CHEMISTRY FORM THREE

TIME: 1 HOUR 30 MINUTES

INSTRUCTION: ANSWER ALL THE QUESTIONS IN THE SPACES PROVIDED

1. Explain the following:

 (i) It is always advisable to scoop chemical substances using a clean spatula. (1mark)

To prevent contamination of the chemicals.

 (ii) Flammable substances should always be kept away from flames in the laboratory. (1mark)

To prevent fire accidents.

2. Use the information in the table below to answer the questions that follow.

Melting point	Element	Atomic number
97.8	R	11
660	S	13
1440	T	14
-40.1	U	17
63.1	V	19

   (a) Write the electron arrangement of: **(2 mark)**
   (b) (i) ion of S

   **ion of S** - *2.8*

   (ii) atom of T

   atom of T - *2.8.4*

   (c) Explain why the melting point of T is higher than that of U. **(2 marks)**
       Atoms are covalently bonded together to form a giant atomic structure. Atoms of U are bonded covalently to form molecules. The molecules are then hold together by weak Van der waals to form a simple molecule structure.

3. (a) When magnesium metal is burnt in air, it reacts with both oxygen and nitrogen gases giving a white ash.

Write two equations for the reactions that take place. (2 marks)

2Mg(s) + O2(g) → 2MgO(s)

3Mg(s) + N2(g) → Mg3 N2(s)
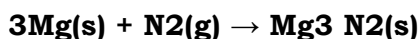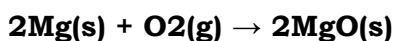
4. (a) State the Graham''s law. (1 mark)

The rate of diffusion of a gas is inversely proportional to the square root of its density at the same conditions of temperature and pressure.

(b) A volume of 80cm3 of nitrogen gas diffused through an oriffice in 40 seconds. How long will 170cm3 of carbon (IV) oxide take to diffuse through the same oriffice? (N = 14, C = 12, O = 16) (3 marks)

$$(b) \quad \frac{R_{N2}}{R_{CO_2}} = \frac{\sqrt{MCO_2}}{\sqrt{MN_2}}$$

$$\frac{\left(\frac{80}{40}\right)}{\left(\frac{170}{x}\right)} = \frac{\sqrt{44}}{\sqrt{28}}$$

$$\frac{2x}{170} = \frac{\sqrt{44}}{\sqrt{28}}$$

$$2x = \frac{170\sqrt{44}}{\sqrt{28}}$$

$$\frac{2x}{2} = \frac{213.106}{2} \, sec$$

$$\therefore x = 106.6 \text{ seconds}$$

5. (a) Define allotropy (1 mark)

This is the existence of an element in different forms but in the same physical state

(b) Graphite is an allotrope of carbon, which conducts electricity although carbon is a non-metal. Explain.(2marks

This because graphite uses 3 electron s out of the four in bonding therefore it is left with one delocalized electron that is used in conduction

(c) Sulphur is extracted from underground deposits by the process shown below.

Ground level
Rock containing sulphur
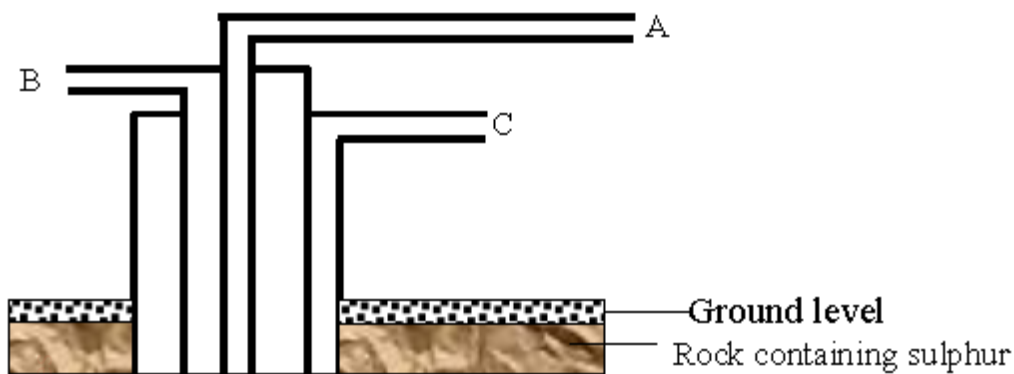
(i)   Water at 1700C is pumped down the outer pipe. Explain how it is possible to obtain water with temperature of 1700C. (1 mark)
By boiling the water under pressure

(ii)   Name the substances passed through;

(a) Pipe A (1 mark)

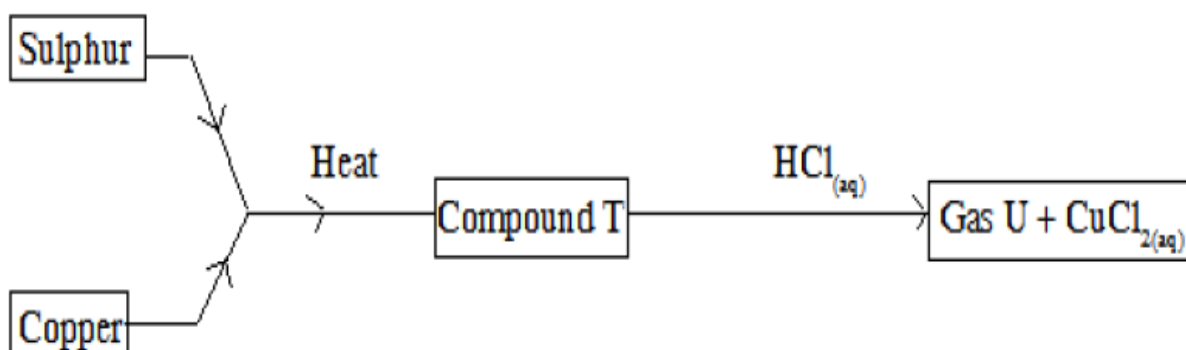***Hot compressed air***

(b) Pipe B (1 mark)

Molten sulphur

6. a)Give two other elements that exhibit allotropy. (2mk)
Carbon

phosphorus

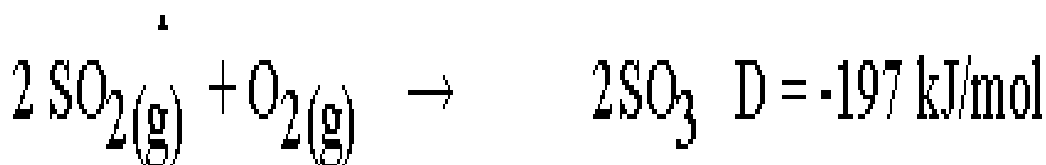b) Study the flow chart below and answer the questions that follow.

c) Name
(i) Compound T (1mk)

Copper(II)sulphide

ii) Gas U (1mk)

hydrogen sulphide

d) The equation below shows the reaction between sulphur (IV) oxide gas and oxygen gas to produce sulphur (VI) oxide in contact process.

$$2\,SO_{2(g)} + O_{2(g)} \rightarrow \quad 2SO_3 \quad D = -197 \text{ kJ/mol}$$

i) State two conditions that are necessary for maximum production of SO3. (2mks)
i) High pressure (2-3 atmospheres)

- Low temperature (450C)

ii) Name the catalyst used for this reaction. (1mk)
Platinum / Vanadium (V) oxide

e) State one use of sulphuric (IV) acid. (1mk)

- Manufacture of dyes and paints

- Manufacture of drugs

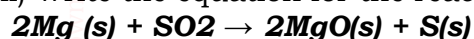*- Dil. H2SO4 is used as an electrolyte in lead -acid accumulators. any 1*

7. A student burnt magnesium ribbon in a gas jar full of sulphur (IV) oxide gas.
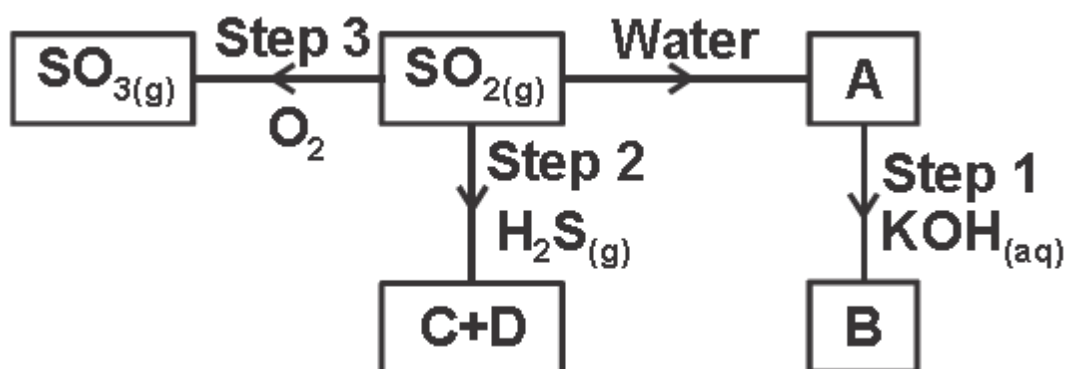i) State two observation made in the gas jar. (1 mark)

Burning magnesium continues to burn.
Yellow deposit of sulphur formed.

ii) Write the equation for the reaction which took place (1 mark)
2Mg (s) + SO2 → 2MgO(s) + S(s)

8. Study the flow chart below and answer the questions that follow.
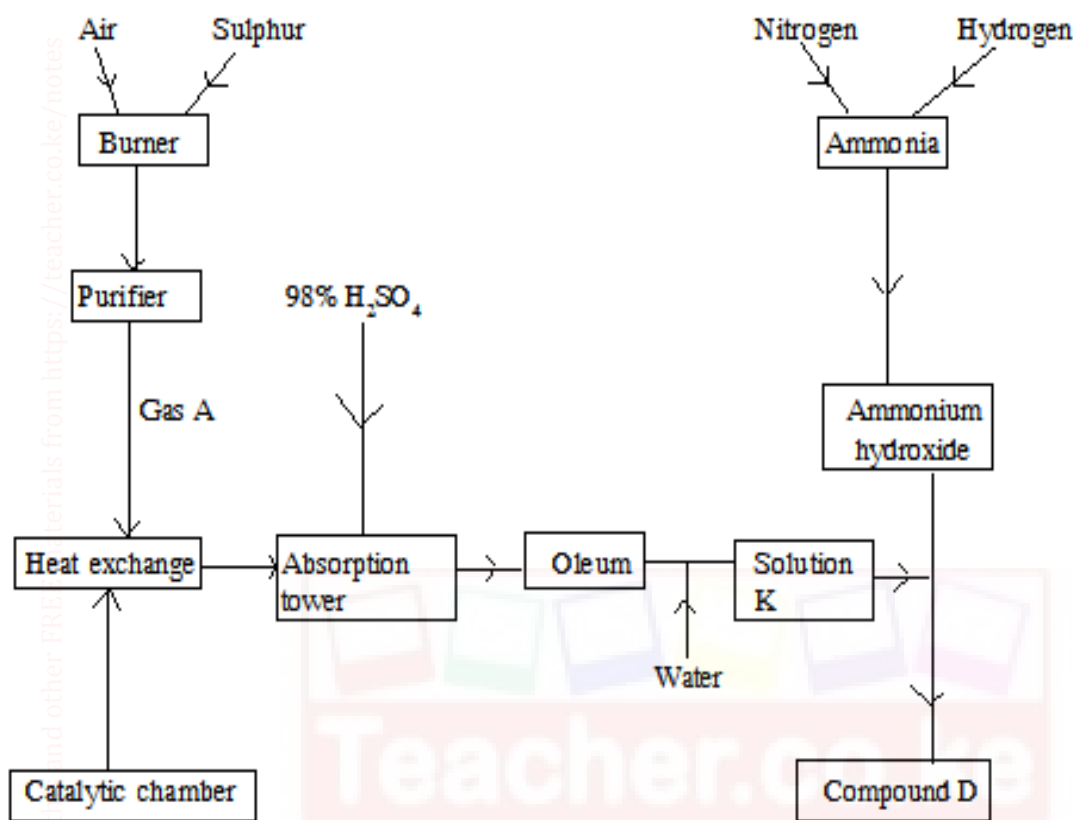

a) Name the substance A and B (1 mark)

i A - H2SO3 - sulphuric IV acid

- K2SO3 - potassium property sulphite

b) State the property of SO2 exhibited in step 2. (1 mark)

Oxidising

9.Below is a chart showing the commercial production of compound D. Study it and answer the questions that follow.

a) Write an equation for the reaction that takes place in the burner. (1mk)

S(s) + O2(g) SO2(g) (balance)

b) Why is it important to purify the products from the burner before being used in the stages that follow? (1mk)

To remove impurities that may poison a catalyst

c) Give one function of heat exchange. (1mk)

To regulate heat within the system

d) Give two reasons why Vanadium pentoxide is preferred to Platinised absestos in the process. (2mks)

Cheap
Not easily poisoned

e) i) Name gas A. (1mk)

Sulphur (IV) oxide (SO2)

ii) Why is water not used in place of concentrated sulphuric acid in the absorption tower. (1mk)

Water produces acid sprays which are harmful to the environment

f) i) Name substances K ,D (2 marks)

K conc. H2SO4

D: Ammonium sulphate (NH4)2SO4)

ii) Give one large scale use of compound D. (1mk)

Used as a fertilizer

h) Explain the environmental effect of gas A if released to the atmosphere. (2mks)

- *Acid rain corrodes iron sheets*
- *Acid rain lead to death of plants and aquatic animals*
- *Causes breathing difficulties*

Two elements X and Y are represented as shown below.

$_{17}X$ and $_{20}Y$

    i)   Write the formula of the compound formed when X and Y react. (1 mark)

  YX2

(II)State the family name to which element X belongs. (1 mark)

Halogens

    ii)   Element Y has a mass number of 40, how many neutrons are present in its nucleus ? (1 mark)

  40 - 20 = 20

4. a)Define the following terms :

i) Atomicity (1 mark)

*Number of atoms of an element in one molecule*

    iii)   Molar gas volume (1 mark)
         Volume occupied by one mole of a gas at s.t.p or r.t.p

b) i) State Gay-Lussac"s law. (1 mark)

When gases react, they do so in volumes which bear simple ratio to one another and to the volume of gaseous products provided all volumes are measured at standard temperature and pressure

ii) A sample of 10cm3 of hydrogen sulphide was burned in 40cm3 of oxygen. Calculate the volume and composition of residual gas (assume all volumes are measured at s.t.p) (2 marks)

ii) $2H_2S_{(g)} + 3O_{2(g)} \rightarrow 2SO_{2(g)} + 2H_2O_{(l)}$
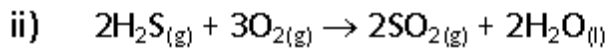
   2 vol   3 vol   2 vol

   $10cm^3$ $40cm^3$ $10cm^3$

2 vol $\rightarrow$ $10cm^3$

3 vol $\rightarrow$

$^3/_2$ x 10 = $15cm^3$

Amount remaining 40 - 15

= $25cm^3$

total volumes = 25 + 10

= $35cm^2$

made up of $10cm^3$ of SO_2 and $25cm^3$ of oxygen