233/2
CHEMISTRY
THEORY
PAPER 2
Time: 2 Hours

BAHATI GIRLS HIGH SCHOOL
MOCK EXAM

INSTRUCTIONS TO CANDIDATES

- Write your name and numbers in spaces provided
- Answer all the questions in spaces provided
- Mathematical tables and electronic calculators may be used
- All working **MUST** be clearly shown where necessary

For Examiner's only

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1	11	
2	12	
3	9	
4	13	
5	12	
6	14	
7	9	
Total Score	**70**	

This paper consists of 8 printed pages.

Candidates should check the question paper to ensure that all the pages are printed as indicated and that no questions are missing.

© *Bahati Girls High School*

TURNOVER

1. The grid below represents a section of the periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbols of the element.

| P | | | | | | | | | | | | | | |
| Q | R | | | | | | | | | | | | | |

						H	S
D				H	S
Y		F	G	E	T

(a) Select the element with lowest ionization energy. Explain (2 marks)

(b) Comment on the chemical stability of the chloride of Q compared to the chloride of D (2 marks)

(c) Explain why S is generally unreactive (1 mark)

(d) Both oxides of Q and G dissolve in water. State and explain the effect of the solutions formed on litmus papers (2 marks)

(e) Y forms an amphoteric oxide. Explain (1 mark)

(f) Explain the trend in reactivity of P and Q as compared to the trend in reactivity of H and E (2 marks)

(g) State two uses of S (1 mark)

2. The apparatus below were used to determine the molar heat of displacement of copper.

1.0g of zinc powder was added to $50cm^3$ of 0.2N Copper II Sulphate solution and the mixture steamed gently, the temperature rose from 21^0C to 28^0C.

(a) Explain why
   (i) A glass rod was used instead of Iron to stir the mixture (2 mark)

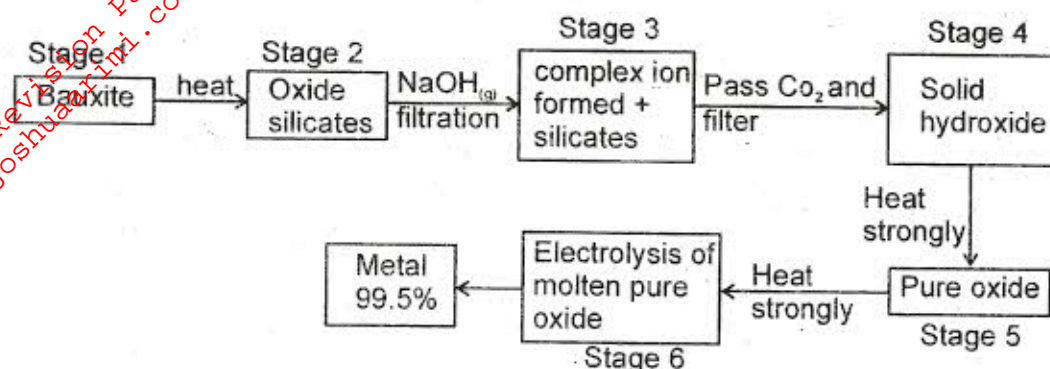   (ii) Polystyrene cup was used instead of a glass beaker (1 mark)

(b) Write a chemical equation for the reaction taking place in the polystyrene cup (1 mark)

(c) Determine,
  (i) the number of moles of Copper II Sulphate solution (1 mark)

  (ii) the molar heat of displacement of Copper. (Specific heat capacity of solution = 4.25 J g⁻¹k. Density = 1g 1cm³) (2 marks)

(d) Why is the molar heat of displacement obtained in (ii) above, lower than the actual value? (1 mark)

(e) Draw an energy level diagram for the reaction above (2 marks)

(f) If magnesium ribbon was used instead of Zinc, compare the ΔH value with that of zinc. Give a reason (2 marks)

3. A current of 0.5 amperes was passed through a cell containing copper anode and copper cathode for 10 minutes and the mass of copper deposited was recorded for each experiment as shown in the table below.

Current (Amperes)	Time minutes	Time seconds	Quantity of electricity (C)	Mass of Copper deposited
0.5	10.0	600		0.0991
1.0	10.0	600		0.1960
1.5	10.0	600		0.2970
2.0	10.0	600		0.3961
2.5	10.0	600		0.4960
2.0	15.0	900		0.5950
2.0	20.0	1200		0.7930

(a) Complete the table by filling the column of quantity of electricity in coulombs (2 marks)

(b) Plot a graph of mass of Copper deposited (vertical axis) against quantities of electricity (3 marks)

(c) From the graph
  (i) Determine the mass of copper per unit of electricity (1 mark)

  (ii) Write an expression showing the relationship between mass of copper (Cu) and quantity of electricity Q (1 mark)
  (iii) Hence determine the mass of copper deposited if 1900c of electricity is passed through the cell (2 marks)

94

4. The following diagram represents the extraction process of a metal. Study it and answer the questions that follow.

Stage 1: Bauxite → heat → Stage 2: Oxide silicates → $NaOH_{(aq)}$ filtration → Stage 3: complex ion formed + silicates → Pass CO_2 and filter → Stage 4: Solid hydroxide → Heat strongly → Stage 5: Pure oxide → Heat strongly → Stage 6: Electrolysis of molten pure oxide → Metal 99.5%

(a) Bauxite is an ore. Which metal is contained in it? (1 mark)

(b) The oxides in stages 2 and 5 have the same formula. Write this formula (1 mark)

(c) Write down the equations for the reactions that form;
   (i) The complex ion in stage 3 (1 mark)

   (ii) The solid in stage 4 (1 mark)

(d) Write the electrolysis reactions at the anode and the cathode in stage 6 (2 marks)

(e) The graphite lining in the anode has to be replaced after some time. Why is this necessary? (1 mark)

(f) (i) Despite being the third most abundant element in the earth's crust, aluminium was not produced on large scale until the nineteenth century. Suggest a reason for this. (1 mark)

   (ii) Why is it possible to carry out the electrolysis at 1230K if the oxide normally melt at about 2300K? (2 marks)

(g) Consider the following data for the compounds aluminium chloride and magnesium chloride.

	Aluminium Chloride	Magnesium Chloride
Action of Heat	Sublimes at 453K	Melts at 1690K
R M M	267	95
Action with water	Is hydrolysed	Dissolves

(i) Using the above data deduce the type of bonding in:
   I. Aluminium Chloride   (½ mark)

   II. Magnesium Chloride   (½ mark)

(ii) Give the formula of aluminium Chloride in vapour phase   (1 mark)

(iii) Write a balanced equation for the reaction between aluminium chloride and water   (1 mark)

5. The reaction scheme below outlines a method of preparation of fertilizers. Study it carefully and answer the questions that follows.
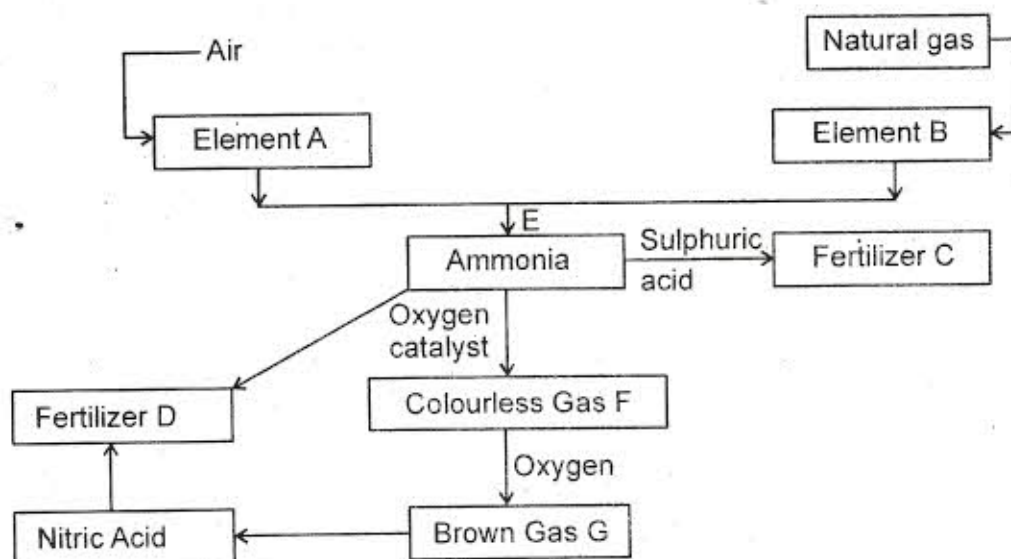
(a) Identify substances (2 marks)

B

D

E

F

(b) Which in your opinion do you think is a better fertilizer, C or D? Give a reason for your answer (2 marks)

(c) Write the equation for the formation of fertilizer C (1 mark)

(d) Gas G was dissolved in water without excess air. State the products formed (1 mark)

(e) State one use of ammonia as shown in the scheme above (1 mark)

(f) How would element A be obtained from the air? (1 mark)

(g) Damp red litmus paper was put into a gas jar of ammonia, it turned blue. Which ion is responsible for this change? (1 mark)

(h) What volume of hydrogen gas at S.T.P would be used if 4.0g of nitrogen combine to form ammonia? (N = 14, H = 1, molar gas volume at S.T.P = 22.4) (3 marks)

6. (a) The figure below shows a cycle for energy changes that take place during formation of solid sodium chloride.
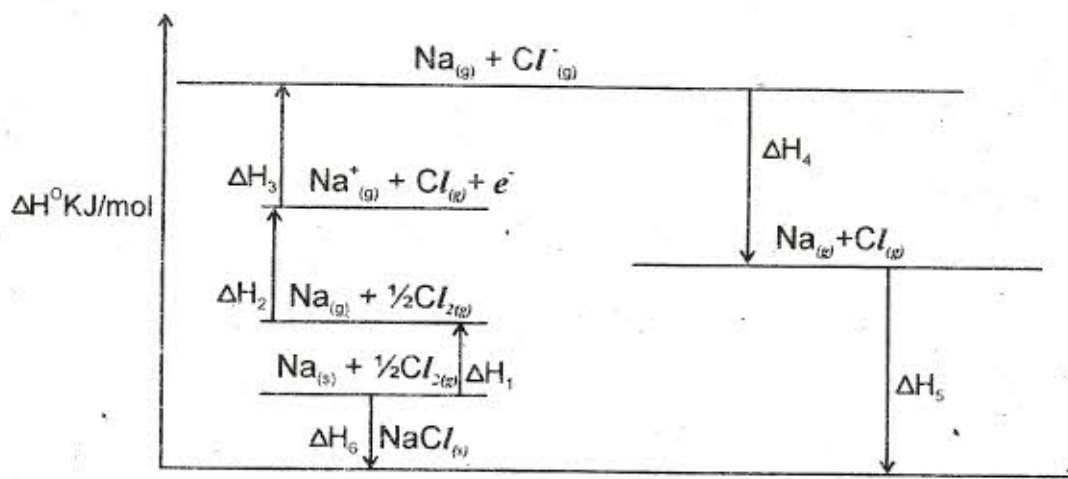
(i) State the type of bonds broken or formed in each of these processes: H_5, H_3 and H_1 (3 marks)

H_5

H_3

H_1

97

(ii) In terms of H_1 to H_6, write an expression for Hess's law of constant heat formation

(1 mark)

(iii) H_5 represent B. The lattice euthalpy for NaCl. What is meant by lattice euthalpy?

(1 mark)

(iv) What energy changes are represented by

(2 marks)

ΔH_1

ΔH_2

ΔH_3

ΔH_6

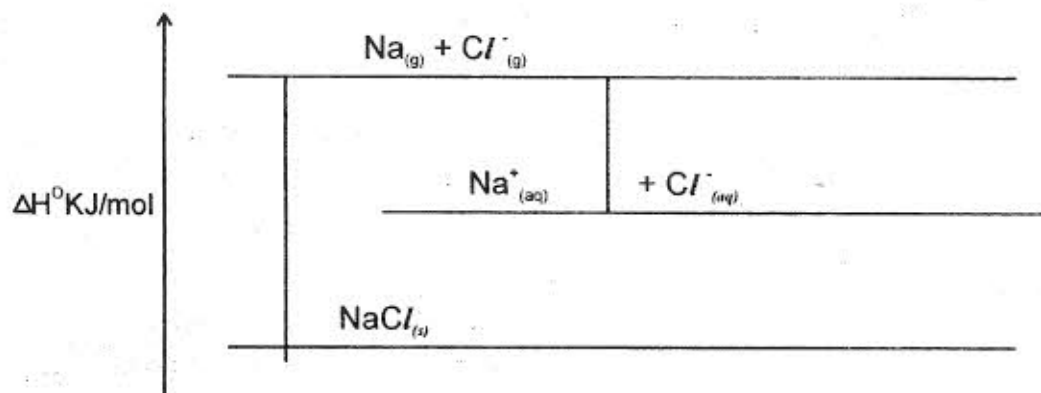(b) Use the values given below to complete the euthalpy cycle diagrams for aqueous sodium chloride and find the value of X.

ΔH lattice $\quad = \quad -776$ kJ/mol

ΔH hydration $\quad = \quad -772$ kJ/mol

ΔH solution $\quad = \quad$ X kJ/mol

(i) Put the values in the diagram below and indicate with arrows the direction of change

(3 marks)

(ii)   Use the cycle you have made to calculate the value of X   (2 marks)
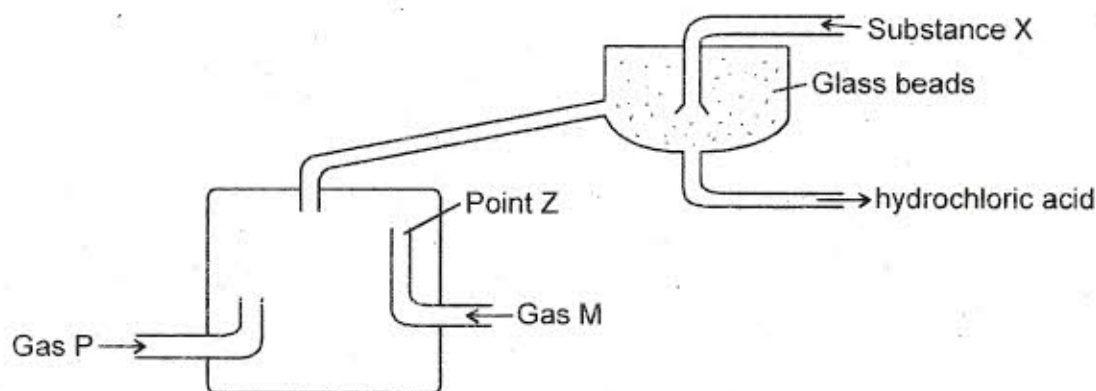
(iii) Would the temperature rise or fall if one mole of sodium chloride is dissolved in excess water?   (1 mark)

(iv) Explain why hydration energies are usually negative values   (1 mark)

7.   The diagram below shows the main steps in the manufacture of hydrochloric acid.

(a) Name the following: (3 marks)
     Substance X

     Gas P

     Gas M

(b) Name one major source of each gas in (a) above   (2 marks)
     P

     M

99

(c) Write an equation for the reaction taking place at point Z   (1 mark)

(d) The samples of concentrated HCl obtained are sometimes yellow. Explain why

(1 mark)

(e) What is the effect of the factory on the environment?   (1 mark)

(f) State 2 uses of Hydrochloric acid (1 mark)