1. (a) The elements S and T have atomic number 17 and 20 respectively. Write the formula of the compound formed when S and T react. (1 mark)

(b) Copper is a good conductor of electricity, state the difference on how copper conducts electricity with molten compound in 'a' above. (2 marks)

2. a) During the extraction of aluminium, molten sodium cyolite is added. What is the purpose of the molten cryolite.

b) Write the two equations i.e at cathode and anode terminals when molten aluminium oxide is electrolysed. (2 marks)

at cathode	at anode

3. Write down the equation of the reaction between concentrated sulphuric acid and sugar (sucrose - $C_{12}H_{22}O_{11}$). (2 marks)

4. Calculate the relative abundance of element B which consists of three isotopes of mass 28, 29 and 30 and percentage abundance of 92.2, x and y respectively, given its relative atomic mass is 28.11. (3 marks)

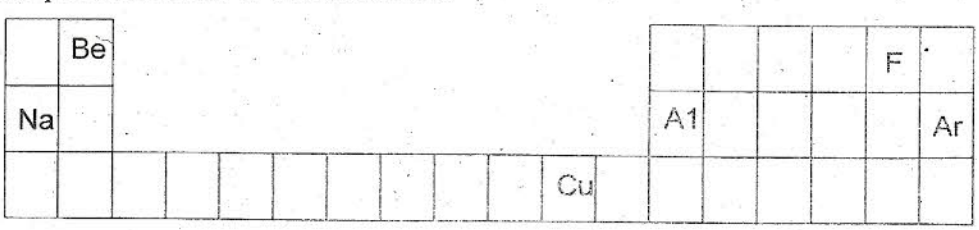
5. Element R and S have atomic numbers 12 and 15 respectively. State the type of bond most likely to be formed by each of these two elements. (2 mark)

R: _____

S: _____

6. 22.20cm^3 of a Sodium Hydroxide solution containing 4.0gL^{-1} were required for complete neutralization of 0.10g of a dibasic acid. Calculate the relative molecular mass of the acid [Na =23, H = 1, O = 16.0] (3 marks)

7. Part of the periodic table is shown below:



Using only the six elements shown in the table, give the symbol of:-

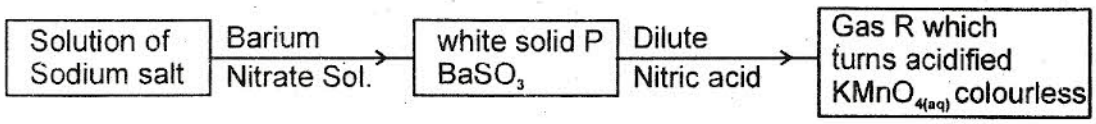
(i) A transition metal; _____ (½ mark)

(ii) An unreactive gas, _____ (½ mark)

(iii) An element that forms two oxides of formula X_2O and XO, where X represents one of the elements in the table (½ mark)

(iv) An element that is least reactive in its group (½ mark)

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



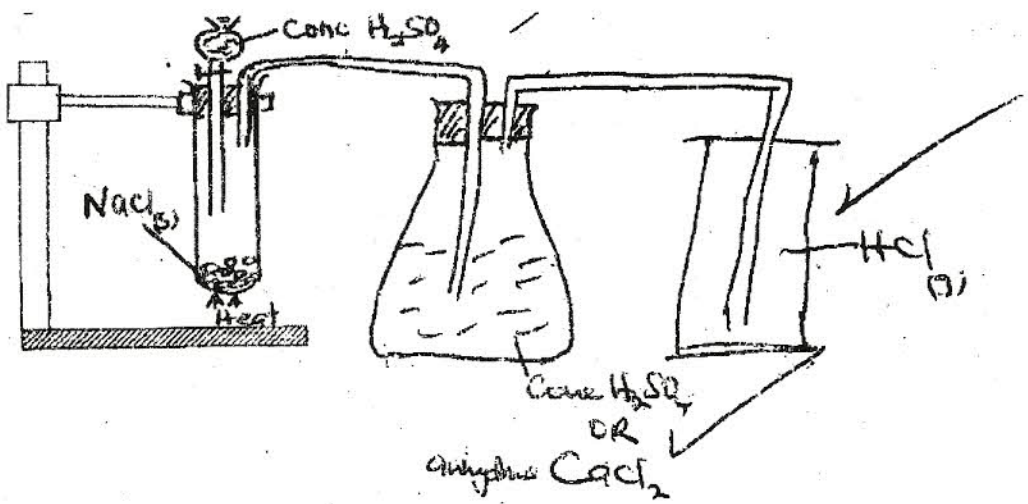
(i) Name solid P (1 mark)

(ii) Give the formula of sodium salt (1 mark)

(iii) Name Gas R. (1 mark)

iv) Write an equation for the reaction between Dilute Nitric acid and solid P.

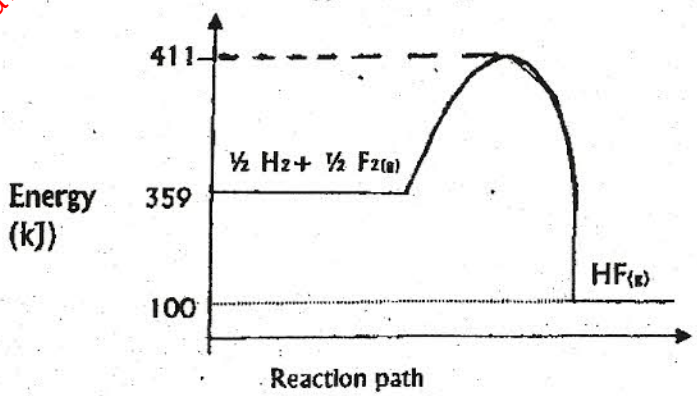
9. The diagram below is part of a set up used in the laboratory preparation of a gas.



i) Complete the diagram to show how dry sample of the gas can be collected. (2 marks)

ii) The gas prepared is dissolved in water, give one use of the concentrated solution formed. (1 mark)

10. Below is an energy level diagram for the reaction $\frac{1}{2} H_{2(g)} + \frac{1}{2} F2_{(g)} \rightleftharpoons HF_{(g)}$



a) Calculate the heat of formation of $HF_{(g)}$ (2 marks)

b) What is the effect of the following to the above system

i) Increase in temperature (1 mark)

ii) Decrease in temperature (1 mark)

11. a) Carbon II Oxide gas reacts with steam according to the equation

$$CO_{(g)} + H_2O_{(s)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$$

What would be the effect of increasing the pressure on the system at equilibrium? Expain. (2 marks)

b) When the reaction above was carried out at lower temperature, the yields of hydrogen and carbon IV Oxide increased. What is the sign of ΔH for the reaction? Explain. (2 marks)

12. Use the information below to answer the questions that follows.

$$Zn_{(aq)}^{2+} + 2e^- \rightleftharpoons Zn_{(s)} \qquad E^\theta = -0.76V$$

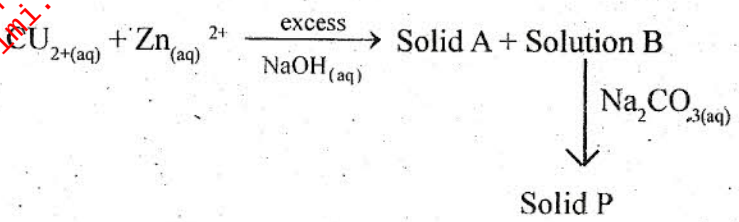
$$Al_{(aq)}^{3+} + 3e^- \rightleftharpoons Al_{(s)} \qquad E^\theta = -1.66V$$

$$Fe_{(aq)}^{2+} + 2e^- \rightleftharpoons Fe_{(s)} \qquad E^\theta = -0.44V$$

i) Calculate the E^θ value for the electrochemical cell represented as $Al_{(s)} / Al^{3+} // Fe_{(aq)}^{2+} / Fe_{(s)}$ (Use half- equations) (2 marks)

ii) Give a reason why aluminium metal would protect iron from rusting better than zinc metal. (1 mark)

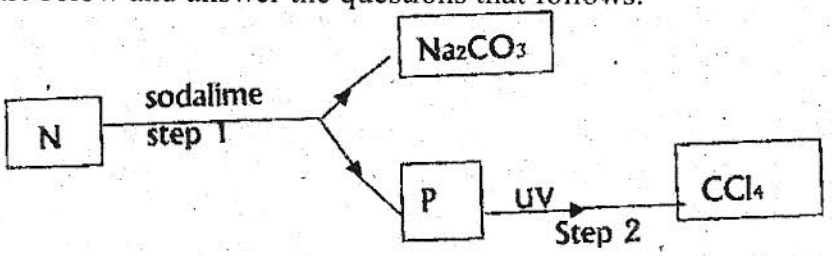
13. The following chart shows some reactions of copper and zinc ions. Study it and answer the questions that follow.



a) Write down the formula of: (1 mark)
i) Solid A

b) What is the colour of solid A (1 mark)

14. Study the chart below and answer the questions that follows.



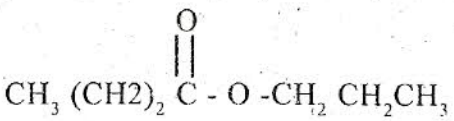
(2 marks)

a) Identify:
N

P

b) What name is given to the type of halogenation/ chlorination reaction given in step 2. (1 mark)

15. When organic compound Y is heated with aqueous sodium carbonate, it produces Carbon IV Oxide. Y reacts with propanol to form a sweet smelling compound Z whose formula is



i) Name and draw the structural formula of compound Y (2 marks)

ii) Write the name of compound Z. (1 mark)

iii) Write a chemical test which can be used to distinguish between Y and Propanol. (2 marks)

16. Use the thermo chemicals equations below to calculate the enthalpy of formation of ethane. (3 marks)

$$C_2H_{6(g)} + {}^{7}/_{2}\ O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O \quad \Delta H = -1560KJ\ mol^{-1} \ldots\ldots\ldots\ldots (i)$$

$$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)} \quad \Delta H = -394KJ\ mol^{-1} \ldots\ldots\ldots\ldots (ii)$$

$$H_{2(g)} + {}^{1}/_{2}\ O_{2(g)} \longrightarrow H_2O_{(l)} \quad \Delta H = -286KJ\ mol^{-1} \ldots\ldots\ldots\ldots (iii)$$

17. 12.5 cm^3 of solution contains 13.8g/dm^3 of carbonate, M_2CO_3, required 12.3cm^3 of H_2SO_4 containing 9.8g/dm^3 for complete neutralization. Find the RAM of M. (3 marks)

18. R-COO-Na^+ and R-C_6H_5 - SO_3-Na^+ represent two cleaning agent where 'R' is a long chain hydrocarbon.

a) Write the formula of the salts that would be formed when each of these cleansing agents is added to water containing calcium ions. (2 marks)

b) Explain how the solubility of the two calcium salts in 'a' above affect the cleansing properties of each of the cleaning agents. (2 marks)

19. A polymer has the following structure

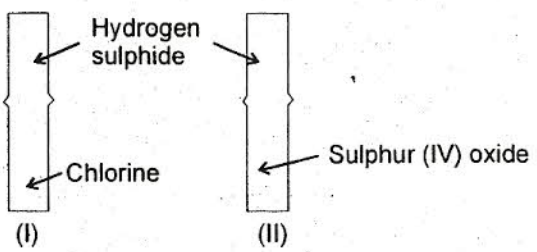
$$\left[-CH_2-\underset{\underset{CN}{|}}{CH}-CH_2-\underset{\underset{CN}{|}}{CH}-CH_2-\underset{\underset{CN}{|}}{CH}- \right]_n$$

a) A sample of this polymer is found to have a molecular mass of 5194. Determine the number of monomers in the polymer (H = 1, C = 12, N = 14) (2 marks)

b) Draw the structure of the monomer (1 mark)

20. An organic compound $CH_3(CH2)_2CH_2OH$ is reacted with concentrated sulphuric acid at 170^{0}C. Write the equation of the reaction and give the name of the organic product compound formed in the reaction. (3 marks)

21. Study the figures below and answer the questions that follow.



All the necessary conditions were met for the reactions in both (I) and (II) to be possible.

(a) State observations in (I) and (II) (2 marks)

I: _____

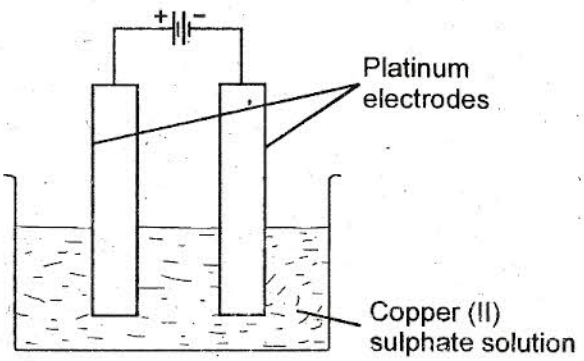
II: _____

(b) Write equations for reactions taking place in (I) and (II) (2 marks)

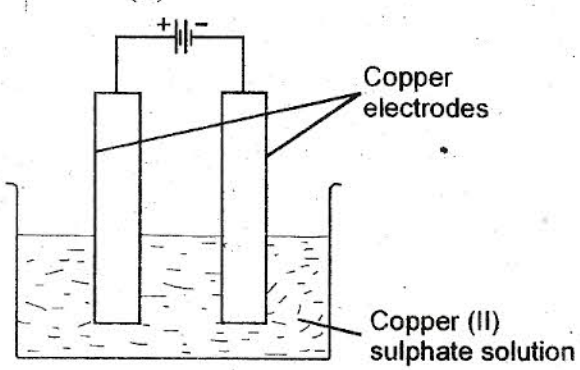
22. The solubility of potassium nitrate is 120g in 100g of water at 85°C and 70g at 20°C. What mass of the salt would crystallize if 60g of Potassium nitrate solution at 85°C were cooled to 20°C? (2 marks)

23. Study the two diagrams and answer the questions that follow

(i)



(ii)



In both cases, current was let to flow for 15 minutes

(a) State observations made in diagrams (i) and (ii) after 15 minutes (2 marks)

(i): _____

(ii): _____

(b) Account for the observations made in a (I) above (2 marks)

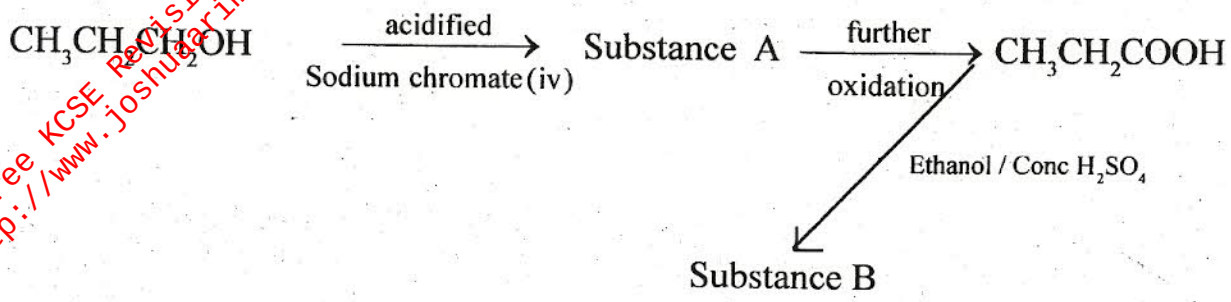
24. Complete the following radioactive equation.

a) ${}^{14}_{7}N + \_\_ {}^{0}_{-1}e \rightarrow {}^{14}_{6}C$ NB: βeta particle (1 mark)

b) Give one use of radioactive elements. (1 mark)

c) Name a hazard associated with radioisotopes to environment. (1 mark)

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



a) Name substances A and B. (2 marks)
A

B

b) Write an equation to show formation of substance B. (2 marks)

c) Name another substance that can be used instead of sodium chromate V. (1 mark)