SENIOR SECONDARY CHEMISTRY

WORKBOOK TWO

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SENIOR SECONDARY CHEMISTRY WORKBOOK TWO

FIRST TERM

SECOND TERM

THIRD TERM.

FIRST TERM

CHAPTER ONE

WK 1: Atomic Properties and the Periodic Table.

1. What are the main features of the periodic table?

(i) .....

(ii) .....

(iii) .....

(iv) .....

(v) .....

2. The scientist who built the present modern periodic table is .....

3. List three uses of the periodic table

(i) .....

(ii) .....

(iii) .....

(iv) .....

4. Define electronegativity .....

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5. What is atomic radius? .....

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6. Consider the following elements: $_1H$. $_2He$. $_3Li$. $_4Be$. $_5B$. $_6C$. $_7N$. $_8O$. $_9F$ $_{10}Ne$. $_{11}Na$. $_{12}Mg$. $_{13}AL$ $_{14}Sl$ $_{15}P$. $_{16}S$. $_{17}U$. $_{18}Ar$. $_{19}K$.$_{20}Ca$.

(a) Construct a periodic table for the elements listed above.

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7. (a) List 4 of the elements which do not form compounds easily.

(i) _____ (ii) _____

(iii) _____ (iv) _____

(bii. why do the elements listed above do not form compounds easily?

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(b) Which of the elements form +1 ions (a) .....

(b)..... (c) .....(d).....

(d) Which of the elements form –1 ions (a).....

(b).....(c).....

(d).....

8. (ai) Which of the element is the strongest oxidizing agent.....

(ii) Which of the element is the strongest reducing agent..... .....

(9) Which of the elements above has

(i) The highest electronegeativity: .....

(ii) The lowest electronagativity .....

(iii) The highest iomization energy.....

(v) The trend in the periodic table are due to mainly (a).....

(b)..... .....

10.(a) The group I elements are called .....

(c) The group II elements are called .....

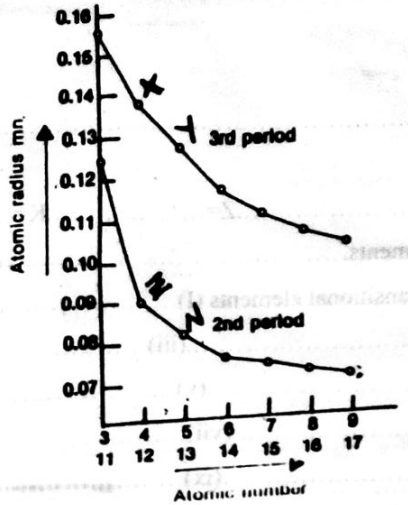
(d) The group VII elements are called.....

(e) The group VIII or zero elements are called .....

11. How do the following increase or decreased down the group and across the period of the periodic table.

	DOWN THE GROUP	ACROSS THE PERIOD FROM(LEFT TO RIGHT)
a) Atomic radius		
b) ionic radius		
c) Ionization energy.		
d) Electron affinity		
e) eletronegativity		

12.



(a) Identify the elements

i) X.....

ii) Y.....

iii) Z.....

iv) N.....

13. **Diagram of Ionization energy (kj/mol) against Atomic number**

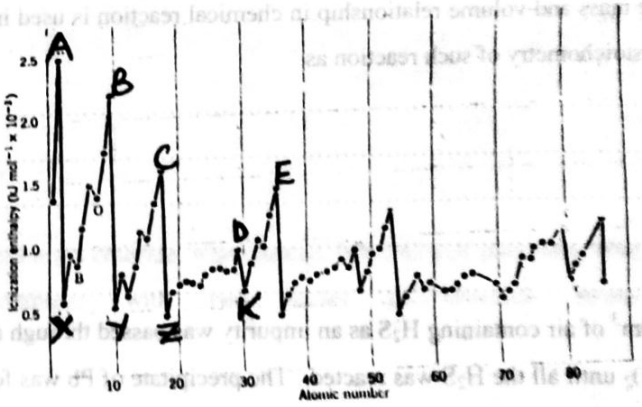


Figure 2-11 Variation of first ionization enthalpies with atomic number.

a) Identify

(i) A .....

(ii) B .....

(iii) C .....

(iv) D .....

(v) E .....

b) Identify

X= .....Y=.....Z=.....K=.....

14. a) What are transitional elements.....

b) (i) the 1st series of the transitional elements (I).....

(ii) .....(iii).....

(iv) .....(v).....

(vi) .....(vii).....

(viii) .....(ix).....

(d) Write the electronic configuration of the following fully and name them.

i) $[Ar]d^3$ .....

ii) $[Ar]\ d^4$ .....

iii) $[Ar]d^5$.....

iv) $[Ar]d^6$.....

Wk 2. Stiochiometry of chemical reactions.

1. The mass and volume relationship in chemical reaction is used in determining the stoichometry of such reaction as

(a) .....

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2. 20 dm^3 of air containing H_2S as an impurity was passed through a solution of Pb $(N03)_2$ until all the H_2S was reacted . The precipitate of Pb was found to weigh 5.02g. According to the equation Pb $(N03)_2 + H_2S \longrightarrow PbS + 2HN0_3$ calculate the percentage by volume of hydrogen sulphide in the air.

[Pb = 207;S =32; GMV at .s. t.p= 22.4dm^{-3}]

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3) Calculate the volume of hydrogen gas liberated at s.t.p when 48.75g of zinc metal reacts with excess dilute Tetraoxosulphate (vi) acid [Zn=65. molar volume of a gas at s.t.p =22 4dm^3]

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4) 4.20 g of platinum chloride, when heated, left 2.43 g of platinum. what mass of the metal combines with two moles of chlorine atoms?.[Cl= 35.5]

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5) A metallic oxide of a metal X contains 40% of oxygen. Calculate the mass of the metal that will combine with 16 g of oxygen.[O =16]

6). Which of the following equations is correct.?

(a) $Zn^{2-}_{(aq)} + Cu_{(s)} \longrightarrow Cu^{2+}_{(aq)} + Zn(s)$

or

(b) $Zn(s) + Cu^{2-}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu(s)$

(7) Explain why (a) or(b) is correct.

(8) Calculate the number of moles of copper that will be displaced from copper (ii) Tetraoxosulphate (vi) by 16.25g of zinc.

[Cu=64 Zn=65]

(9) Copper forms two chlorides containing respectively 35.9% of and 52.8% of-chlorine. *[Cu=64:Cl=35.5]*

Calculate

a) The mass of the metal which combine with 35.5g of chlorine

b) Write the formular of the chloride in each case

a).....

b).....

10). 8. 125g of zinc was reaction with excess dilute hydrochloric acid.

a) Calculate the volume of hydrogen evolved at S.T.P

b) What will be the volume of dry hydrogen gas evolved at 27^0c and 760mm.Hg The saturation vapor pressure at 27^0c is 25 mm Hg. [Zn = 65. molar volume of a gas at S.T.P.= $22.4dm^3$]

a).....

b).....

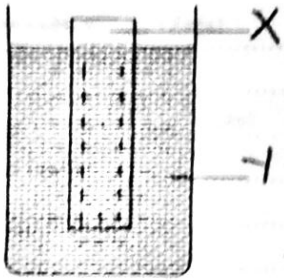
Wk3. Electrochemistry and electrode potential.

1. Define standard electrode potential.

2. Draw the diagram of electrode potential of zinc

3. The diagram of electrode potential of copper is the diagram below . Identify X and Y.

Electrode potential of copper, $Cu^{2+}(aq)/Cu(s)$



4. A correct electrochemical series can be obtained from K, Na, Ca, Al, Mg, Zn, Fe, Pb,H, Cu, Hg, Ag, by interchanging

a) Al and Mg

b) Zn and Fe

c) Zn and Pb

d) Pb and H

5. Substances that allow the passage of electric current are called..... While those that do not allow the passage of electric current are called .....

6. Distinguish between electrochemical cell and electrolytic cell

Electrochemical cell	Electrolytic cell

7. List the carriers of electricity in the following

a) Molten electrolyte.....

b) Fused electrolyte.....

c) Conductor.....

d) Semiconductors.....

8. i) $Cu^{2+} + 2e \longrightarrow Cu$, E = 0.34 volts

ii) $Zn \longrightarrow Zn^{2+} + 2e$; E= - 0.76 volts

The above are half-cell equations of chemical reactions.

a) Calculate the e.m.f of the over all reaction.....

b) Write the overall equations of the reactions.....

c) Which specie is reduced in the above reaction.....

d) Which species is oxidized in the above reaction.....

e)Which of the equations occurs at the cathode.....

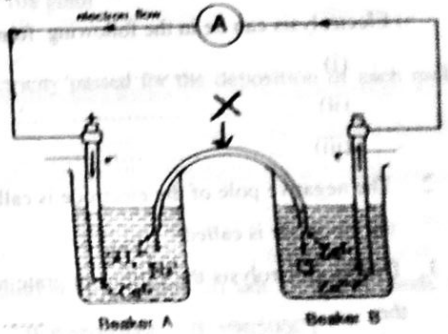
f) Which of the equations occurs at the anode.....

g) Which specie is the oxidizing agent?.....

h) Which specie is the reducing agent?.....

(9)

Fig. Cell linked by a salt bridge.



a) Identify X;.....

b) What is the function of X.....

c) Write the short-form of the equation connecting the two half cells

(d) Give an example of a secondary cell.....

e) Give an example of a primary cell with a diagram.

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10. $X^{2+} + 2e \longrightarrow X$: E = - 0.56V

$Y^{2+} + 2e \longrightarrow Y$: E = + 0.32V

a) Which of X or Y will displace each other from solution.

b) Which of X or Y is higher in electrochemical series

.....

c) Which of X or Y will be used to electroplate the other?

WK 4 Electrolysis and uses.

1. Define electrolysis:

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Electrolysis can be in the following forms namely.

(i) .....

(ii) .....

(iii) .....

2. The negative pole of the electrode is called .....while the positive pole of the electrode is called.....

3. During electrolysis the cations migrate to the ..... and anions migrate to the .....

4. List the 3 factors responsible for selective discharge at the electrodes.

(a) .....

(b) .....

(c) .....

5. Draw the diagram of electrolysis of acidified water and label fully.

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(6a) State the Ist law of electrolysis.

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(b) State the 2nd law of electrolysis.

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7. In the following equations.

(i) $Ca^{2+} + 2e \longrightarrow Ca = 40gmol^{-1}$

(ii) $Ag^{+} + e \longrightarrow Ag = 108gmol^{-1}$

(iv) $AL^{3+} 3e \longrightarrow AL = 108\ gm0l^{-1}$

[1F = e = 95600 Coulombs]

Calculate the number of coulombs of electricity passed for the deposition of each molar mass of elements above.

(i) .....

(ii) .....

(iii) .....

(8a) If a current of 5A is passed through a solution of a copper (ii) salt for 485 seconds, the number of moles of copper deposited will be ? [Cu =64gmol^{-1}, 1F =96500C]

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(ii) State the ionic theory

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(b) Draw a diagram for the experiment to compare the amounts of different substances liberated by the same quantity of electricity

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C) List four uses of electrolysis.

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9a. A current was passed through a concentrated solution of sodium chloride in an electrolytic cell with platinum electrodes

(i) Name the gas evolved at the anode.

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(ii) Which ions were present in the solution at the end of electrolysis?.

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iii) What was the nature of the final solution.

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(iv) Give one other product formed during the process?

.....

(v) If a dilute solution of sodium chloride had been used instead of a concentrated solution, which gases would be evolved at the anode?

.....

(b) An element X has a relative atomic mass of 88. When a current of 0 .5 ampere was passed through the fused chloride of X for 35 minutes ,10secs, 0.44g of X was deposited at the cathode

[1 faraday =96500c]

(c) calculate the number of faradays needed to liberate 1 mole of X

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10a. Draw a diagram to show the measurement of electrode potential of a named metal at room temperature.

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(b) 0. 22g of a divalent metal is deposited when a current of 0 .45 Ampere is passed through a solution of its salt for 25 minutes using appropriate electrodes. Calculate the relative atomic mass of the metal.

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(c) Describe carefully what happens when copper (ii) Tetraoxosulphate (vi) solution is electrolyzed between.

(i) Platinum electrodes.

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.....(d)

What mass of (a) copper (b) Aluminum and what volume at S.t.p. of (c) Chlorine and (d) Oxygen will be liberated during electrolysis by a charge of one faraday ?.

[Al = 27: Cu = 64: 1 motor volume at s.t.p = 22 .4days]

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WK 5 **CHAPTER TWO**

Types of Reactions / Redox Reactions.

Define oxidation in terms of electron transfer

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(a) Define reduction in terms of electron transfer.

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(b) List other oxidation processes.

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List other reduction processes.

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2. The following are types of reactions.

(i) Direct combination reaction.

(ii) Decomposition reaction.

(iii) Reversible reaction.

(iv) Displacement reaction.

(v) Double decomposition reaction.

(vi) Exothermic and endothermic reaction

(vii) Thermal dissociation.

(viii) Oxidation and reduction

(ix) Catalytic reaction.

Write an equation to illustrate each of the above reaction

(i) .....

(ii) .....

(iii).....

(iv).....

(v).....

(vi).....

(vii).....

(viii).....

(3) Chemical reactions are of several types. Study the following reactions and then indicate which type each he longs.

(a) The action of heat on lead (ii) trioxonitrate.

(v)..... .....

(b) The reaction of iron fillings and steam in a closed solution.

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(c) The reaction of chlorine and iron (ii) chloride solution.

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4. Give a different equation each case to illustrate the following types of reaction.

(a) Thermal decomposition.

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(b) catalytic decomposition:

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(c) Name a catalyst that can be used in (b) above

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(5)a Define the following.

(i) An oxidizing agent.

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Example .....

(ii) A reducing agent .....

An example. .....

(b) Describe a test for an oxidizing agent.

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(c) Describe a test for a reducing agent.

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(7a) The standard electrode potentials for the following half cell reactions, are-:

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$Zn\ (s) \longrightarrow Zn^{2-}\ (aq) + 2e\ ,\ E = -0.76\ V$

$Cu^{2-}{}_{(aq)} + 2e- \longrightarrow CU_{(s)}\quad E = +0.34\ V$

(i) Calculate the standard potential for the forward reaction.

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Write the overall equation of the reaction above.

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.....

ii) Which of the specie is reduced :

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iv) Which of the specie is the oxidizing agent

.....

iii) which specie above is the reducing agent ?

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viii) In (ai) above is the forward reaction spontaneous?

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x) If a piece of copper metal were placed in IM Zinc tetraoxosulphate (vi) Solution, would there be a reaction?

Draw and label completely a voltaic cell.

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a In electrolysis, oxidation takes place in the ..... and reduction kes in the .....

) If 10 cm^3 of hydrogen gas is obtained at the cathode by electrolysis of dilute traoxosuphate (vi)acid using Hoffman's apparatus, the volume of oxygen produced .....

)In (b) above how many faradays are required by 1mole of hydrogen.

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(c) How many ...ys are required by 1mole of oxygen.

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(d) Which of the following is not applicable to rusting.

(a) it is a process of oxidation

(b) it is analogous to burning.

(c) It is a chemical change.

(d) Moisture is necessary.

(e) Carbon (iv) oxide is liberated.

10 a Balance the following skeletal equations.

$MnO_4^- + Sn^{2-} + H^- \longrightarrow Cr^{3-} + Fe^{3-} + H_2O$

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(c)In (a) which substance is the oxidizing agent?

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Which substance is oxidized ?.

.....

(cii) In (b) which substance is the reducing agent.

.....

which substance is reduced?.

.....

(di) $MnO_4^- + 8H^+ + ne \longrightarrow Mn^{2-} + 4H_2O$

(dii) $Cr_2O^{-2-} + 14H^- + ne \longrightarrow 2Cr^{3-} + 7H_2O$

In each of the equation of (di) and (dii). calculate the value of n in each case.

WK 6 Acid base reactions /Titrations.

(i) What is an acid?

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(ii) What is a base? .....

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(iii) What is a strong acid? .....

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(iv) What is a weak acid.? .....

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(v) Differentiate between a strong acid and concentrated acid.

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2. 30.0 cm^3 of a 0.095M solution of HNO_3 was required to neutralize 25.cm^3 of a solution containing 7.20gldam^3 of NaCo3.XH_2O. The equation for the reaction is $Na2Co_3.XH_2O + HNO_3 \longrightarrow 2NaNo_3 + (x+1)H_20 + Co_2$. Calculate (a) the number of moles per dm3 of sodium trioxocorbonate (iv) solution.

(b). The value of X .

[Na =23. C=12. O=16 . H=1]

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3. Solution B was made by taking 20cm^3 of a saturated solution of Na_2Co_3 at 250c and diluting it to 100cm^3 with distilled water. Solution A is 0.090M Hcl. By titration 29.5cm^3 of A required 25cm3 of B for neutralization using methyl orange as indicator. From the results. calculate:

(a) The concentration of B in moles per dm3

(b) The solubility of Na2Co3 at 25^{0c} in moles per dm^3.

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4. 1.5g of a dibasic acid H_2X of 98%w/w was made up to 250cm^3 made up with distilled water in a volumetric flask. 20cm^3 of the acid neutralize 25cm3 of sodium hydroxide solution containing 4.0gdm3.Calculate (a) the concentration of H_2X in moles per dm^{-3} (b) the concentration of the sodiumhydroxide in gldm$^{\circ}$. (C) The value of X in H_2X.

[Na =23. 0=16.H=1]

$H_2X\ 10g) + 2NaOH_{(aq)} \longrightarrow Na_2X_{(s)} + 2H_20_{(l)}$

(5) A is a solution of hydrochloric acid. which was prepared by diluting 10.0 cm^3 of a 10 moldm^{-3} at room temperature. 22.50cm^3 of A neutralized 25.00cm^3 of B using methyl orange indicator. Calculate (a) the concentration of solution A in mole dm.-3.

(b) The concentration of solution B in mole dm^{-3}

(c) The solubility of solution B at room temperature.

[H=1. CL=35.5. Ca =40:. 0=16]

$Ca(0H)_{2\,eq} + 2Hq_{(aq)} \longrightarrow CaCl_2(aq) + 2H_20\ C_L)$

(6) A is a solution of an impure tetraoxosulphate(iv) acid containing 6.5g in 25 0cm^3 of solution B is a solution of pure sodium hydroxide containing 8.0gper dm^3 of A using methyl orange as indicator.

[H= 1; S=32; 0=16]

H2S04 (aq) + 2Na0H Calculate

(a) The molar concentration of B

(b)The mass concentration of pure acid A in gdm^{-3}.

(c) The percentage impurity in the acid solution

(7) A is a solution containing 6.0 gdm^{-3} of hydrochloric acid .B is a solution containing 10 50gdm^{-3} of hydrated sodium trioxocarbonate (iv) $Na_2Co_3.XH_2O$. 16.50cm^3 of A was required to neutralize 25.0cm3 of B, using methylorange indicator. Calculate (a) the concentration of A in mol.dm-3.

(b) the concentration of A in mol.dm-3

(d) The value of X and hence the percentage water of crystallization in the hydrated sodiumtrioxocarbonate (iv) $Na_2CO_3.XH_2O$

(8) What are indicators.

(b) What are primary standards.

(c) State the reasons indicators used to titrate:

(i) A week acid against strong base.

A week base against strong acid.

(iii) weak acid against weak base.

(j) Sketch the titration curves of Ci to Ciii .

(C i)

(Cii)

(Ciii)

Describe briefly how you will prepare 0.1M of H_2So4. Mention the key laboratory of apparat hat must be used.

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(9a) You are provided with IM NaoH solution. 250 volumetric flask and distilled water only.

(a) Describe how you would use the above information prepare 0.10M solution of sodium hydroxide solution.

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(6) What is the volume of distilled water required.

(10)a List 5 precautions that could be ensured during titration.

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(6) What is the concentration in moldm-^{3} of a solution containing O.1Og of sodium hydroxide per 50cm3 of a solution.

(b) Draw a titration table. indicating a hypothetical tlter values of burette readings during a titration process include rough or trial values if need be.

Take the average of your titer values.

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WK 7. RATF OF CHEMICAL REACTIONS.

1. How does the collision theory explain the rate of a chemical reaction?

(i) Surface area:

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(ii) Catalyst:.....

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2. I) Reaction rates are measured by considering how quickly products are

..... Or how reactants are .....

ii) In a chemical reaction. any property which changes. as the amount of ..... or ..... Change can be used to investigate the rate of reaction.

iii) List the factors that affect the rate of a chemical reaction

(a) .....

(b) .....

(c) .....

(d) .....

(e) .....

3a) The minimum energy which must be supplied or attained before a reaction can occur is called .....

(b) The rate of a typical chemical reaction is ..... at the beginning because the reaction are then at their ..... and gradually .....

(4a) The following are common catalysts

(i) Vanadium (v) oxide (V_2O_5)

(ii) Iron (Fe)

(iii) Nickel (Fe)

(iv) Lead ethyl

(v) Oxygen

(vi) Manganese(iv) dioxide(M_{no2})

Mention what each of the catalyst is used for.

(i) .....

(ii) .....

(iii) .....

(iv) .....

(v) .....

(vi) .....

(b) Write the equation for each of the reactions catalyzed by the above catalysts.

(i) .....

(ii) .....

(iii) .....

(iv) .....

(v) .....

(vi) .....

5. (a) Which of the following samples will react fastest with dilute hydrochloric acid

(A) 10g of lumps of $CaCo_3$ at 25^0C

(B) 10g of powdered $CaCo_3$ at 25^0C

(C) 10g of lump of $CaCo_3$ at 50^0C

(D) 10g of powdered $CaCO_3$ at 50^0C

(b) Manganese (iv) oxide is known to hasten the decomposition of hydrogen peroxide. It main action is to .....

(A) increase the surface area of the reactants

(B) increase the concentration of the reactants

(C) Lower the concentration of the reaction

(D) Lower the heat of the of the reaction. ΔH of the reaction.

In the diagram above in indicate what X. Y. Z represent?

X .....

Y .....

Z .....

(b) At 400^0C the three gases. hydrogen. iodine and hydrogen iodide exit together in equilibrium. The equation for the reaction is $H_{2(g)}+I_{2\ (g)} \rightleftharpoons 2HI_{(g)}$

What effect will an increase in pressure have on

(i) The rate of reaction of hydrogen with iodine

(ii) The position of equilibrium.

(iii) Name the product formed when hydrogen iodide is dissolved in water and

(iv) Describe what would happen when passed into solution

(i) .....

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a) The decomposition of $N_2O_{5\ (g)}$ to $No_{2\ (g)}$ and $O_{2\ (g)}$ was monitored by observing the changes in pressure of the system. The values of pressure at certain periods of time are as follows.

Time (mins)	0	10	20	30	40	50	60
Pressure (mm)	348	247	185	140	105	78	58

Calculate the rate of the reaction using a graph paper.

(b) Sketch graph showing how the rate of a chemical reaction proceeds to completion.

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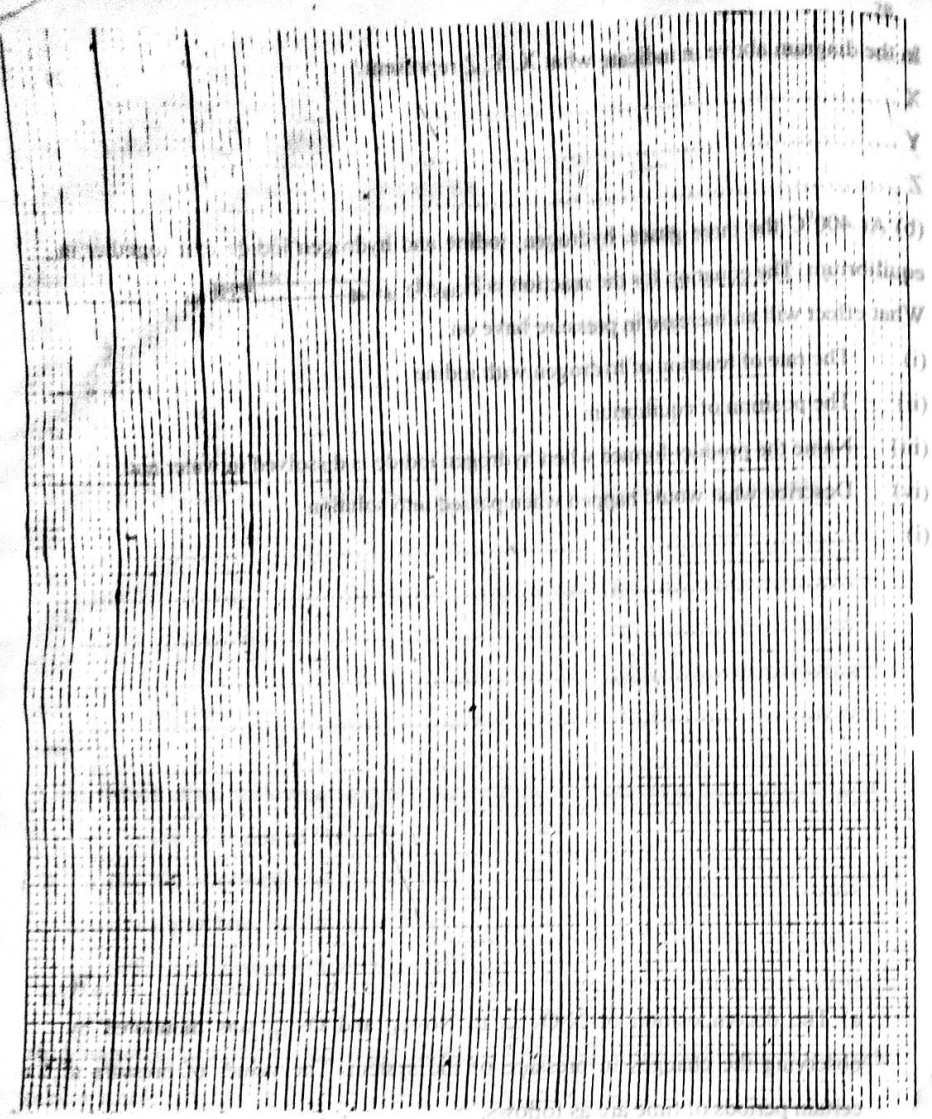

1. List five characteristics of a catalyst.

(i) .....

(ii) .....

(iii) .....

(iv) .....

(v) .....

2. List five factors that affect rate of a chemical reaction.

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3. What is an exothermic reaction?

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4. What is an endothermic reaction?

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5. Sketch & label an energy profile diagram to show an exothermic reaction. Illustrate how to obtain Δ H

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7. Sketch and label fully energy profile diagrams to illustrate catalyzed exothermic and endothermic reactions.

Catalyzed exothermic reaction.

(i) Catalyzed endothermic reaction.

8. The table below shows the result for the formation of hydrogen in the reaction of zinc granules and excess dilute hydrochloric acid at room temperature at 25^0 c as obtained by a research student.

Time (s)	5	10	15	20	25	30	35	40	45	50	80	100
Volume of hydrogen $(cm)^3$	10	15	21	27	32	44	60	80	120	198	121	122

(b) At what time is the reaction over?

(d) Account for the differences in the rate of reaction

(i) At the beginning and (ii) near the end of the reaction.

(f) sketch and explain on the same graph what would be obtained when.

(i) Temperature is increased.

(ii) Acid concentration is reduced

CHAPTER 3

Wk 8 Energy Effects and Chemical equilibrium.

1a) Enthalpy change (ΔH) can be measured by the use of.

(b) Define heat of combustion

(c) Define heat of neutralization

(3a) What is a spontaneous process.....

(b) List 3 processes that are naturally spontaneous process. .....

.....

(d) List 2 factor that are responsible for spontaneous processes.....

.....

(4a) Entropy is .....

.....

(b) An increase in disorder is a ..... entropy and a decrease in disorder is a ..... Entropy.

(ii) Solid ⟶ Liquid ⟶ Gases. Does entropy decreases or increases

.....

(c) When ΔS is positive it is a ..... process. But if ΔS is negative, it is a spontaneous processes in ..... direction.

(5) Calculate the entropy change for the reaction

$C_{(s)} + 0_{2(g)} \longrightarrow Co_{2(g)}$

$S^0C = 230$ J/molk

$S^0O_2 = 205$J/molk

$S^0CO_2 = 215$ J/molk

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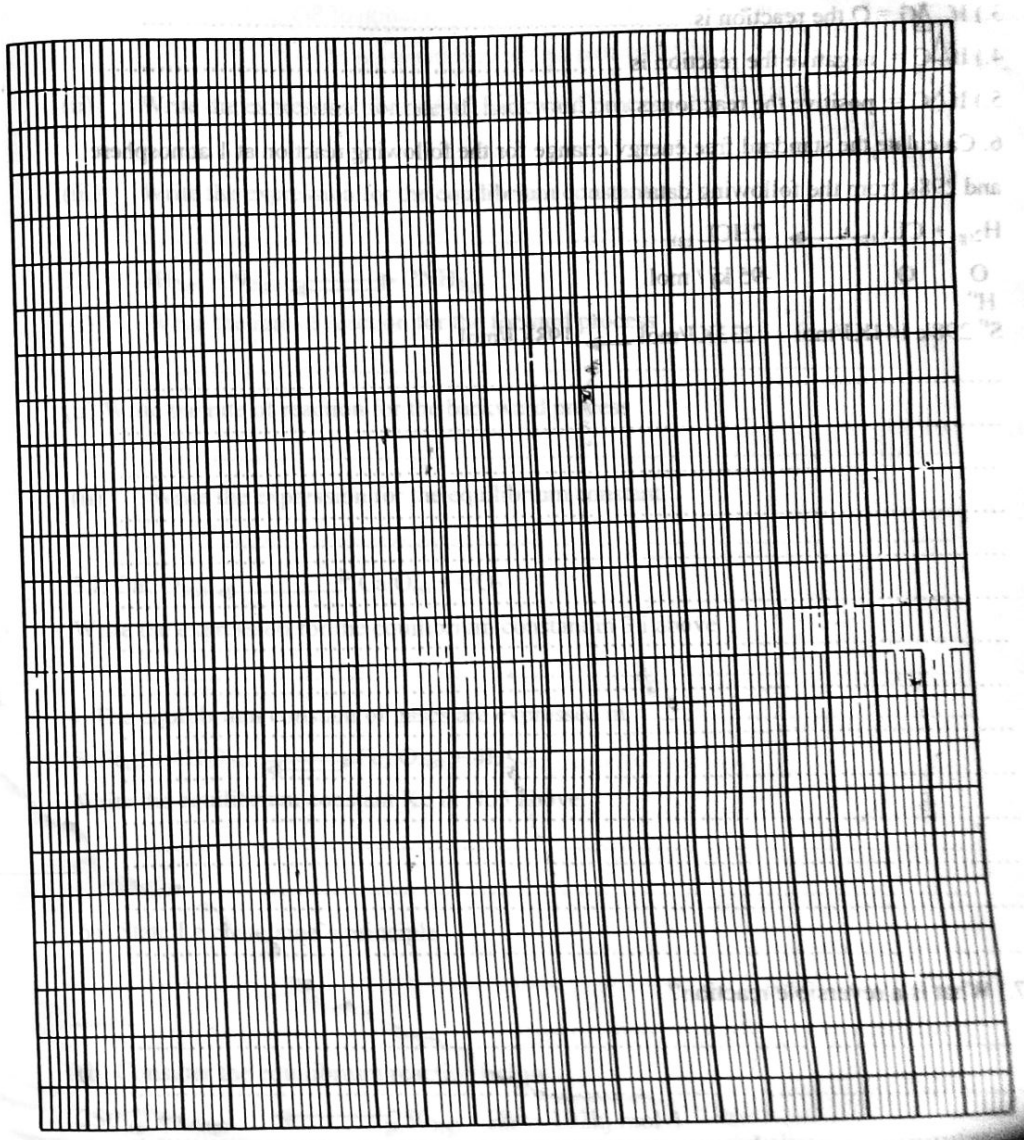
(b) Is the reaction spontaneous? ..... why ? .....



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