1. a) Write an equation to show the effect of heat on the nitrate of:

i) Sodium

.....

ii) Copper

.....

b) The table below gives information about elements P,Q,R and S.

Element	Atomic radius	Ionic radius	Atomic number
P	0.134	0.074	3
Q	0.090	0.012	5
R	0.143	0.050	13
S	0.099	0.181	17

i) In which period of the periodic table is element Q? Give a reason.

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ii) Explain why the atomic radius of: I. P is greater than that of Q.

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II. S is smaller than its ionic radius.

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iii) Select the element which is in the same group as R.

.....

iv) Using dots $(\bullet)$ and crosses (x) to represent outermost electrons, draw a diagram to show the bonding in the compound formed when P reacts with S.

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2. In an experiment to determine the molar heat of neutralization of hydrochloric acid with sodium hydroxide, students of a secondary school reacted 100cm3 of 1M hydrochloric acid with 50cm3 of 2M sodium hydroxide and obtained the following results.

Initial temperature of acid $= 25.0^0C$

Initial temperature of alkali $= 25.0^0C$

Highest temperature reached with acid and alkali mixture $= 34.0^0C$

a) Define the term molar heat of neutralization.

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b) Write an ionic equation of the neutralization reaction between hydrochloric acid and sodium hydroxide.

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c) Calculate;

i) The change in temperature (ΔT)

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ii) The amount of heat produced during the reaction (specific heat capacity of solution=4.2KJKg^{-1}K^{-1})

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iii) The amount of heat of neutralization of sodium hydroxide.

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d) Write the thermochemical equation for the reaction.

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e) Draw an energy level diagram for the reaction.

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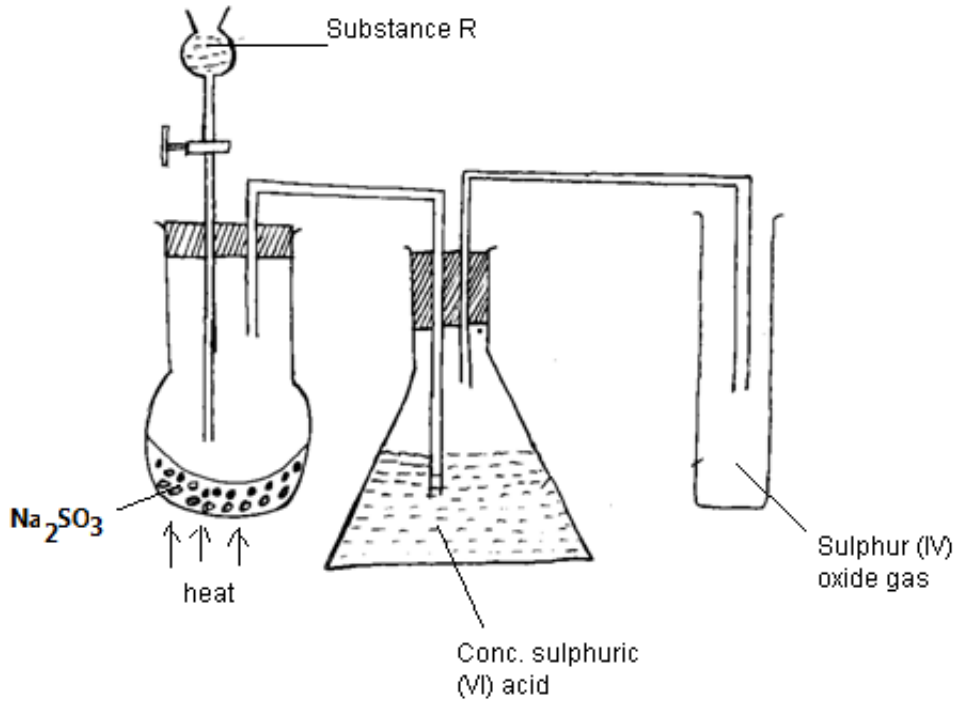
3. The diagram below shows a set-up that was used to prepare and collect sulphur (IV) oxide.

Study it and answer the questions that follow.



a) i) Name substance R.

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ii) Why is sulphur (IV) oxide gas not collected over water?

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iii) What observation would be made if a freshly cut red flower was placed in a gas jar containing moist sulphur (IV) oxide?

.....

iv) Sulphuri (IV) oxide and hydrogen sulphide react according to the following shown question.

$$2H_2S_{(aq)} + SO_{2(aq)} \rightarrow 3S_{(s)} + 2H_2O_{(l)}$$

Identify the oxidizing reagent. Explain your answer.

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b) The data given in the table below was obtained when oxygen was reacted with sulphur (IV) oxide at various temperatures to form sulphur (VI) oxide. Study it and answer question that follows.

Temperature K	673	707	823	913
Percentage yields of sulphur (VI) oxide	86	82	76	60

Is the information of sulphur (VI) oxide an exothermic or endothermic process? Explain

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c) i) Give one reason why vanadium (V) oxide is preferred to platinum as a catalyst in the contact process.

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ii) Write an equation to show how calcium hydroxide is used to control pollution caused by sulphur (IV) oxide in the manufacture of sulphuric (VI) acid by the contact process.

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iii) List three raw materials used in manufacture of sulphuric (VI) acid by the contact process.

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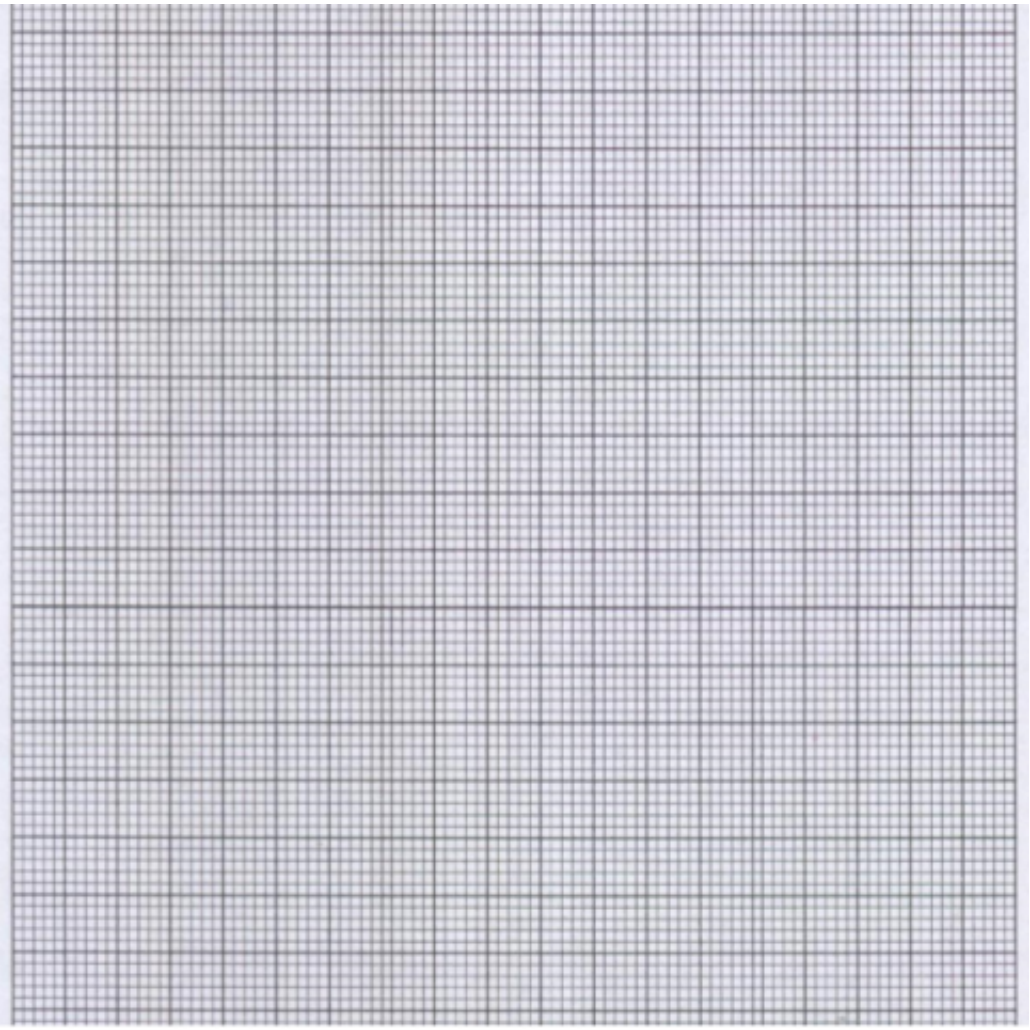
4. a) The table below gives the solubilities of hydrated copper (II) sulphate in mol dm^{-3} at different temperatures.

Temperature(^{0}C)	Solubility (md/dm^{-3})
20	$8x10^{-2}$
40	$12x10^{-2}$
60	$16x10^{-2}$
80	$22x10^{-2}$
100	$30x10^{-2}$

i) On the grid provided, plot graph of solubility of copper (II) sulphate (vertical axis) against temperature.



ii) From the graph, determine the mass of copper (II) sulphate deposited when the solution is cooled from 70^0c to 40^0c

(Molar mass of hydrated copper (II) sulphate =250g.

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b) In an experiment to determine the solubility of sodium chloride, 5.0cm3 of a saturated solution of sodium chloride weighing 5.35g were placed in a volumetric flask and diluted to a total volume of 250cm3. 25cm3 of dilute solution of sodium chloride completely reacted with 24.1cm3 of 0.1M

silver nitrate solution.

$$AgNO_{3(aq)} + NaCI_{(aq)} \rightarrow AgCI_{(s)} + NaNO_{3(aq)}$$

Calculate:

i) Moles of silver nitrate is $24.1cm^3$ of solution.

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ii) Moles of sodium chloride in 25.0cm3 solution.

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iii) Moles of sodium chloride in 250cm3 of solution.

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iv) Mass of sodium chloride in 5.0cm3 of saturated sodium chloride solution (Na=23.0, Cl=35.5)

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v) Mass of water in 5.cm3 of saturated solution of sodium chloride.

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vi) The solubility of sodium chloride in g/100g water.

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5. The table below gives standard electrode potential for the metal represented by the letters D,E,F and G.

Study it and answer the questions that follow.

Metal	Standard electrode potential (volts)
D	-0.13
E	-0.85
F	+0.34
G	-0.76

a) Which metal can be displaced from a solution of its salts by all the other metals in the table? Give a reason.

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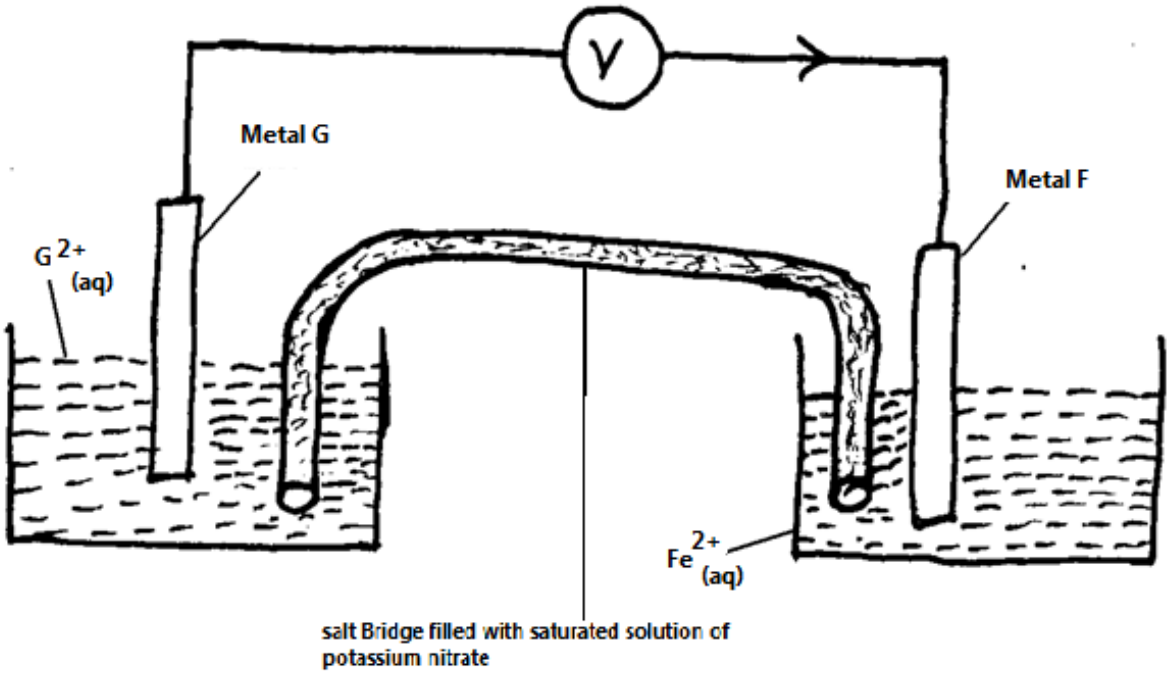
b) Metals F and G were connected to form a cell as shown in the diagram below.



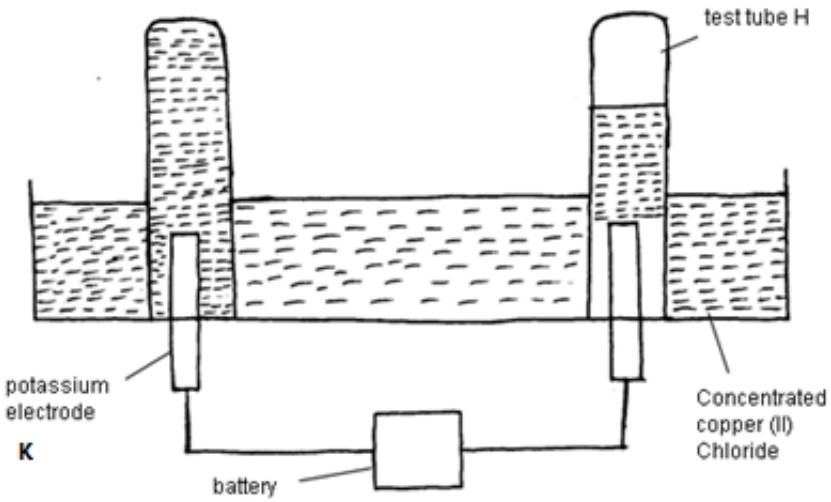
i) Write the equation for the reactions that occur at electrode

F.....

G.....

ii) On the diagram above, indicate with an arrow the direction in which electrons would flow.

c) An electric current was passed through a concentrated solution of copper (II) chloride as shown in the diagram below.



i) Explain the observation that would be made on the electrolyte as the experiment progresses.

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ii) After sometime, test-tube it was found to contain a mixture of two gases. Explain this observation.

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iii) Which of the electrodes is the anode?

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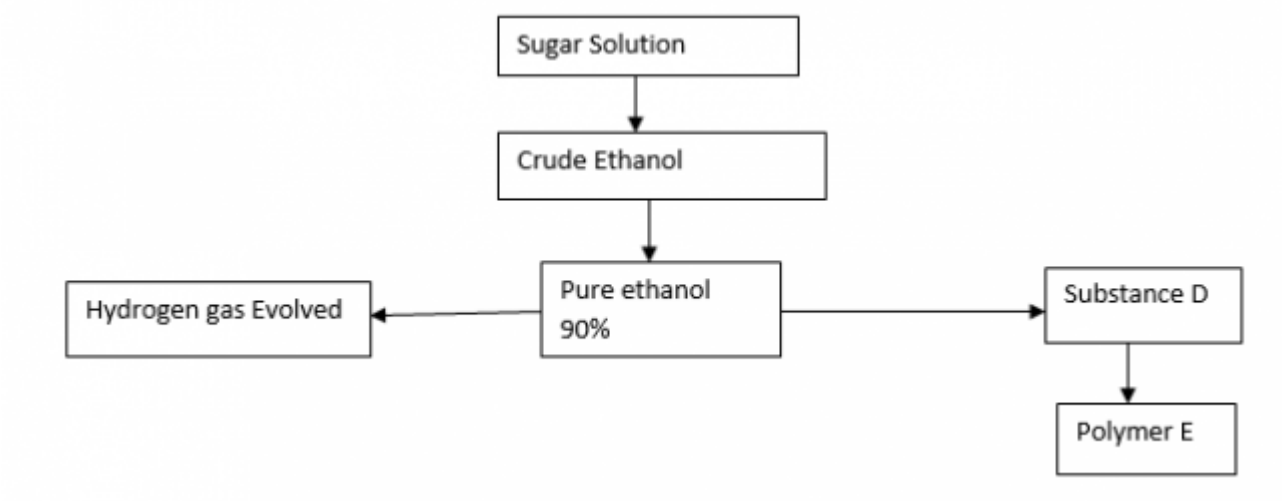
6. Study the flow chart below and answer the questions that follow;



a) Name

i) Substance A.....

ii) Process X.....

iii) Substance B.....

iv) Substance D.....

v) Substance E.....

b) Name the process that leads to formation of substance E.

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c) What is the effect of continuous use of the polymer E on the environment.

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d) If one mole of sugar,C6H12O6 produces 2 molecules of pure ethanol and two of carbon (IV) oxide as the only products.

i) Write an equation for the reaction.

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ii) How many moles of sugar are there in 144g C6H12O6.

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iii) How many moles of ethanol would this amount of sugar produce.

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iv) What mass of ethanol corresponds to the number of moles of b (iii).

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e) How can the concentration of ethanol produced can be increased.

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f) Give two commercial uses of ethanol.

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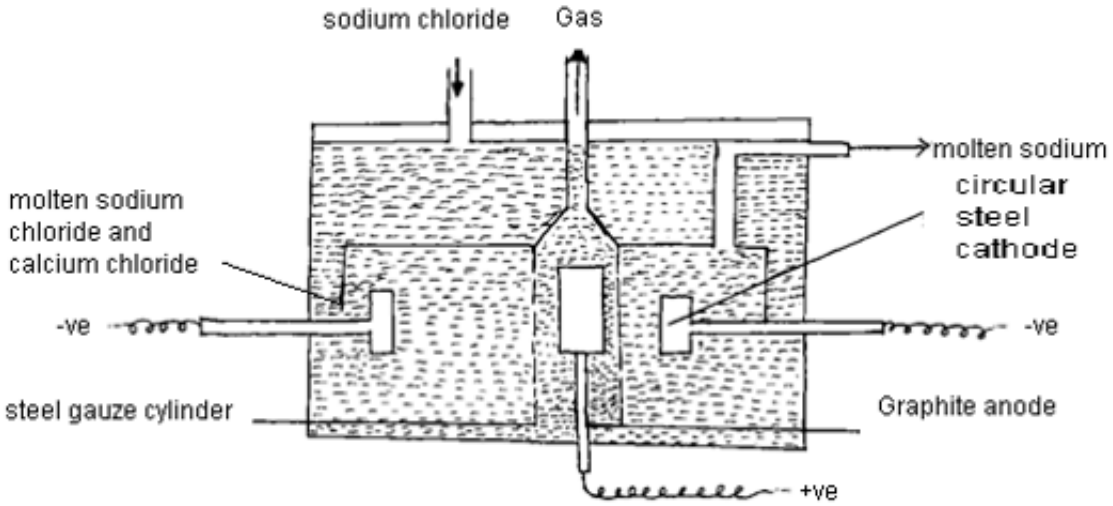
7. The diagram below shows the extraction of sodium metal using the Downs cell. Study it and answer the questions that follow:



i) Explain why in this process the sodium chloride is mixed with calcium chloride.

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ii) Why is the anode made of graphite and not steel?

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iii) State TWO properties of sodium metal that make it possible for it to be collected as shown in the diagram.

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iv) What is the function of the steel gauze cylinder?

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v) Write ionic equations for the reactions which take place at:

I. Cathode

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II. Anode

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vi) Give one industrial use of sodium metal.

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vii) Explain why sodium metal is stored under kerosene.

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