

1.

(a) The table shows some information about six particles.

Complete the table.

particle	proton (atomic) number	number of neutrons in particle	number of electrons in particle
^{35}Cl	17	18
.....	17	20	17
$^{39}\text{K}^+$	19	18
$^{79}\text{Br}^-$	44	36
^{81}Br	35	35
.....	37	48	36

[6]

(b) Identify two atoms which are isotopes of the same element.

..... and [1]

[Total: 7]

2.

(a) State the name of the process that is used to

(i) separate oxygen from liquid air,

..... [1]

(ii) separate the individual dyes in ink,

..... [1]

(iii) obtain water from aqueous sodium chloride,

..... [1]

(b) State what is meant by the terms
element,

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

compound,

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

ion.

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

(c) Carbon and silicon are elements in Group IV of the Periodic Table. Both carbon and silicon exist as more than one isotope.

(i) Explain allotropic forms of carbon.

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

(ii) Define the term *isotopes*.

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

[Total: 10]

3.

(a) Complete the following table which gives information about carbon atoms and silicon atoms.

	carbon	silicon
proton number		
electronic structure		
nucleon number	12	28
number of neutrons in one atom		

[3]

(b) Silicon has a giant structure which is similar to the structure of diamond.

(i) Name the type of bond which is present between silicon atoms in silicon.

[1]

(ii) Suggest **two** physical properties of silicon.

Use your knowledge of structure and bonding to explain why silicon has these physical properties.

property 1

reason

property 2

reason

[4]

(c) Samples of air taken from industrial areas are found to contain small amounts of carbon dioxide.

State why carbon dioxide in excess is harmful.

[1]

(d) Carbon dioxide, CO_2 , is a gas at room temperature and pressure, whereas silicon(IV) oxide, SiO_2 , is a solid.

(i) Name the type of structure which the following compounds have.

carbon dioxide

silicon(IV) oxide

[1]

(ii) Use your knowledge of structure and bonding to explain why carbon dioxide is a gas at room temperature and pressure, whereas silicon(IV) oxide is a solid.

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

[3]

[Total: 14]

4.

(a) Magnesium is a metal.

Describe the structure and bonding in magnesium.

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

[3]

(b) Why can magnesium conduct electricity when solid?

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

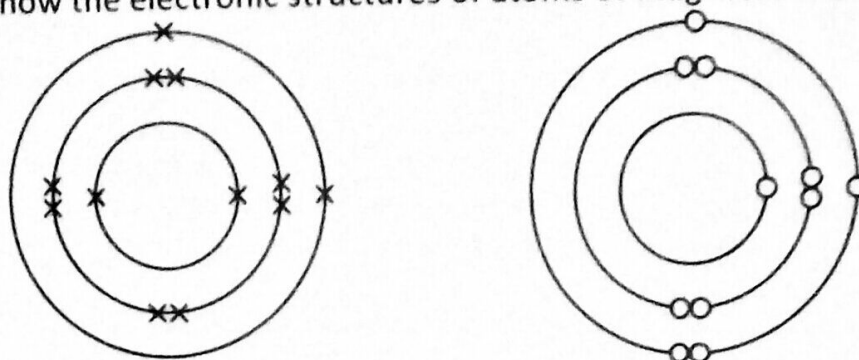
[2]

(c) Why is magnesium malleable?

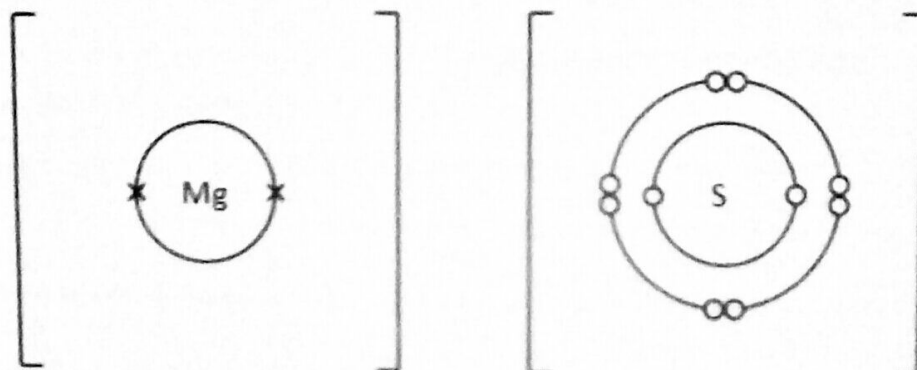
.....
.....
.....
.....

[2]

- (d) Magnesium reacts with sulfur to form the ionic compound magnesium sulfide, MgS . The diagrams show the electronic structures of atoms of magnesium and sulfur.



- (i) Complete the diagrams to show the electronic structures of the ions in magnesium sulfide. Show the charges on the ions.



[3]

- (ii) Ionic compounds, such as magnesium sulfide, do **not** conduct electricity when solid. Magnesium sulfide does **not** dissolve in water. Magnesium sulfide **does** conduct electricity under certain conditions. State the conditions needed for magnesium sulfide to conduct electricity. Explain why magnesium sulfide conducts electricity under these conditions.

.....

.....

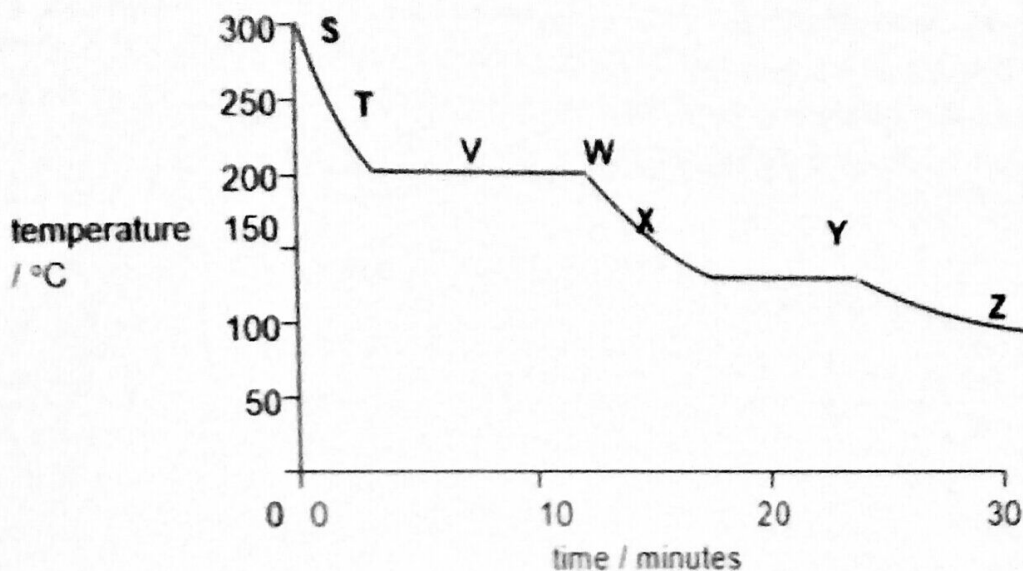
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.....

[2]

[Total: 12]

5. The graph shows how the temperature of a substance changes as it is cooled over a period of 30 minutes.



(a) Which letter, S, T, V, W, X, Y or Z, shows when

(i) the particles in the substance have the most kinetic energy,

..... [1]

(ii) the particles in the substance are furthest apart,

..... [1]

(iii) the substance exists as both a gas and a liquid?

..... [1]

(iv) Use the graph to estimate the freezing point of the substance.

..... °C [1]

(v) Name the change of state directly from a solid to a gas.

..... [1]

(b) When smoke is viewed through a microscope, the smoke particles in the air appear to jump around.

Explain why the smoke particles move in this way.

..... [2]

[Total: 7]

6.

(a) Kinetic theory explains the properties of matter in terms of the arrangement and movement of particles. Nitrogen is a gas at room temperature. Nitrogen molecules, N_2 , are spread far apart and move in a random manner at high speed. Draw the electronic structure of a nitrogen molecule. Show only the outer electron shells.

[2]

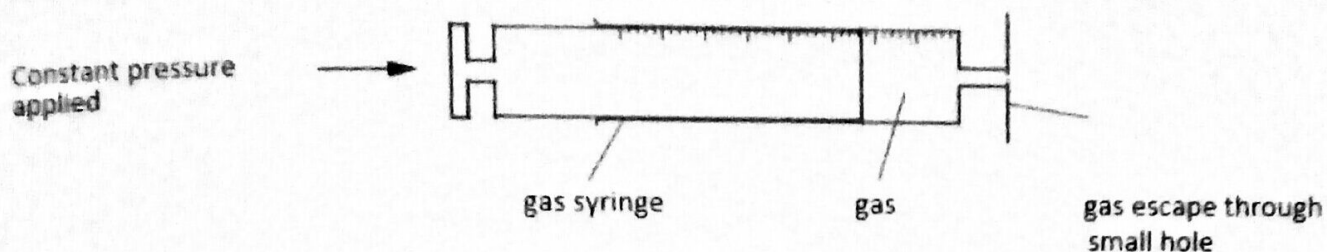
(b) Compare the movement and arrangement of the molecules in solid nitrogen to those in nitrogen gas.

[3]

(c) A sealed container contains nitrogen gas. The pressure of the gas is due to the molecules of the gas hitting the walls of the container. Use the kinetic theory to explain why the pressure inside the container increases when the temperature is increased.

[2]

(d) The following apparatus can be used to measure the rate of diffusion of a gas.



The following results were obtained.

gas	temperature/ °C	rate of diffusion in cm ³ / min
Nitrogen	25	1.00
Chlorine	25	0.63
nitrogen	50	1.05

(i) Explain why nitrogen gas diffuses faster than chlorine gas.

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

(ii) Explain why the nitrogen gas diffuses faster at the higher temperature.

..... [1]

[Total: 10]