

## High Demand Questions

## QUESTIONSHEET 1

- (a) Oxygen and sulphur are in the same group of the periodic table.

Complete the table below to show the arrangement of electrons in oxygen and sulphur atoms.

Atom	shell 1	shell 2	shell 3
oxygen			
sulphur			

[2]

- (b) (i) Draw a diagram of an oxygen atom.

[2]

- (ii) Use your diagram to describe two ways in which oxygen can achieve a full outside shell of electrons.

.....  
.....  
..... [2]

- (c) Some of the oxygen in the atmosphere is in the form of ozone, O<sub>3</sub>. Scientists believe that chlorine radicals are destroying ozone.

- (i) What is the difference between a chlorine radical and a chlorine molecule?

.....  
..... [2]

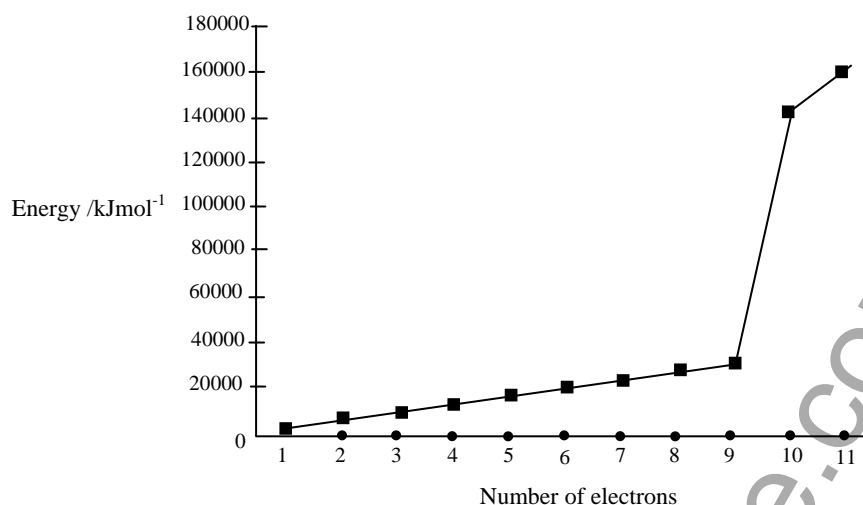
- (ii) What substances are thought to be main sources of chlorine radicals in the atmosphere?

..... [1]

## High Demand Questions

## QUESTIONSHEET 2

- (a) There are eleven electrons in a sodium atom.  
The amounts of energy required to remove each one have been measured and the results shown on a sketch graph.



- (i) Why is the first electron in sodium the easiest to remove?

.....  
 ..... [2]

- (ii) Why do the energies for electrons 2 to 9 go up by relatively small amounts?

..... [1]

- (iii) Why are the last two energies very high?

..... [1]

- (b) Draw a sketch graph to show the energies needed to remove the first four electrons in aluminium.  
Explain your answer.

.....  
 ..... [3]

## High Demand Questions

## QUESTIONSHEET 3

(a) (i) Explain what is meant by the numbers in the symbol  ${}_{20}^{40}\text{Ca}$ .

.....  
..... [2]

(ii) Use the numbers to state the number of protons, neutrons and electrons found in  ${}_{20}^{40}\text{Ca}$

protons

neutrons

electrons

(b) Complete the table below to show the numbers of protons, neutrons and electrons found in the ions shown. [3]

ion	protons	neutrons	electrons
${}_{1}^{1}\text{H}^{+}$			
${}_{4}^{9}\text{Be}^{2+}$			
${}_{26}^{56}\text{Fe}^{3+}$			
${}_{53}^{127}\text{I}^{-}$			
${}_{34}^{79}\text{Se}^{2-}$			

[8]

High Demand Questions

## QUESTIONSHEET 4

Neon has two main isotopes,  ${}_{10}^{20}\text{Ne}$  and  ${}_{10}^{22}\text{Ne}$

- (a) Draw diagrams of the atoms of each of the neon isotopes.

[3]

- (b) Neon gas is made up of 90% of neon-20 and 10% of neon-22.  
Calculate the exact relative atomic mass of neon.

.....

.....

.....

..... [3]

- (c) How do the chemical properties of each isotope of neon compare with each other?  
Explain your answer.

.....

.....

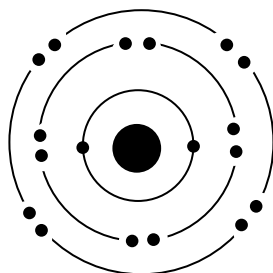
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..... [3]

## High Demand Questions

## QUESTIONSHEET 5

The diagram below shows the electronic arrangement of an unknown substance.



(a) (i) How many protons would there be if the unknown substance was a neutral atom?

..... [1]

(ii) What would the diagram represent if it was a neutral atom?

..... [1]

(b)(i) How many protons would there be if the substance was a 2+ ion?

..... [1]

(ii) What would the diagram represent if it was a 2+ ion?

..... [1]

(c) (i) In what group of the periodic table would the unknown substance be if the represented a 1+ ion?

..... [1]

(ii) How many neutrons would the 1+ ion have if its relative atomic mass was 39?

..... [1]

(d) (i) In what group of the periodic table would the unknown substance be if it represented a 1- ion?

..... [1]

(ii) What would the relative atomic mass of the 1- ion be if it had 20 neutrons?

..... [1]

An unknown element is found to exist as the following two isotopes:



(a) Complete the following table:

	number of protons	number of neutrons	number of electrons
${}_{13}^{24}\text{X}$			13
${}_{13}^{28}\text{X}$	13	15	

[2]

(b) Describe what is meant by the term 'isotopes'.

.....  
.....  
..... [2]

(c) In experiments, both isotopes were found to show the same chemical behaviour.  
Use the information in the table to explain why the chemical behaviour of both isotopes is the same.

.....  
.....  
..... [2]

(d) A naturally occurring sample was found to contain 25% of X-24 and 75% of X-28.  
Calculate the relative atomic mass of the element X.

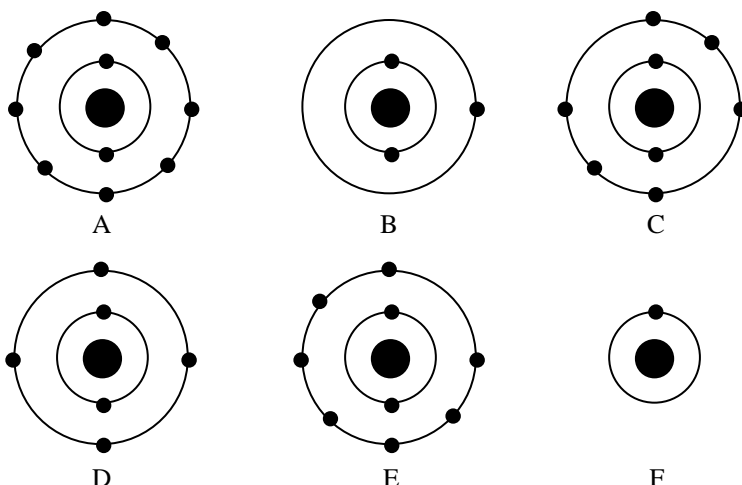
.....  
.....  
..... [3]

(e) Use your periodic table to identify X.

..... [1]

TOTAL / 9

The diagrams below represent the electronic arrangement of different atoms and ions.



- (a) Which letter represents an atom of a Group I metal?  
 ..... [1]
- (b) Which letter represents an atom of a Group VII non-metal?  
 ..... [1]
- (c) Which letter represents an atom of a noble or inert gas?  
 ..... [1]
- (d) Which letter represents an atom which is not in the second period of the Periodic Table?  
 ..... [1]
- (e) Which letter represents an ion of a Group I metal?  
 ..... [1]
- (f) Which two letters represent atoms which form an ionic compound with a formula similar to  $\text{Na}_2\text{S}$ ?  
 ..... [1]
- (g) Which two letters represent atoms which form a molecule with a formula similar to  $\text{SiCl}_4$ ?  
 ..... [1]

TOTAL / 7

(a) Use the Periodic Table to write down the electronic arrangement of:

(i) calcium

..... [1]

(ii) chlorine

..... [1]

(b) If calcium is heated and put into a gas jar of chlorine a violent reaction takes place and solid calcium chloride is formed. The reaction proceeds due to the transfer of electrons.

(i) Use the electron arrangements and the idea of electron transfer to explain how the reaction between atoms of calcium and chlorine takes place.  
(You may include a diagram in your answer)

.....  
.....  
.....  
..... [4]

(ii) Write down the formulae of the ions that calcium and chlorine form during the reaction.

..... [2]

(iii) Write down the formula of calcium chloride.

..... [1]

(c) Calcium chloride is a solid at room temperature and has a high melting point.  
Explain why calcium chloride has a high melting point.

.....  
.....  
..... [2]

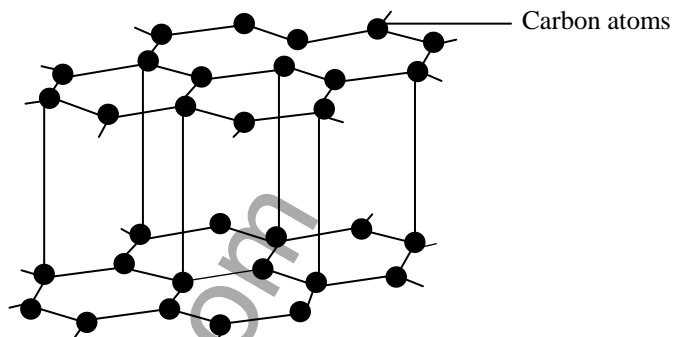
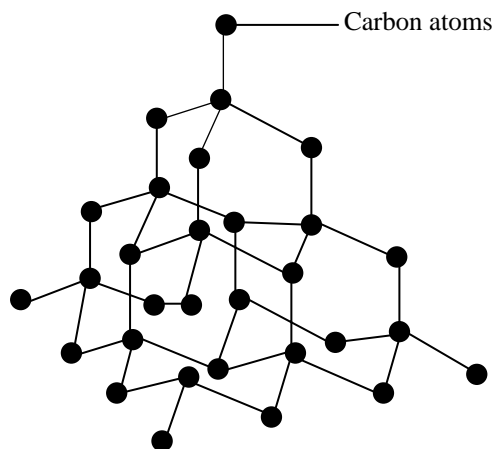
TOTAL / 11



Carbon is known to exist as two different allotropes.

The allotropes are known as diamond and graphite.

Both diamond and graphite consist of carbon atoms bonded together in three-dimensional structures.



- (a) What is the name given the type of bond in which electrons are shared?

..... [1]

- (b)(i) Diamond is one of the hardest substances known to man and is used on the edges of glass cutting tools.  
Explain why the structure of diamond makes it so hard.

..... [2]

- (ii) Graphite is soft and slippery and is used to lubricate surfaces.  
Explain why the structure of graphite makes it soft and slippery.

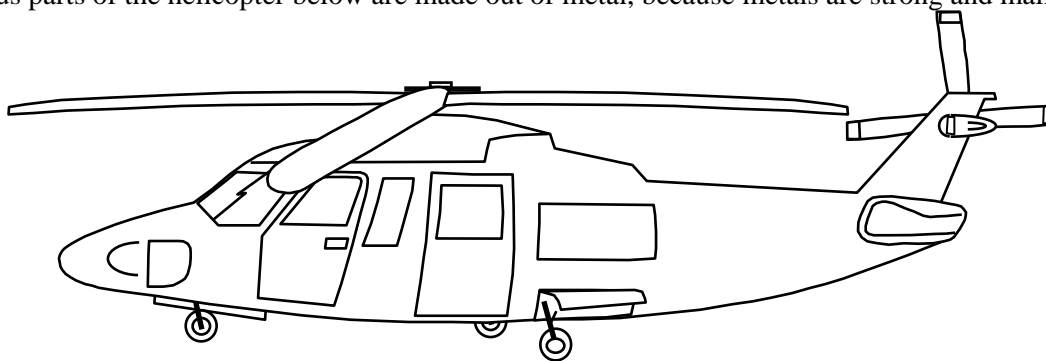
..... [2]

- (c) Diamond is an electrical insulator, but graphite conducts electricity.  
Explain why graphite conducts electricity.

..... [2]

TOTAL / 7

Various parts of the helicopter below are made out of metal, because metals are strong and malleable.



- (a) Describe, with the aid of a diagram, the metallic bonding present in metals.

[4]

- (b) Use your knowledge of the structure of metals to explain why:

- (i) they are strong

.....  
.....  
..... [2]

- (ii) they are malleable

.....  
..... [1]

- (c) As the blades of the helicopter rotate, heat produced in the joints is conducted away along the blades. Explain how metals conduct heat.

.....  
..... [2]

- (d) The properties of some of the metals used in the helicopter have been altered by mixing them with other metals. What name is given to this type of mixture?

..... [1]

TOTAL / 10

Sodium chloride is often called common salt.

It can be made by reacting a small piece of hot sodium with chlorine gas.

- (a) Write the electronic arrangement for an atom of:
- (i) sodium  
..... [1]
- (ii) chlorine  
..... [1]
- (b) Write down the formulae of the ions formed by:
- (i) sodium  
..... [1]
- (ii) chlorine  
..... [1]
- (c) Write down the formula of sodium chloride.  
..... [1]
- (d) Solid sodium chloride will not conduct electricity, but when dissolved in water it will.
- (i) Explain why an aqueous solution of sodium chloride conducts electricity.  
.....  
..... [1]
- (ii) In what other way could you alter the state of sodium chloride so that it will conduct electricity?  
..... [1]
- (e) A hot piece of sodium was placed in a jar of helium. No reaction took place.
- (i) Write the name of the group of the periodic table to which helium belongs.  
..... [1]
- (ii) Explain why helium is unreactive.  
..... [1]

The following table shows some of the ions found in natural waters.

ion	Mg <sup>2+</sup>	Na <sup>+</sup>	SO <sub>4</sub> <sup>2-</sup>	NO <sub>3</sub> <sup>-</sup>	Ca <sup>2+</sup>	Cl <sup>-</sup>	K <sup>+</sup>
name	magnesium	sodium	sulphate	nitrate	calcium	chloride	potassium

(a) Use the list of ions to work out the formulae of the following compounds:  
(Explain your answers)

(i) sodium sulphate

.....  
..... [2]

(ii) potassium nitrate

.....  
..... [2]

(iii) calcium chloride

.....  
..... [2]

(iv) magnesium nitrate

.....  
..... [2]

(v) potassium chloride

.....  
..... [2]

(b)(i) What type of bonding occurs in all of these compounds?

..... [1]

(ii) Explain how this type of bonding occurs.

.....  
..... [2]

(Continued...)

## QUESTIONSHEET 12 CONTINUED

- (c) (i) Iodine is in the same group of the Periodic Table as chlorine.  
What is the formula of an iodide ion?

..... [1]

- (ii) Strontium, Sr, is in the same group of the Periodic Table as magnesium.  
What is the formula of the strontium ion?

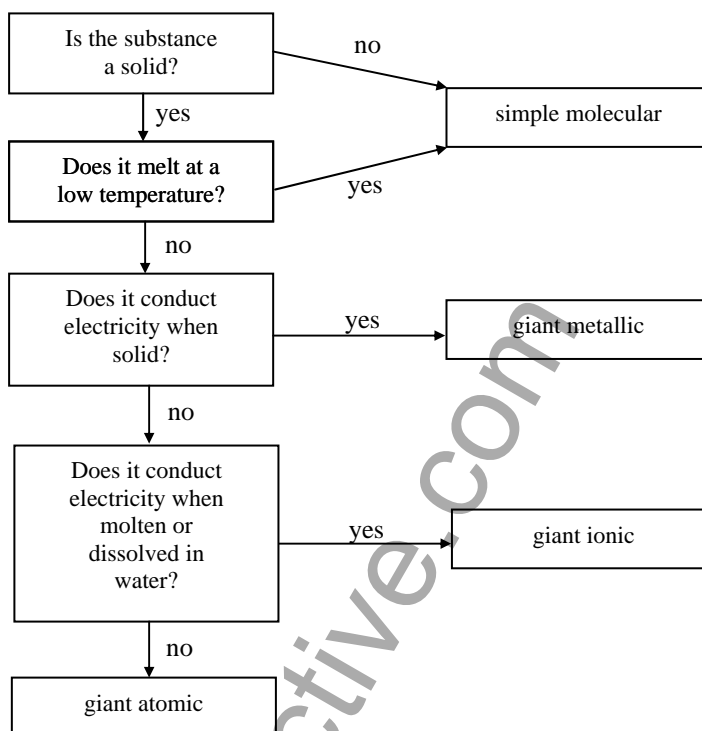
..... [1]

- (iii) What is the formula of strontium iodide?

..... [1]

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The flow chart below can be used to decide on the type of bonding found in different substances.



Use the chart to identify the structure of the following substances:

- (a) (i) Decane boils at  $-30^{\circ}\text{C}$ . It does not conduct electricity under any circumstances.

..... [1]

- (ii) Boron melts at  $2027^{\circ}\text{C}$ . Molten boron does not conduct electricity.

..... [1]

- (iii) Glucose melts at  $146^{\circ}\text{C}$ , but the molten solid does not conduct electricity.

..... [1]

- (iv) Solid cobalt conducts electricity. It melts at  $1495^{\circ}\text{C}$ .

..... [1]

- (v) A solution of calcium nitrate in water conducts electricity. Solid calcium nitrate melts at  $561^{\circ}\text{C}$ .

..... [1]

(Continued...)

## QUESTIONSHEET 13 CONTINUED

- (b) Carbon dioxide has a simple molecular structure.  
What does this tell you about its melting point and boiling point?

..... [1]

- (c) Draw a diagram to show the structure of cobalt.

[2]

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The table below shows the electronic arrangements of six atoms, A to F.

atom	A	B	C	D	E	F
electronic arrangement	2, 8, 6	2, 8, 8	2, 8, 3	2	2, 8, 8, 6	2, 5

Use the letters representing the atoms to select the following:

- (a) Two atoms from the same group of the periodic table

.....  
..... [2]

- (b) The ion  $K^+$

..... [1]

- (c) Two noble gases.

.....  
..... [2]

- (d) An atom which has 3 electrons in its outside shell.

..... [1]

- (e) An atom which has 5 electrons in its outside shell.

..... [1]

- (f) An atom with the atomic number 24.

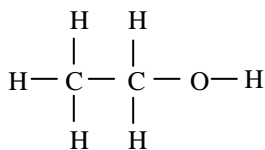
..... [1]

- (g) An atom with 7 protons.

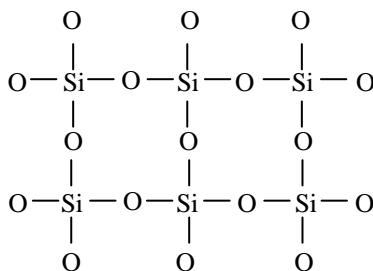
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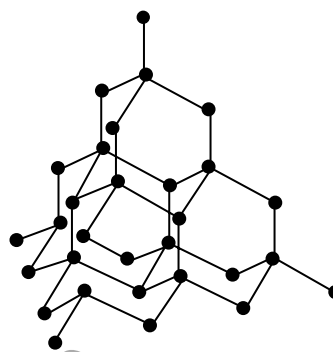
The diagrams below show the structures of ethanol, mica and diamond.



Ethanol



Mica



Diamond

(a) How many bonds does each carbon have in:

(i) ethanol?

..... [1]

(ii) diamond?

..... [1]

(b) How many bonds does each hydrogen have in ethanol?

..... [1]

(c) (i) How many bonds does each silicon have in mica?

..... [1]

(ii) How many bonds does each oxygen have in mica?

..... [1]

(d) (i) Which of the elements, carbon, hydrogen, oxygen and silicon would you expect to find in the same group of the Period Table?

..... [1]

(ii) Explain your answer.

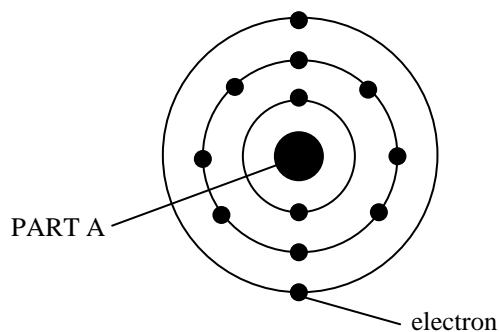
.....

..... [2]

## Medium Demand Questions

## QUESTIONSHEET 16

(a) The diagram below shows an atom of magnesium.



(i) What is the name of part A?

..... [1]

(ii) What two types of particle does part A contain?

.....  
..... [2]

(iii) What is the charge on part A?

..... [1]

(b)(i) How many electrons are in one atom of magnesium?

..... [1]

(ii) Write the electron arrangement for an atom of magnesium.

..... [1]

(c) Use the diagram and your answer to part (b) to answer the following questions.

(i) In what group of the Periodic Table is magnesium?

..... [1]

Explain your answer.

..... [1]

(ii) In what period of the Periodic Table is magnesium?

..... [1]

Explain your answer.

..... [1]

TOTAL / 10

## Low Demand Questions

## QUESTIONSHEET 17

Oxygen is able to form two bonds with other elements.

Potassium can form one bond, magnesium two and aluminium three.

(a) Work out the formulae of the following compounds.

(i) potassium oxide

..... [1]

(ii) magnesium oxide

..... [1]

(iii) aluminium oxide

..... [1]

(b) Iron sometimes forms two bonds and sometimes three.

(i) Work out the formulae of the two oxides of iron.

.....  
..... [2]

(ii) How are the two oxides of iron distinguished in their names?

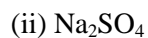
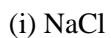
.....  
..... [1]

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## Low Demand Questions

## QUESTIONSHEET 18

Here are the formulae of three compounds containing sodium.



(a) Give the name of each compound.

.....  
.....  
..... [3]

(b)(i) Which compound is made up of the most atoms?

..... [1]

(ii) How many atoms does it contain?

..... [1]

(c)(i) Which compound has the most different types of atoms?

..... [1]

(ii) List the types of atom in this compound.

.....  
..... [3]

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## Low Demand Questions

## QUESTIONSHEET 19

Complete the following paragraphs about atoms.

Atoms are the \_\_\_\_\_ particles of matter that can exist on their own. They are made up of particles called protons, \_\_\_\_\_ and electrons. Protons have a \_\_\_\_\_ charge and electrons have a \_\_\_\_\_ charge.

The protons are found in the \_\_\_\_\_ of the atom. In a neutral atom, the number of protons must \_\_\_\_\_ the number of electrons. If they do not, the particle will be called an \_\_\_\_\_.

The number of protons in an atom is called its \_\_\_\_\_ \_\_\_\_\_. The total number of particles in the nucleus gives the \_\_\_\_\_ \_\_\_\_\_ of the element.

The atoms of different elements are \_\_\_\_\_. They must contain different numbers of \_\_\_\_\_ and \_\_\_\_\_, although they may have the same number of \_\_\_\_\_.

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Low Demand Questions

QUESTIONSHEET 20

Complete the following table

Name of element	neon		sodium		carbon
symbol		Mg		N	
mass number	20	24		14	
atomic number	10		11	7	6
number of neutrons		12	12	7	6

[9]

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