1 g of silicon.

Relative atomic masses: O = 16; Si = 28

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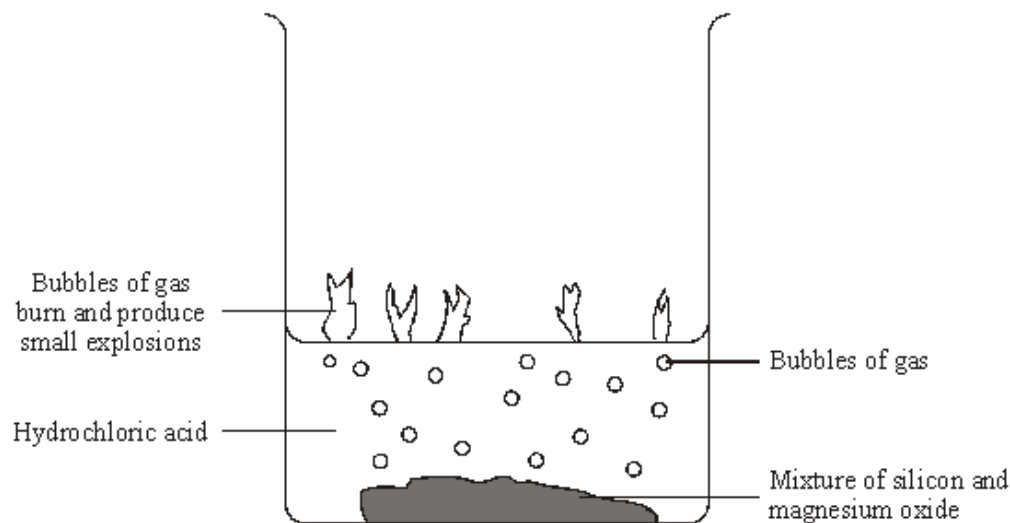
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Mass = .....g

(3)



- (b) The resulting mixture of magnesium oxide and silicon is added to a beaker containing hydrochloric acid. The silicon is then filtered from the solution.



- (i) The magnesium oxide reacts with the hydrochloric acid and forms magnesium chloride ( $\text{MgCl}_2$ ) solution and water.

magnesium oxide + hydrochloric acid  $\rightarrow$  magnesium chloride solution + water

Write a balanced symbol equation for this reaction, including state symbols.

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(2)

- (ii) The gases produced are a mixture of several silicon hydrides.

One of the gases produced in the reaction is the silicon hydride with the formula  $\text{SiH}_4$ .

The structure of this molecule is similar to methane,  $\text{CH}_4$ .

Draw a diagram to show the bonding in a molecule of  $\text{SiH}_4$ . Represent the electrons as dots and crosses and only show the outer shell (energy level) electrons.

(1)

- (iii) A sample of a different silicon hydride was found to contain 1.4 g of silicon and 0.15 g of hydrogen.

Calculate the formula of this silicon hydride. You must show all your working to gain full marks.

Relative atomic masses: H = 1; Si = 28

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(4)

- (iv) The silicon hydrides react immediately they come into contact with oxygen in the air. They burst into flames with a small explosion and give out energy.

Which letter, **A** to **H**, best describes this reaction?

Energy involved in breaking and forming bonds	Activation energy	Rate of reaction	Letter
The energy released from forming new bonds is greater than the energy needed to break existing bonds	high	fast	<b>A</b>
		slow	<b>B</b>
	low	fast	<b>C</b>
		slow	<b>D</b>
The energy needed to break existing bonds is greater than the energy released from forming new bonds	high	fast	<b>E</b>
		slow	<b>F</b>
	low	fast	<b>G</b>
		slow	<b>H</b>

Letter .....

(1)

- (c) The structure of silicon is similar to the structure of diamond.

Describe the structure of silicon and explain why it has a high melting point. You may draw a diagram if this helps.

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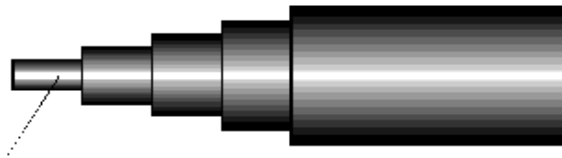
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(4)

(Total 15 marks)

- Q32.** The drawing shows a high quality wire used to make electrical connections on a hi-fi system.



Multi-strand "OFC" copper  
to maintain high signal purity  
Multi-strand "OFC" copper  
to maintain high signal purity

(a) Copper is used because it is a very good conductor of electricity. Copper is a typical metal.

(i) Describe the structure and bonding in a metal. You may wish to draw a diagram to help you to answer this question.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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(3)

(ii) Explain, by reference to your answer to part (a)(i), why copper conducts electricity.

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(1)

(iii) Explain, by reference to your answer to part (a)(i), why copper can be drawn into wires.

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(1)

(b) The copper used to make this wire is “OFC” copper. This stands for ‘oxygen free copper’.

- (i) It is thought that when molten copper is cooled and solidified it can take in some oxygen from the air. This may slightly decrease the conductivity of the copper.

Suggest why the conductivity might be decreased.

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(2)

- (ii) To make it oxygen free, the copper is heated in an atmosphere of hydrogen.

Explain how this will remove the oxygen.

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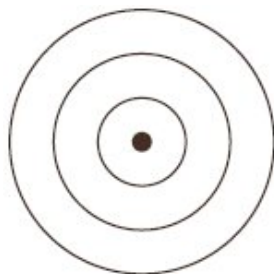
(1)

(Total 8 marks)

**Q33.** 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.

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(2)  
(Total 3 marks)

- Q34.** Read the article about the use of nanoparticles in sun creams.

### **Sun creams**

Many sun creams use nanoparticles. These sun creams are very good at absorbing radiation, especially ultraviolet radiation. Owing to the particle size, the sun creams spread more easily, cover better and save money because you use less. The new sun creams are also transparent, unlike traditional sun creams which are white. The use of nanoparticles is so successful that they are now used in more than 300 sun cream products.

Some sun creams contain nanoparticles of titanium oxide. Normal-sized particles of titanium oxide are safe to put on the skin.

It is thought that nanoparticles can pass through the skin and travel around the body more easily than normal-sized particles. It is also thought that nanoparticles might be toxic to some types of cell, such as skin, bone, brain and liver cells.

- (a) Explain why nanoparticles pass through the skin and travel around the body more easily than normal-sized particles of titanium oxide.

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(2)

- (b) Explain why sun creams containing nanoparticles should be tested further.

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(1)

- (c) Suggest why some companies that make sun creams might not want to do more tests.

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(2)

(Total 5 marks)

**Q35.** Read the article about the use of nanoparticles in sun creams.

### Sun creams

Many sun creams use nanoparticles. These sun creams are very good at absorbing radiation, especially ultraviolet radiation. Owing to the particle size, the sun creams spread more easily, cover better and save money because you use less. The new sun creams are also transparent, unlike traditional sun creams which are white. The use of nanoparticles is so successful that they are now used in more than 300 sun cream products.

Some sun creams contain nanoparticles of titanium oxide. Normal-sized particles of titanium oxide are safe to put on the skin.

It is thought that nanoparticles can pass through the skin and travel around the body more easily than normal-sized particles. It is also thought that nanoparticles might be toxic to some types of cell, such as skin, bone, brain and liver cells.

- (a) Explain why nanoparticles pass through the skin and travel around the body more easily than normal-sized particles of titanium oxide.

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(2)

- (b) Explain why sun creams containing nanoparticles should be tested further.

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(1)

- (c) Suggest why some companies that make sun creams might not want to do more tests.

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(2)

(Total 5 marks)



