233/2
CHEMISTRY
Paper 2
THEORY
Time: 2 hours

MANGU HIGH SCHOOL
MOCK EXAM

INSTRUCTIONS TO CANDIDATE

1. Answer **ALL** the questions in the spaces provided.
2. Non-programmable, silent calculators and Mathematical tables may be used.
3. All working **MUST** be clearly shown where necessary.

For Examiner's use only

Questions	Maximum Score	Candidate's Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
TOTAL SCORE		80

This paper consists of 7 printed pages.

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

© *Mangu High School*

31

1. The grid below is part of the periodic table. Study it and answer the questons that follow. (The letters are not actual symbols of the elements)

(a) (i) Classify elements **X** and **Y**. (1 mark)

(ii) Select element in period two which has the largest atomic radius. Give a reason for your answer. (2 marks)

(iii) Electron structure of ion E^+ is 2, 8. Indicate the position of element **E** on the grid. (1 mark)

(iv) State **one** use of element **Z** and give a reason for that use. (2 marks)

(v) Write an equation to show the action of heat on the nitrate of element **C**.

(vi) Explain why **P** can belong to two groups. (1 mark)

(vii) Identify element **S**. (1 mark)

(viii) From the table, which is the strongest reducing agent? (1 mark)

2. Study the flow chart below and answer the questions that follow
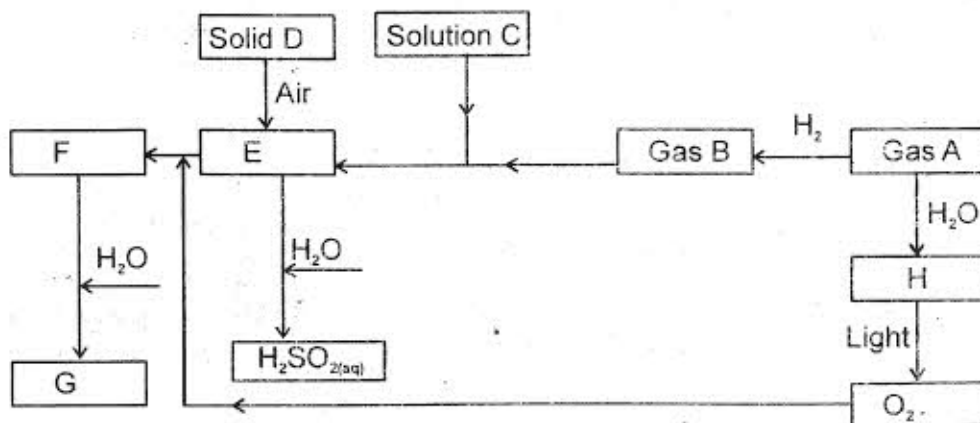
(a) Identify substances   (4 marks)

    A

    B

    C

    D

    E

    F

    G

    H

(b) (i) Obervations would be made when gas **B** and solution **C** react   (2 marks)

    (ii) Write a chemical reaction for the reaction in (b) (i) above.   (1 mark)

3.   (a) Draw a diagram of an electrochemical cell zinc-copper (voltaic cell)   (2 marks)

    Indicate:

(b) (i) the charges on each electrode   (1 mark)

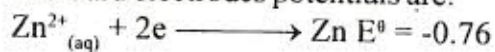   (ii) the direction of electron movement   (1 mark)

(c) Write:

    (i) Equations for reactions at each electrode.   (2 marks)

    (ii) An equation for the overall reaction   (1 mark)

(d) Standard electrodes potentials are:

$$Zn^{2+}_{(aq)} + 2e \longrightarrow Zn \quad E^\theta = -0.76$$

$$Cu^{2+}_{(aq)} + 2e \longrightarrow Zn \quad E^\theta = +0.34$$

    Calculate the e.m.f of the cell   (1 mark)

(e) The same quantity of electricity was passed through three cells depositing silver in the first, copper in the second and 480cm³ of hydrogen at room temperature and pressure in the third cell. Calculate the mass of copper and silver deposited.
(H = 1, Cu = 64, Ag = 108. 1 mole of gas occupies 24dm³ at r.t.p)

4. In the preparation of soap, 1.108g of a natural fat having the structure shown below was refluxed with 10cm³ of 1.0M sodium hydroxide for one hour.

$$R \longrightarrow COOCH_2$$
$$|$$
$$R \longrightarrow COOCH$$
$$|$$
$$R \longrightarrow COOCH_2$$
$$(fat)$$
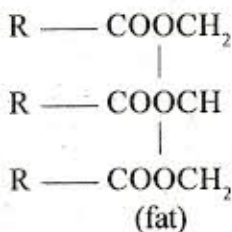
The reaction mixture was cooled and unreacted alkali was titrated with 4.0cm³ of 1.0M hydrochloric acid.

(a) (i) Write an equation for complete hydrolysis of the fat.   (2 marks)

(ii) Why the mixture of fat and sodium hydroxide refluxed four one hour.   (1 mark)

(iii) Calculate the relative formula of the fat.   (3 marks)

(b) Starting with $CH_3(CH_2)_{13}CH=CH_2$, outline using equations the manufacture of sulphate based detergent.   (2 marks)

(c) State one advantage of using the detergent mentioned in (b) above.   (1 mark)

34

5. (a) Define lattice energy (1 mark)

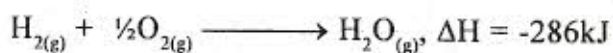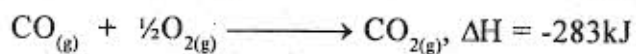(b) Study the reactions below and answer the questions that follow.
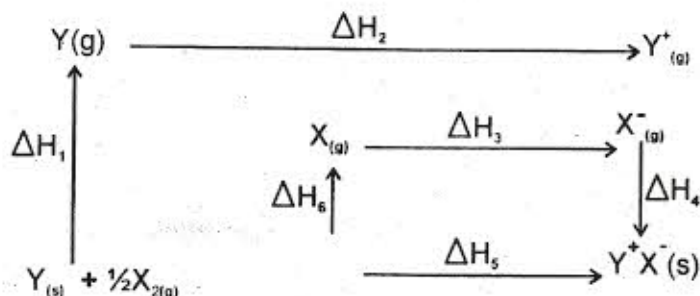
(i) Identify the type of enregy changes represented by (2 marks)
ΔH_1
ΔH_2
ΔH_3
ΔH_4

(ii) Show the relationship of the energy changes shown in the above flow diagram. (1 mark)

(c) Water gas is one of the widely used fuel. It is a mixture of equimolar mixture of carbon (II) oxide and hydrogen. The heats of combustions of CO and H_2 are given below:

$$CO_{(g)} + \tfrac{1}{2}O_{2(g)} \longrightarrow CO_{2(g)}, \Delta H = -283kJ$$

$$H_{2(g)} + \tfrac{1}{2}O_{2(g)} \longrightarrow H_2O_{(g)}, \Delta H = -286kJ$$

From the information above, calculate the ΔH for complete combustion of $22.4dm^3$ of water gas measured at s.t.p. (2 marks)

(d) The lattice energy of calcium chloride is -2237kJ. The hydration energy of Ca^{2+} is -1562kJ and chloride is -384kJ.

   (i) Draw an energy cycle for dissolving of calcium chloride in water.   (2 marks)

   (ii) Calculate the enthalpy of solution of calcium chloride.   (2 marks)

   (iii) Draw the energy level diagram for dissolving of calcium chloride.   (2 marks)

6. (a) Cuprite (Cu_2O) and Malachite ($CuCO_3 \cdot Cu(OH)_2$) are two important copper ores.

   (i) Which of the two has a greater copper content? Give reason.   (2 marks)

   (ii) A sample of malachite is heated strongly, it decomposes. Write a balanced equation for the decomposition reaction.   (1 mark)

   (iii) Explain how you would extract copper metal from the products above by electrolysis.   (2 marks)

   (iv) Give the ionic equation to show how copper is obtained above by electrolysis.

   (v) A student, by mistake, mixed up copper powder and zinc powder. He was interested in the copper than in the zinc. Explain how he could recover the copper.   (2 marks)

7. An acid has the formula $HOOC(CH_2)_xCOOH$. A solution of the acid in water has a concentration of $8.84 gdm^{-3}$. This solution is titrated with $0.1m$ NaOH. $5.0cm^3$ of the acid solution required of the alkali for reaction.

(a) Write an equation for the reaction between the acid and sodium hydroxide solution.

(1 mark)

(b) Calculate

(i) The number of moles of NaOH used. (2 marks)

(ii) The number of moles of the acid per dm^{-3}. (3 marks)

(iii) The relative formula mass of the acid. (2 marks)

(iv) The value of **X** in the molecule of the acid. (2 marks)

8. (a) What is nuclear fission? (1 mark)

(b) When a Geiger muller counter was placed near a radioactive material, the following rates of emissions were recorded.

Time (Minutes)	0	5	10	15	20
Count rates	152	78	41	22	13

When the radioactive material was removed, the counter gave the followng counts over 6 minutes 3, 4, 5, 5, 3, 4.

(i) What is the cause of the counts over the 6th minutes? (1 mark)

(ii) Calculate the correct counts resulting from the radioactive material. (3 marks)

(iii) Use the correct counts from the radioactive material to plot a suitable graph of counts against time. (4 marks)

(iv) From your graph, determine the half life of the radioactive material. (1 mark)