

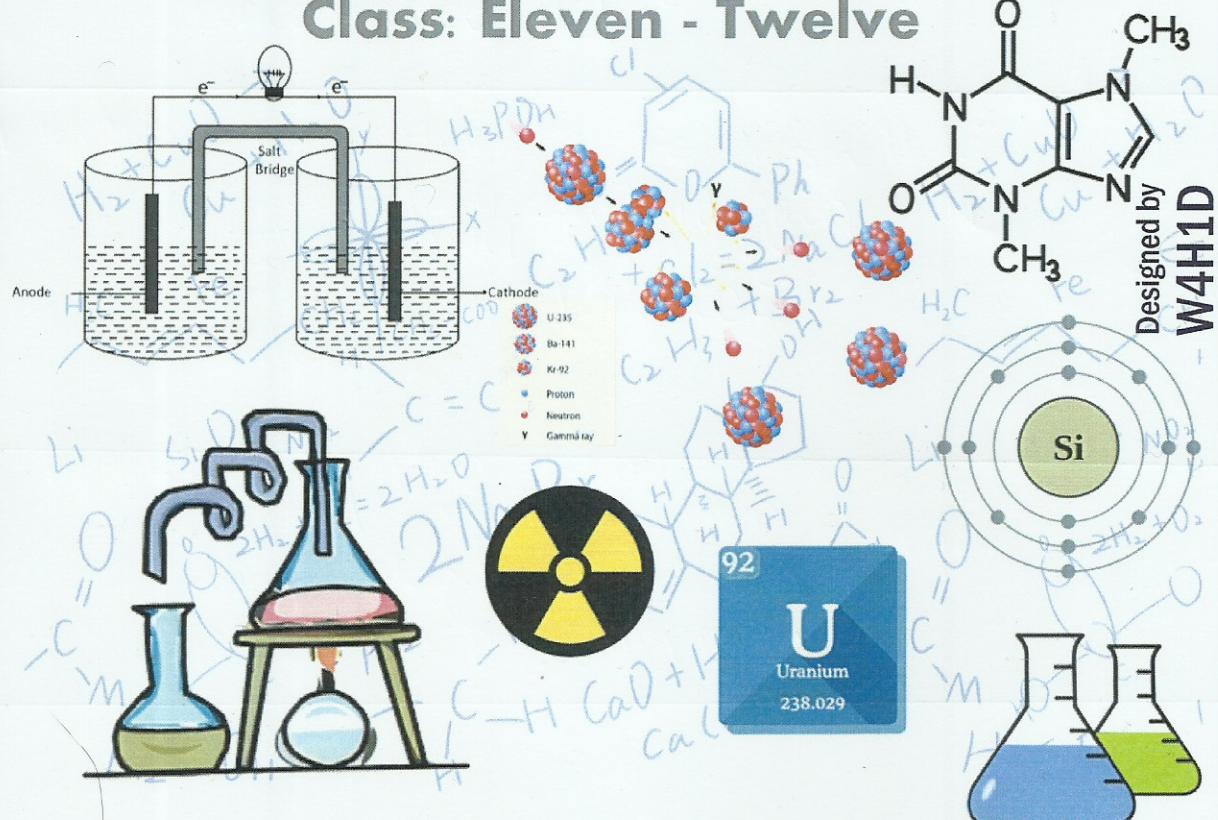
BANGLADESH SCHOOL & COLLEGE, SULTANATE OF OMAN

Sultanate of Oman

Chemistry 2nd Paper

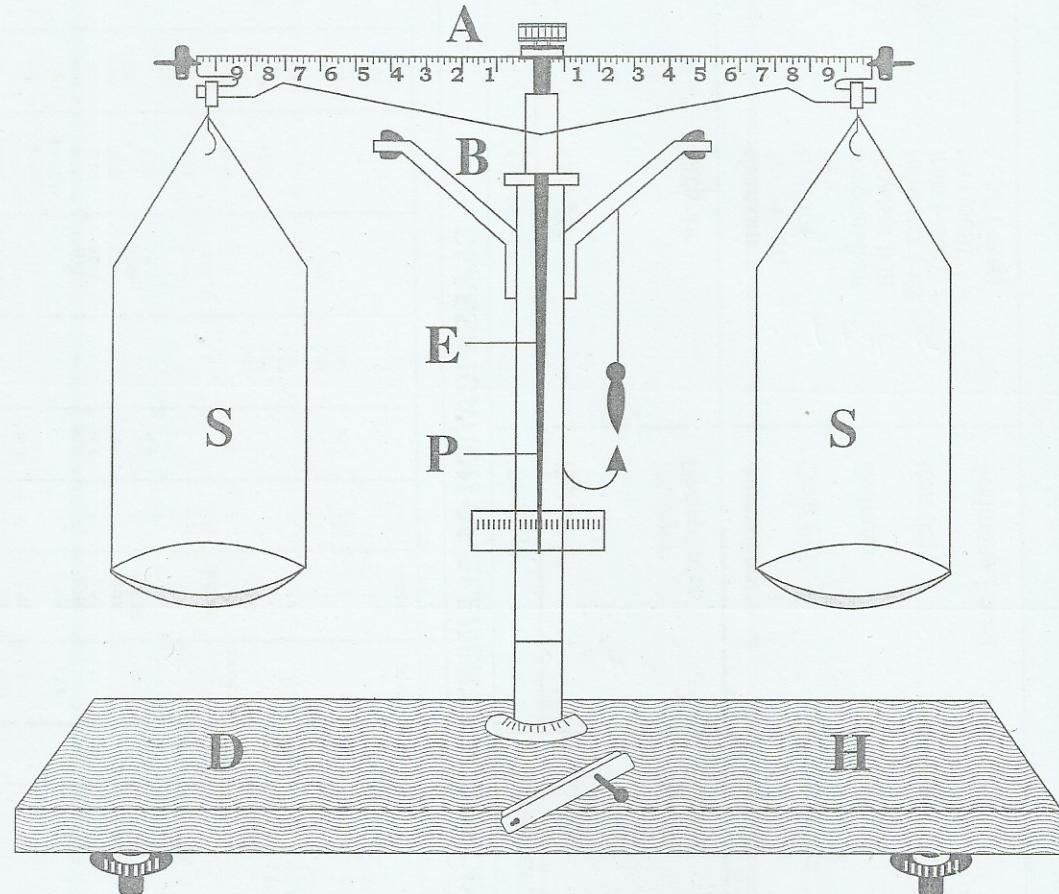
Practical Notebook

Class: Eleven - Twelve



Name	Nazmul Huda	
Roll no.		Reg. no.
Session	2020 - 2021	
Board	Dhaka	

BALANCE



A= METALLING BEAM

D= WOODEN FRAME

H= HANDLE

B= MOVABLE ROD

E= POINTER

P= PILLER, S= BALANCE PANS

NAME : Najmul Huda

SCHOOL/ COLLEGE : Bangladesh School & College, Saham.

SUBJECT : Chemistry 2nd Paper

ROLL NO. : _____ SESSION : 2020 - 2021

REGISTRATION NO. : _____

USEFUL DATA FOR PHYSICS

SI NO	NAME OF ELEMENTS	SPECIFIC			LATENT HEAT	THERMAL CONDUCTIVITY	VELOCITY OF SOUND	REFRACTIVE INDEX	CRITICAL ANGLE	BREAKING STRESS	MODULUS OF RIGIDITY	YOUNGS MODULIUS	CO-EFFICIENT EXPANSION		
		GRAVITY	RESISTANCE	HEAT											
1	COPPER	8.93	1.78	0.091-0.094	-	50.6	-	-	-	-	30,000	3.9-40X10 ¹¹	12.4-12.8X10 ¹¹	0.000167	-
2	BRASS	8.6	4.156	0.088-0.092	-	65.0	-	-	-	-	36,000	3.5X10 ¹¹	9.9-10.2X10 ¹¹	0.000189	-
3	IRON (-OUS)	7.2	13.19-18.80	0.119	-	-	-	-	-	-	34,000	7.7-8.3X10 ¹¹	0.000102	-	-
4	IRON (IC)	7.86	12.0-16.80	-	-	-	-	-	-	-	36,000	7.9-8.9X10 ¹¹	19.9-20X10 ¹¹	0.000189	-
5	STEEL	26.27	3.21	0.21	-	-	-	-	-	-	5200	-	10-13X10 ¹¹	-	-
6	ALUMINUM	6.6	6.10	0.033	-	93.0	-	-	-	-	-	-	-	-	-
7	ZINC	7.1	20.80	0.109	-	24.1	-	-	-	-	-	-	-	-	-
8	LEAD	11.4	-	0.056	-	5.4	-	-	-	-	-	-	-	-	-
9	NICKEL	8.9	-	-	-	-	-	-	-	-	0.083	-	-	-	-
10	SILVER	10	-	-	-	-	-	-	-	-	0.14200	4900	-	-	-
11	GOLD	19.3	-	0.033	-	21.0	-	-	-	-	-	-	-	-	-
12	PLATINUM	21.5	1.63	0.055	-	0.16	-	-	-	-	2.8	-	-	-	-
13	MERCURY	-	-	-	-	-	-	-	-	-	0.02000	-	-	-	-
14	TIN	2.29	11.00	0.16	-	14.0	-	-	-	-	5000-5300	-	-	-	-
15	GLASS (FUNT)	2.9-5.9	-	0.42	-	-	-	-	-	-	-	-	-	-	-
16	GLASS (CROWN)	2.4-2.8	11.30	-	1.51	-	-	-	-	-	153-180	41.25	-	-	-
17	TARANTINE OIL	0.87	-	-	1.00	-	-	-	-	-	137.0	41.45	-	-	-
18	ALCOHOL (ETHYL)	0.79	-	-	0.502	-	-	-	-	-	1260.0	43.15	-	-	-
19	WATER	-	-	-	0.58	-	-	-	-	-	14.10	-	-	-	-
20	ICE	0.92	-	-	80.0	-	-	-	-	-	-	-	-	-	-
21	GLYCERINE	1.28	-	-	-	-	-	-	-	-	-	-	-	-	-
22	KEROSENE	0.98	-	-	-	-	-	-	-	-	-	-	-	-	-
23	RUBBER	0.9-13	-	-	-	-	-	-	-	-	0.0045	30-40	-	-	-

CLASSIFICATION OF ELEMENTS ACCORDING TO THEIR VALENCY

Mono valent	Divalent	Trivalent	Tetravalent	Panta Valent	Hexavalent
Hydrogen	Oxygen	Boron	Carbon	Nitrogen	Sulphur
Fluorine					
Chlorine					
Bromine					
Iodine					
Potassium	Calcium	Nitrogen	Silicon		
Sodium	Strontium	Phosphorus	Supphur		
Zinc	Barium				
Mercury (ous)	Magnesium				
Copper (-ous)	Copper (ic)				
Iron (-ous)	Iron (-ic)				
tin (-ous)	Tin (-ic)				
Silver	Lead	Antimony (-ous)	Lead		

PRACTICAL

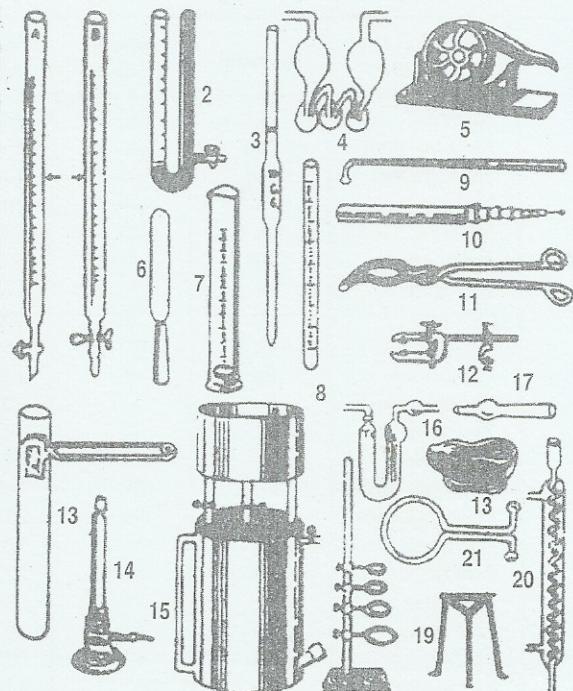
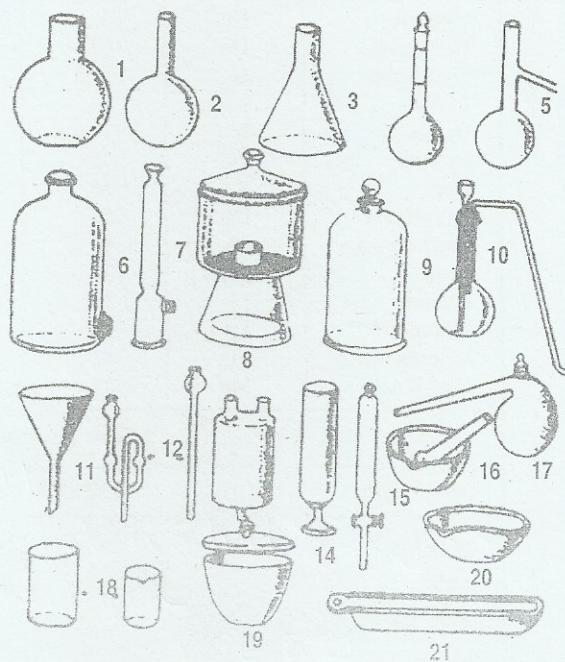


PLATE NO.1

- | | |
|-----------------------|-----------------------------------|
| 1. BURETTE | 12. CLAMP |
| 2. EUDIOMETER | 13. TEST TUBE WITH HOLDER |
| 3. PIPETTE | 14. BUNSEN BUENER |
| 4. POTASH BULES | 15. GAS HOLDER |
| 5. CORK SQUEEZER | 16 & 17. Ca Cl ₂ -TUBE |
| 6. SPATULA | 18. MERCURY TROUGH |
| 7. MEASURING CYLINDER | 19. TRIPOD STAND |
| 8. MEASURING TUBE | 20. CONDENSER |
| 9. BLW PIPE | 21. CLIP |
| 10. CORK BORER | 22. RETORT STAND |
| 11. TONGS | |

PLATE NO. 2

1. FLAT BOTTOM FLASK
2. ROUND BOTTOM FLASK
3. CONICAL FLASK
4. MEASURING FLASK
5. DISTILLING FLASK
6. ASPIRATOR
7. TOWER
8. DESICCATOR
9. BELL JAR
10. FLASK WITH THISTLE FUNNEL & DELIVERY TUBE
11. FUNNEL
12. THISTLE FUNNELS
13. WOULFEE'S BOTTLE
14. TEST GLASS
15. SEPARATING FUNNEL
16. MORTAR & PESTLE
17. BETORT
18. BEAKERS
19. CRUCIBLE
20. BASIN
21. BOAT

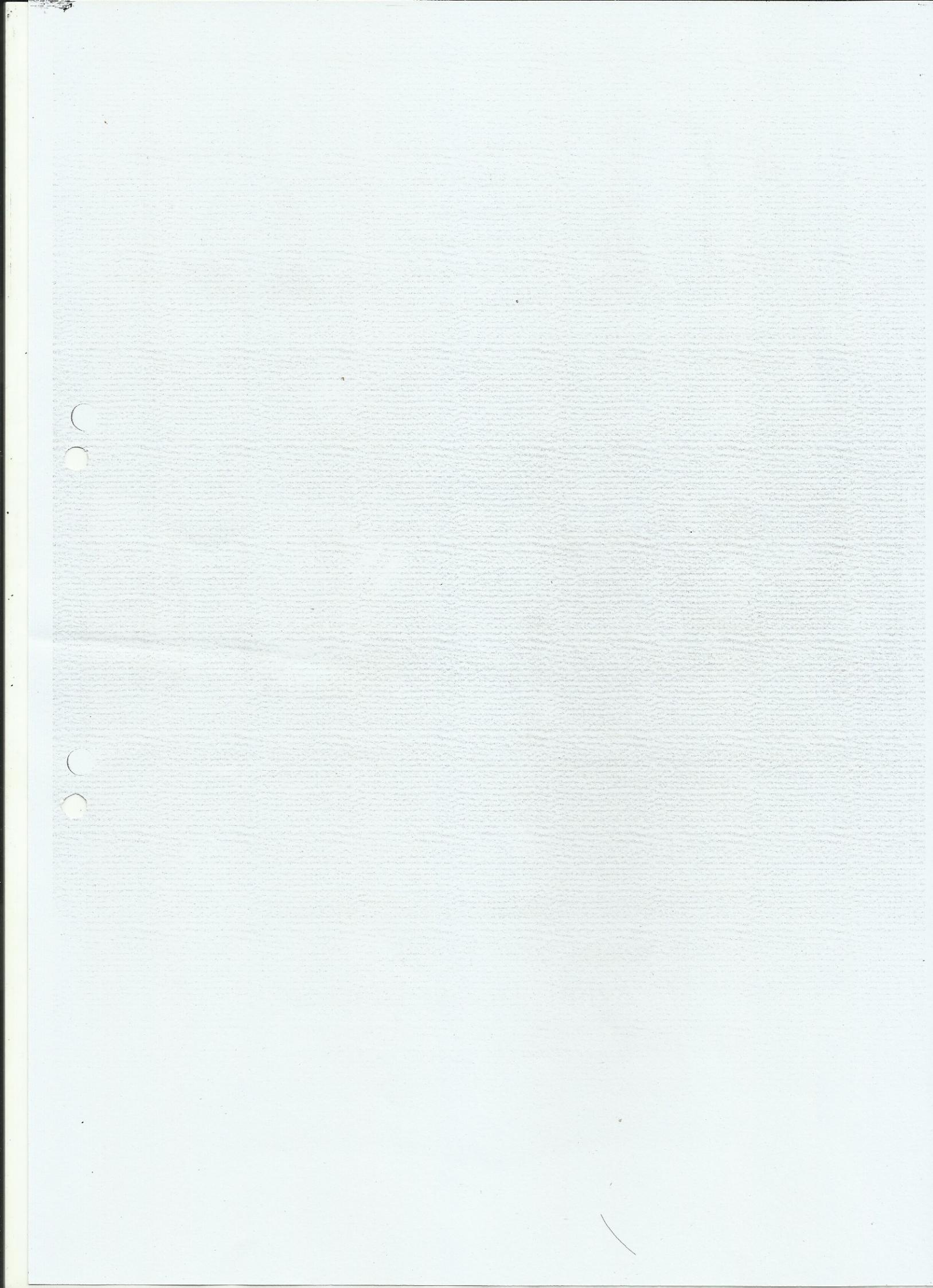


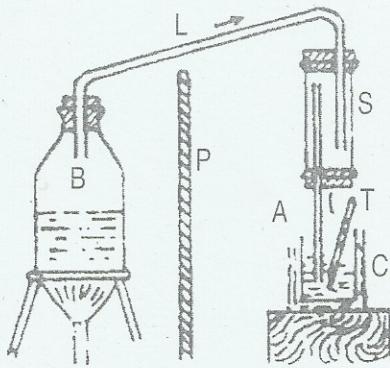
ATOMIC NUMBERS AND ATOMIC WEIGHTS WITH THEIR SYMBOLS

Name of the Element	Symbol	Atomic Number	Atomic Weight	Name of the Element	Symbol	Atomic Number	Atomic Weight
Actinium	Ac	89	227	Mercury	Hg	80	200.5
Aluminium	Al	13	6.97	Molybdenum	Mo	42	95.9
Amercium	Am	95	243	Neodymium	Nd	60	144.2
Antimony	Sb	51	121.7	Neon	Ne	10	20.17
Aragon	Ar	18	39.94	Nickel	Ni	28	58.7
Arsenic	As	33	74.9216	Niobium	Nb	41	92.9064
Astatine	At	85	210	Nitrogen	N	7	14.0067
Barium	Ba	56	137.3	Osmium	Os	76	190.2
Berkelium	Bk	97	249	Oxygen	O	8	15.999
Beryllium	Be	56	137.36	Palladium	Pd	46	106.4
Bismuth	Bi	4	9.02	Phosphorus	P	15	30.97376
Boron	B	83	209.00	Platinum	Pt	78	195.0
Bromine	Br	5	10.82	Potassium	K	19	39.09
Cadmium	Cd	35	80	Praseodymium	Pr	59	140.9077
Calcium	Ca	48	11.24	Prtactinium	Pa	91	231.0359
Carbon	C	20	40	Radium	Ra	88	226.0254
Cerium	Ce	6	12	Radom	Rn	86	222
Caesium	Cs	58	140.12	Rhenium	Re	75	186.2
Chlorine	Cl	55	132.91	Rhodium	Rh	45	102.9055
Chromium	Cr	17	35.476	Ruthenium	Ru	44	101.75
Copper	Cu	29	63.5	Rubinium	Rb	37	85.43
Dysprocium	Dy	66	162.46	Samarium	Sun	62	150.4
Erbrium	Er	68	167.67	Seandium	Sc	21	44.9559
Europium	Eu	63	152.0	Selenium	So	34	78.09
Fluorine	F	9	19.00	Sillcon	Si	14	28.08
Franeium	Fr	87	223	Silver	Ag	47	107.868
Gadolinium	Gd	64	156.9	Sodium	Na	11	22.98977
Gaflium	Ga	31	62.72	Stontlum	Sr	38	87.62
Germanium	Ge	32	72.62	Sulphur	S	16	32.06
Gold	Au	79	797.2	Tuntalum	Ta	73	180.947
Hafnium	Hf	72	178.6	Tellurim	Te	52	127.6
Helium	He	2	4.002	Terbium	Th	65	159
Hokmium	Ho	67	163.5	Thallium	Ti	81	20.39
Hydrogen	H	1	1.007	Thorium	Th	90	232.12
Indium	I	53	126.92	Thulium	Tm	69	169.04
Iodine	Ir	77	193.1	Tin	Sm	50	119
Iridium	Fe	26	55.84	Titanium	Ti	22	47.90
Iron	Kr	36	83.7	Tungstem	W	74	184.0
Krypton	La	57	138.9	Uranium	U	92	238.07
Ianthenum	Ph	82	207.22	Vonadium	V	28	50.95
Lead	Lm	3	6.940	Xenon	Xe	54	131.3
Lithium	Li	3	6.94	Ytterubim	Yb	70	178.0
Lutecium	Lu	71	174.97	Yttrium	Y	39	88.9059
Magnecium	Mg	12	24.305	Zunc	Zn	30	65.38
Manganese	Mn	25	54.9380	Zircontum	Zr	40	91.22

তড়িৎ কোষের বৈদ্যুতিক চাপ (E.M.F of Cells)

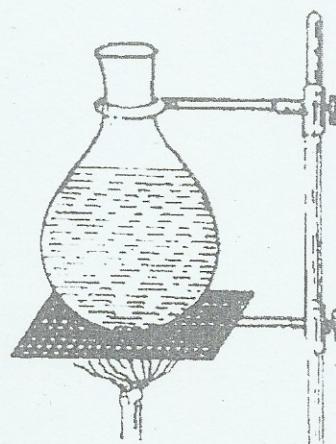
কোষের নাম	বৈদ্যুতিক চাপ ভোল্ট	কোষের নাম	বৈদ্যুতিক চাপ ভোল্ট
ড্যানিয়েল	1.07-1.08	ড্যানিয়েল	2.0000
বুলসেন	1.08-1.90	বুলসেন	1.8-1.9000
গেকল্যান্স	1.45	গেকল্যান্স	1.433
শুঙ্ক	1.50	শুঙ্ক	1.01830
সেকেভারী		সেকেভারী	
সৌমা এডিস (সঞ্চয়ী)	1.9-2.20	সৌমা এডিস (সঞ্চয়ী)	1.1-1.4000



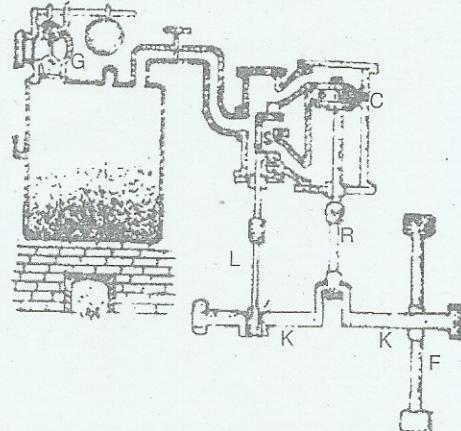


B- Water vessel
 S- Steam trap
 P- A screen
 C- Calorimeter
 T-Thermometer
 A-Exit tube

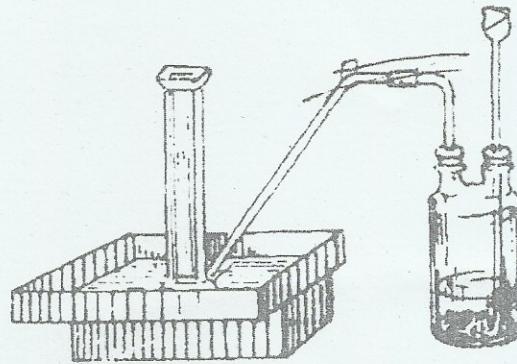
DETERMINATION OF LATENT HEAT
 OF VAPORIZATION OF WATER



TRANSMISSION OF HEAT



SECTIONAL DIAGRAM OF COMPLETE
 STEAM OF ENGINES



LABORATORY METHOD PREP
 OF HYDROGEN

Victoria

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Index

Index

This is to Certify that Mr./Miss

A Student of Class Roll No. Has Performed the Required

Number of Experiments in Physics/Chemistry Laboratory of

School/College/University as per Syllabus During the Session

Head of the Department Physics/Chemistry

Identification of functional group of different classes of organic compounds.

(i) Test of alcoholic hydroxyl group (-OH): (R-OH):-

[Sample: Methanol, ethanol, butanol, propanol etc.]

Experiment	Observation	Inference.
1) Sodium metal test: Add a small piece of sodium metal to 0.5 ml of the organic compound in a dry test tube.	1) Brush effervescence of hydrogen gas is produced. $2\text{ROH} + 2\text{Na} \rightarrow 2\text{RONa} + \text{H}_2 \uparrow$	1) Alcoholic -OH group is present.
2) Acetyl chloride test: Add a few drops of acetyl chloride to 0.5 ml of the organic compound in a dry test tube and shake.	2) A colorless gas with pungent odour (HCl) comes out, bring a glass rod moisten with NH_4Olt near the mouth of the test tub. Dense white fumes are produced. $\begin{aligned} \text{ROH} + \text{CH}_3\text{COCl} &\longrightarrow \\ \text{CH}_3\text{COOR} + \text{HCl} & \\ \text{HCl} + \text{NH}_3 &\longrightarrow \text{NH}_4\text{Cl} \\ &\quad (\text{white fume}) \end{aligned}$	2) Alcoholic -OH group is present.

ii) Test of phenolic hydroxyl (-OH) group : [$\text{C}_6\text{H}_5\text{OH}$]

[Sample: Phenol, Cresol etc.]

Experiment	Observation	Inference
1) 5% NaOH test:- Take 1-2 ml of 5% aqueous NaOH solution	1) Organic compound is dissolved.	1) Organic compound is acidic. So,

Identification of functional group of different classes of organic compounds.

<p>in a test tube and add a small amount of organic compound to it and then shake.</p> <p>2) <u>5% NaHCO₃ test:</u> Take 1-2 ml of 5% aqueous NaHCO₃ solution in a test tube and add a small amount of organic compound to it and then shake.</p>	$C_6H_5-OH \rightarrow C_6H_5ONa$ (Sodium Phenate) + H ₂ O	phenolic -OH may be present.
<p>2) Organic compound is insoluble.</p>	<p>2) Organic compound is weakly acid.</p> <p>So, phenol -OH may be present.</p>	

iii) Test of carboxylic (-COOH) group:-

[Sample: Methanoic acid, ethanoic acid, oxalic acid, benzoic acid, salicylic acid etc]

Experiment	Observation	Inference
<p>1) <u>5% NaHCO₃ test:</u> Add a pinch or drop of organic compound to 2-3ml of 5% NaHCO₃ solution in a test tube.</p>	<p>1) A brisk effervescence takes place due to evolution of CO₂.</p> $R-COOH + NaHCO_3 \rightarrow R-COONa + CO_2 \uparrow + H_2O$	1) -COOH group is confirmed.
<p>2) <u>Ester formation test:</u> Warm a small amount of organic compound with 1-2 ml of alcohol and 2-3 drops of cone. H₂SO₄.</p>	<p>2) A pleasant smell is produced.</p> $R-COOH + C_2H_5OH \xrightarrow{H_2SO_4} RCOC_2H_5 + H_2O$ <p>Ester</p>	2) -COOH group is confirmed.

Identification of function group of different classes of organic compounds.

iv) Test of aldehydic group (-CHO) :-

[Sample: Formalin, ethanol, benzaldehyde etc.]

Experiment	Observation	Inference
1) Tollen's reagent test:- Add a few drops of the organic compound to 2 ml of the reagent. Heat the test tube in boiling water for 2 mins and allow to stand.	1) A silver mirror or greyish black ppt. of Ag is formed. $\text{R-CHO} + 2\text{AgNO}_3 + 3\text{NH}_4\text{OH} \longrightarrow 2\text{Ag}\downarrow + \text{RCOONH}_4 + 2\text{NH}_4\text{NO}_3 + \text{H}_2\text{O}$ (Silver mirror).	1) Aldehydic group (-CHO) is confirmed.
2) Fehling's Solution test:- Warm 2-3 drops of organic compound with 1ml of Fehling's solution.	2) A red ppt. is formed $\text{R-CHO} + 2\text{Cu(OH)}_2 + \text{NaOH} \longrightarrow \text{Cu}_2\text{O} + \text{RCOONa} + 3\text{H}_2\text{O}$ (Red ppt.)	2) Aldehydic group (-CHO) is confirmed.

v) Test of ketone group (-CO-) :-

[Sample:- Propanone ($\text{CH}_3-\text{CO}-\text{CH}_3$), butanone ($\text{C}_2\text{H}_5-\text{CO}-\text{CH}_3$), Pentanone - 2 ($\text{CH}_3-\text{CO}-\text{C}_2\text{H}_7$), Acetophenone ($\text{C}_6\text{H}_5-\text{CO}-\text{CH}_3$) and solid benzophenone ($\text{C}_6\text{H}_5-\text{CO-C}_6\text{H}_5$) etc.]

Experiment	Observation	Inference
1) Tollen's reagent test:- Add a few drops of the organic compound to 2 ml of the reagent. Heat the test tube in boiling water for 2 mins and allow to stand.	1) No silver mirror is formed.	1) Aldehydic group (-CHO) is absent.

Identification of functional group of different classes of organic compounds.

2) Fehling's Solution test :- Warm 2-3 drops of the organic compound with 1 ml Fehling's solution.	2) No red ppt. is formed.	2) Aldehydic group (-CHO) is absent.
--	---------------------------	--------------------------------------

Precaution:

- 1) Test tube should be cleaned with distilled H₂O.
- 2) Original solution must be prepared by distilled H₂O.
- 3) Supplied salt should not be touched by bare hand.
- 4) Sodium must be kept under kerosin.
- 5) Sodium should not be touched by bare hand.

Preparation of 0.1M Na₂CO₃ solution.Principle:

At a particular temperature, when one litre of a solution contains one tenth mole of solution, then the solution is called decimolar (0.1 M) solution. Decimolar solution of sodium carbonate (0.1 M) Na₂CO₃ will be prepared in 250 ml flask. So, required amount of Na₂CO₃ for this is :-

$$0.1 \text{ M} = \frac{n(\text{Na}_2\text{CO}_3)}{0.25 \text{ L}}$$

$$\text{or, } n(\text{Na}_2\text{CO}_3) = 0.1 \text{ mol L}^{-1} \times 0.25 \text{ L}$$

$$= 0.025 \text{ mol}$$

$$1 \text{ mol Na}_2\text{CO}_3 = 106 \text{ g Na}_2\text{CO}_3$$

$$\therefore 0.025 \text{ mol Na}_2\text{CO}_3 = 0.025 \times 106 \text{ g Na}_2\text{CO}_3$$

$$= 2.65 \text{ g Na}_2\text{CO}_3$$

\therefore To prepare 250 ml 0.1 M Na₂CO₃ solution,
2.65 g Na₂CO₃ is required.

Required Apparatus:

Chemical balance with weight box, weighing bottle volumetric flask or measuring flask - 250 ml, funnel wash bottle with water etc.

Required Chemicals:

Pure anhydrous Na₂CO₃, distilled water.

FIGURE NO. 02

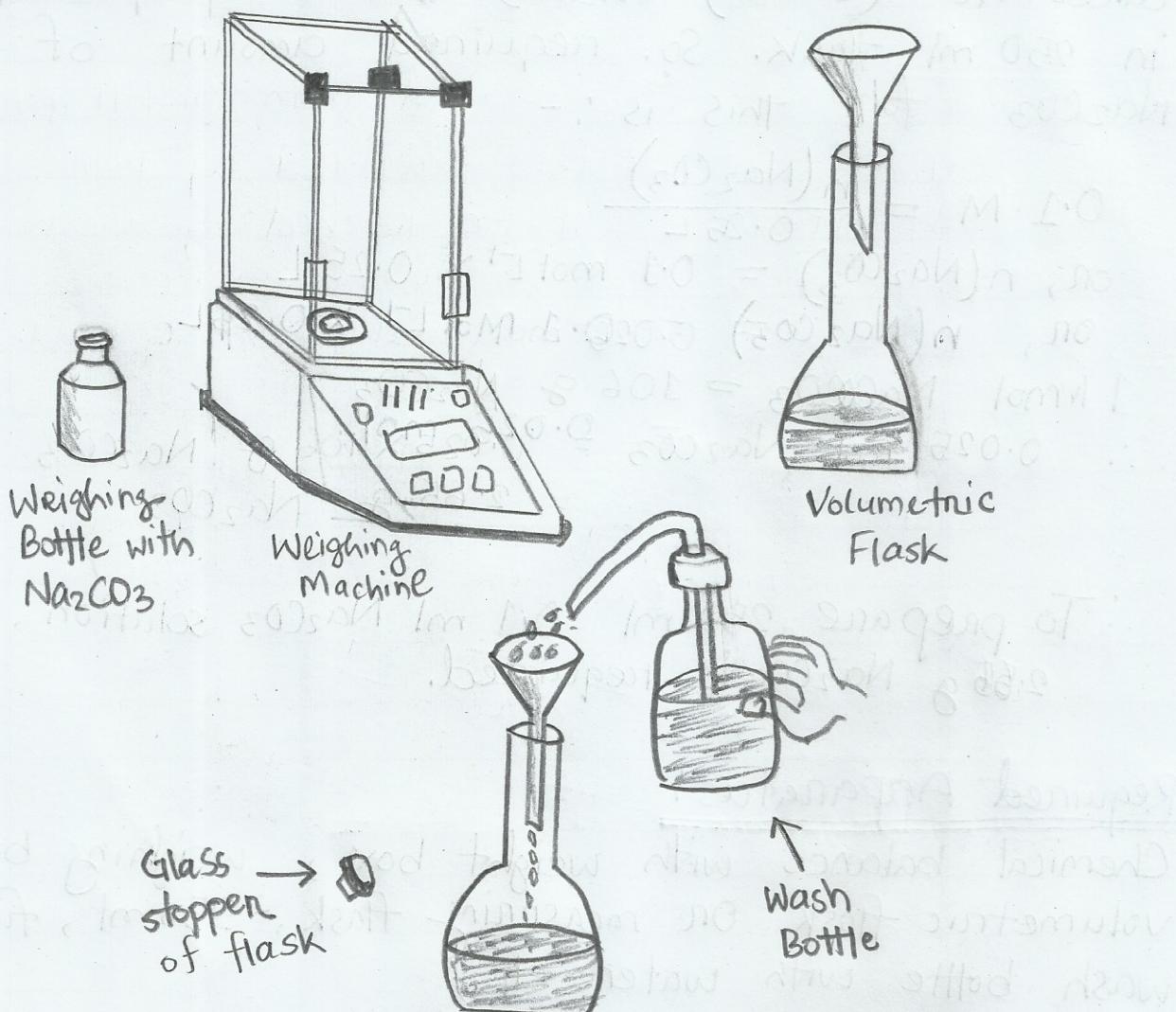


Figure (Exp-02): Preparation of 0.1M Na_2CO_3 solution in the laboratory.

Preparation of 0.1 M Na_2CO_3 solution.Procedure:

1) Weighting of required Na_2CO_3 : At first, 1st weight of weighing bottle with Na_2CO_3 is taken.
 [Either in Paul Bunge balance or on electronic balance].

Now about 2.65 g Na_2CO_3 from weighing bottle is poured slowly on the funnel placed on measuring flask. It is done slowly by three or four times. Then take second weight of the weighing bottle finally.

$$\therefore \text{Na}_2\text{CO}_3 \text{ taken} = (\text{1st weight} - \text{2nd weight}) \\ = 2.703 \text{ g (suppose)}.$$

2) Transfer of Solute in the flask: Following figure, water from wash bottle is added onto the funnel to wash all the Na_2CO_3 in the flask. Now water is added till the flask is half-filled with water; place glass stopper at the mouth of the flask and stir well to dissolve the Na_2CO_3 .

3) Add water upto mark at the neck of the flask:

Now glass stopper is taken off and water is added slowly upto the mark of the neck of measuring flask. Finally, fit the stopper and tilt the flask to make the solution homogeneous. Thus 250 ml 0.1 M Na_2CO_3 solution is prepared.

Calculation:

Calculation of molarity of Na_2CO_3 solution prepared:
 Mole no. of Na_2CO_3 taken, (n) = $2.703 \text{ g Na}_2\text{CO}_3 \times \frac{1 \text{ mol}}{106 \text{ g Na}_2\text{CO}_3}$

NAME OF THE EXPERIMENT

DATE 15/04/2022

Preparation of 0.1 M Na₂CO₃ solution.

PAGE NO. 07

EXPT. NO. 02

$$= \frac{2.703}{106} \text{ mol} = 0.0255 \text{ mol}$$

\therefore Molarity of prepared Na₂CO₃ solution = $\frac{0.0255 \text{ mol}}{0.250 \text{ L}}$

$$= 0.102 \text{ M}$$

Thus prepared 0.1 M Na₂CO₃ is called standard solution.

Precautions:

- 1) Na₂CO₃ must be pure and anhydrous.
- 2) Weighing bottle should be dry.
- 3) Funnel, measuring flask all should be washed with distilled water.

Preparation of 0.1 M HCl solution from
the given concentrated HCl.

Principle:

Concentrated HCl acid is a secondary acid, molarity of commercial HCl acid remains mentioned on the label of acid bottle. Hence dilute solution of any concentration can easily be prepared from concentrated acid by using equation for dilution.

The concentration of commercial HCl acid may be of 12 M generally.

Now 500 ml 0.1 M HCl solution can be prepared as:-

Here,

$$V_1 = \text{volume of dilute HCl} = 500 \text{ ml}$$

$$M_1 = \text{molarity of dilute HCl} = 0.1 \text{ M}$$

$$V_2 = \text{Volume of concentrated HCl} = ?$$

$$M_2 = \text{Molarity of concentrated HCl} = 12 \text{ M}$$

We know,

$$V_1 \times M_1 = V_2 \times M_2$$

$$\text{or, } 500 \text{ ml} \times 0.1 \text{ M} = V_2 \times 12 \text{ M}$$

$$\text{or, } V_2 \times 12 \text{ M} = 500 \text{ ml} \times 0.1 \text{ M}$$

$$\text{or, } V_2 = \frac{500 \text{ ml} \times 0.1 \text{ M}}{12 \text{ M}}$$

$$\therefore V_2 = 4.2 \text{ ml}$$

Required Apparatus:-

Volumetric flask (500 ml), measuring cylinder, funnel, wash bottle, beaker etc.

Required Chemicals:-

Concentrated HCl acid, distilled water.

FIGURE NO. 03

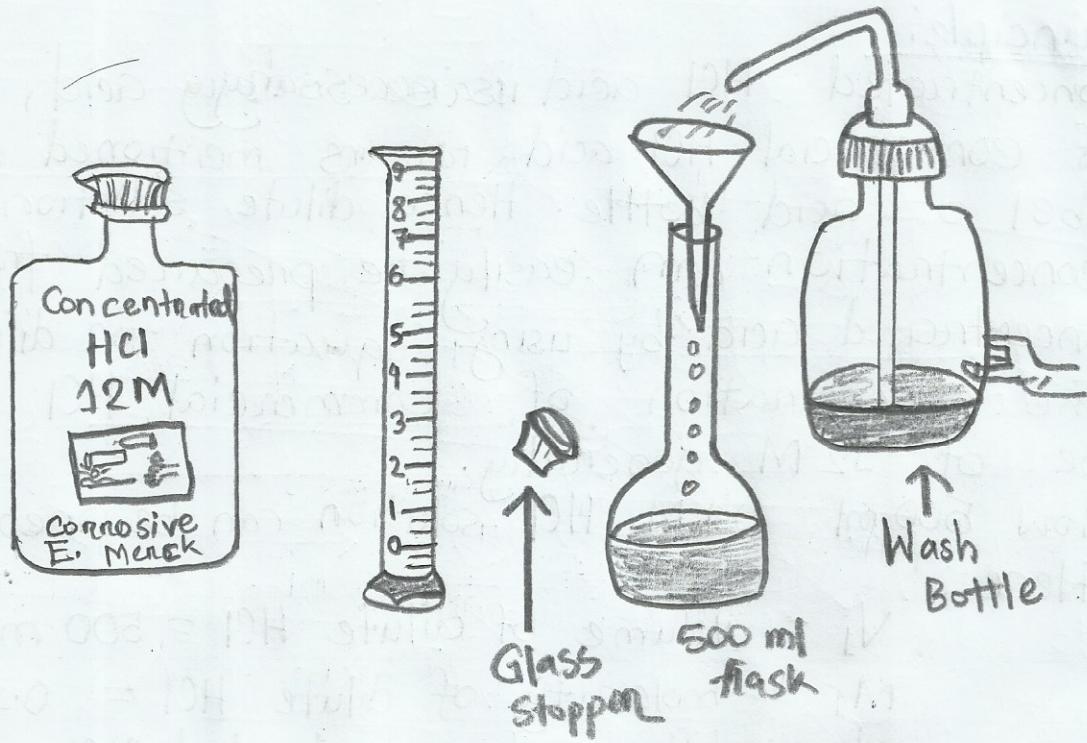


Figure (Exp-03): Preparation of 0.1 M HCl solution from the given concentrated HCl.

$$M \cdot 0 \times 1 \text{ m} \text{ l} = M \cdot 0 \times 1 \text{ m} \text{ l}$$

$$M \cdot 0 \times 1 \text{ m} \text{ l} = M \cdot 0 \times 1 \text{ m} \text{ l}$$

$$M \cdot 0 \times 1 \text{ m} \text{ l} = V \text{ m} \text{ l}$$

$$1 \text{ m} \text{ l} = V \text{ m} \text{ l}$$

Preparation of 0.1 M HCl solution from the given concentrated HCl.

Procedure :-

- 1) One 500 ml volumetric flask is taken and a funnel is placed on its mouth.
- 2) According to principle, measure 4.2 ml conc. HCl with measuring cylinder and is poured into that flask through the funnel.
- 3) Now water from wash bottle is added in the funnel to wash all conc. HCl into the flask till the flask is half-filled. Now place glass stopper at the mouth of the flask and tilt the flask up and down to make the solution homogenous.
- 4) Now, glass stopper is taken off and more water is added into the flask from the wash bottle to fill upto the mark at the neck. Again glass stopper is put and the flask is shaken to make the solution homogenous. Thus, 0.1 M solution of HCl is prepared.

Calculation :-

Here,

$$V_1 = 4.2 \text{ ml}$$

$$M_1 = 12 \text{ M}$$

$$V_2 = 500 \text{ ml}$$

$$M_2 = \text{molarity of dilute acid} = ?$$

From dilution equation,

$$V_1 M_1 = V_2 M_2$$

$$\text{or, } V_2 M_2 = V_1 M_1$$

$$\text{or, } M_2 = \frac{V_1 M_1}{V_2} = \frac{12 \times 4.2}{500} = 0.1008 \text{ M}$$

NAME OF THE EXPERIMENT

DATE 16/04/2022

Preparation of 0.1 M HCl solution from
the given concentrated HCl.

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EXPT. NO. 03

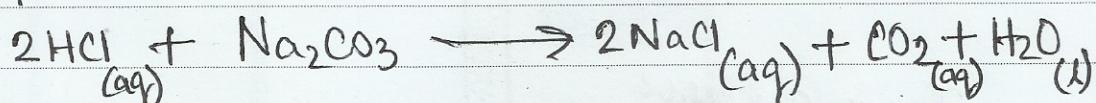
Precautions:

- 1) While diluting acid with water, always should be added acid to water and not the water to acid.
- 2) The concentrated acid should be poured into water very slowly.
- 3) Concentrated acids are highly erosive, so it should be handled with great care.

Theory:

Sodium carbonate is a primary standard substance and di-acidic weak base. Hydrochloric acid is a secondary standard substance and mono-basic strong acid. The molarity of hydrochloric acid is determined by titrating it against the standard solution of sodium carbonate using methyl orange as indicator. In this case, H⁺ and OH⁻ from acid and base respectively react with each other producing H₂O.

HCl is neutralized by Na₂CO₃ according to the following reaction:-



According to the theory of titration, $yM_A V_A = nM_B V_B$.
Here,

$$n = \text{Mole number of acid (HCl)} [\text{Coefficient of acid}] = 2$$

$$y = \text{Mole number of base (Na}_2\text{CO}_3) [\text{Coefficient of base}] = 1$$

$$M_A = \text{Molarity of acid (HCl)}, V_A = \text{Volume of acid (cm}^3)$$

$$M_B = \text{Molarity of base (Na}_2\text{CO}_3), V_B = \text{Volume of base (cm}^3)$$

Required Apparatus:

Conical flask, pipette, burette.

Required Chemicals:

- i) Prepared secondary standard 0.1 M HCl solution. (approx)
- ii) Primary standard 0.1 M Na₂CO₃ solution.
- iii) Indicator: Methyl Orange.

FIGURE NO. 04

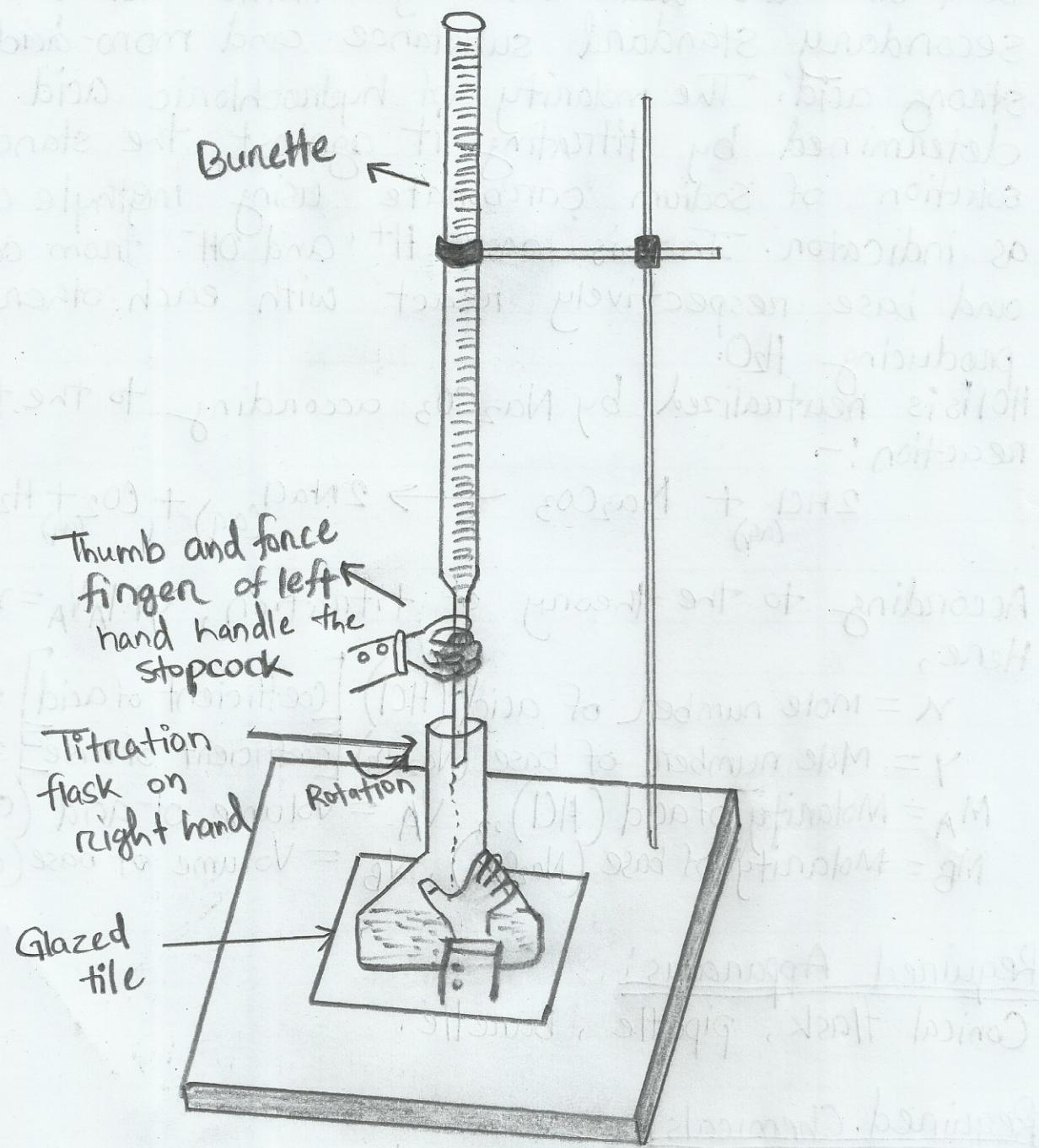


Figure (Exp-04):- Determination of the amount of acid/base in unknown solution by titration.

End Point:-

Yellow to Pink.

In Burette:

Acid solution.

Procedure:

- 1) A burette of 50 cm³ is taken and is washed with water.
- 2) Rinse the burette with given solution of HCl and fill it with the solution. Clamp it vertically in burette stand.
- 3) Rinse a pipette of 10 cm³ with the given sodium carbonate solution and pipette out 10 cm³ of sodium carbonate solution in a washed conical flask.
- 4) 2-3 drops of methyl orange indicator is added to the conical flask and place it just below the nozzle of the burette over a white glazed like tile.
- 5) Note down the lower meniscus of the solution on the burette and record it as the initial burette reading.
- 6) Now run the acid solution slowly and drop-wise to the conical flask with shaking till the color of the solution changes from yellow to pink.
- 7) Read the lower meniscus of the solution again in burette and record it as final burette reading.

strength of secondary standard given
solution of HCl by primary standard 0.1M Na_2CO_3 solution.

- 8) Find the volume of hydrochloric acid used.
- 9) Repeat the procedure to take a set of at least three concordant readings.

Titration Data:-

Strength of primary standard Na_2CO_3 solution = 0.102M

Serial No.	Taken volume of Na_2CO_3 solution (cm^3)	Burette reading of HCl		Volume of the required HCl (cm^3)	Average volume of required HCl (cm^3)
		Initial Reading	Final Reading		
1	10	0.1	20.2	20.1	
2	10	20.2	40.3	20.1	20.1
3	10	0.1	20.2	20.1	

Calculation of the strength of prepared HCl solution:

Here,

$$x = 2$$

$$y = 1$$

$$M_A = ? \quad [\text{Molarity of acid}]$$

$$V_A = 20.1 \text{ cm}^3$$

$$M_B = 0.102 \text{ M}$$

$$V_B = 10 \text{ cm}^3$$

From theory of acid-base titration,

$$y M_A V_A (\text{HCl}) = n M_B V_B (\text{Na}_2\text{CO}_3)$$

$$\text{or, } 1 M_A \times 20.1 = 2 \times 0.102 \times 10$$

$$\text{or, } 20.1 M_A = 2.04$$

$$\text{or, } M_A = \frac{2.04}{20.1} = 0.1015 \text{ M}$$

\therefore Strength of prepared HCl = 0.1015 M.

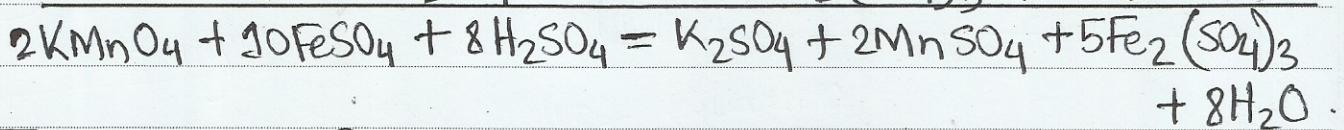
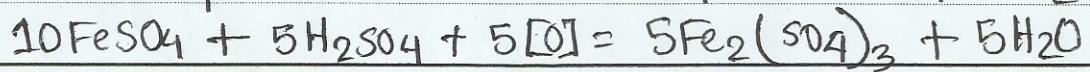
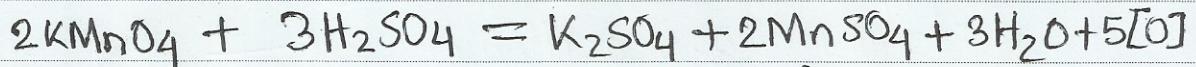
NAME OF THE EXPERIMENT Determination of strength of secondary standard given solution of HCl by primary standard 0.1 M Na₂CO₃ solution DATE 16/04/2022 PAGE NO. 14 EXPT. NO. 04

Precautions:-

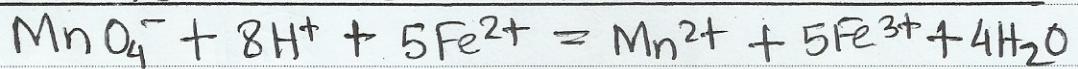
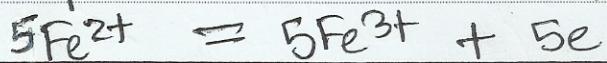
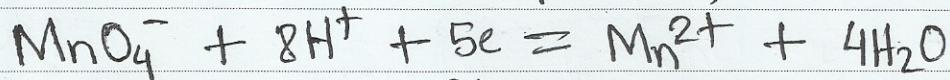
- 1) The burette should be rinsed carefully with the given solution of HCl.
- 2) The pipette also should be rinsed with given solution of sodium carbonate.
- 3) Methylene orange indicator should be added very carefully.
- 4) The conical flask should be placed just below the nozzle of the burette over a white glazed line.
- 5) Reading of the meniscus should be taken carefully.

Theory:

In presence of sulphuric acid, potassium permanganate acts as an oxidising agent. On the other hand, ferrous ion (Fe^{2+}) is a reducing agent. Therefore, when potassium permanganate is added to it, ferrous ion is oxidised to ferric ion and potassium permanganate is reduced to magnanous ion.



Ionic form of the above equation,



Therefore, each mole of potassium permanganate oxidizes 5 moles of iron. The amount of iron in the solution is calculated by determining the volume of potassium permanganate solution added to titrate a definite volume of a Fe^{2+} salt solution.

Required Apparatus:

500 cm³ beaker, 25 cm³ measuring flask, funnel, burette, pipette, conical flask, rough balance, water glass.

Required Chemicals:

- 1) Mohr's salt $[\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}]$ or green vitriol or hydrated ferrous sulphate $[\text{FeSO}_4 \cdot 7\text{H}_2\text{O}]$.
- 2) Indicator: KMnO_4 acts as self indicator.
- 3) End point: Colorless to permanent pink color.

Procedure:

i) Preparation of 0.1 M ferrous salt solution:-

Mohr's salt, $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ (molecular mass = 392) or green vitriol, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ (molecular mass = 278) can be used as ferrous salt.

- 1) Weigh 10g of Mohr's salt in a watch glass.
- 2) About 200 cm^3 of 1M H_2SO_4 is taken in a 250 cm^3 measuring flask and add weighed Mohr's salt to it. Wash down every minute particle of the salt in to the flask with a wash bottle.
- 3) Make the volume upto to the graduated mark with more distilled water.
- 4) Shake it vigorously to make the solution homogeneous.

ii) Titration of ferrous salt solution by standard potassium permanganate solution:-

- 1) KMnO_4 solution is taken in the burette as explained in the previous experiment and fix it in vertical position and note the initial reading on the burette.
- 2) A titration flask is taken and is washed with distilled water. Take a 20 ml pipette, wash it with water and

in a supplied sample solution using standard solution of potassium permanganate.

then rinse it with given Mohr's salt solution.

- 3) Measure 20 ml of Mohr's salt solution and pour it into the titration flask. Add 5 cm³ of conc. H₂SO₄ to it. Do not heat it. It is to be titrated in cold.
- 4) Place the titration flask on a white tile under the burette. Run in KMnO₄ solution slowly in a small lots and go on shaking the titration flask till one drop colors the solution light pink. Note the reading on the burette and record it as final burette reading.
- 5) Repeat the experiment till three concordant value of KMnO₄ used are obtained.

Table: Determination of the amount of Fe²⁺ ion using Standard KMnO₄:

Serial No.	Taken volume of Fe ²⁺ salt solution (cm ³)	Burette Reading		Required volume of KMnO ₄ (cm ³)	Average volume of KMnO ₄ solution(cm ³)
		Initial Reading	Final Reading		
1	20	0.0	4.0	4	
2	20	4.0	8.0	4	
3	20	8.0	12.0	4	4

Calculation:-

Suppose, volume of required KMnO₄ solution = 4 cm³

Theoretically, 1000 cm³ of 1M KMnO₄ solution = 5 × 55.8 g Fe²⁺

∴ 1 cm³ of 1M KMnO₄ solution = 5 × 0.0558 g Fe²⁺

$$\begin{aligned} \therefore 4 \text{ cm}^3 \text{ of } 0.0206 \text{ M KMnO}_4 \text{ solution} &= 5 \times 0.0558 \times 4 \times 0.0206 \text{ g Fe}^{2+} \\ &= 0.023 \text{ g Fe}^{2+} \end{aligned}$$

Therefore, 20 cm^3 of dilute ferrous salt solution contains 0.023 g of Fe^{2+} .

$\therefore 250 \text{ cm}^3$ of dilute ferrous salt solution contains

$$= \frac{0.023 \times 250}{20} \text{ g of } \text{Fe}^{2+}$$

$$= 0.2875 \text{ g of } \text{Fe}^{2+}$$

Result:

The supplied ferrous salt solution contains $0.2875 \text{ g of } \text{Fe}^{2+}$.

Precautions:

- 1) Mohr's salt has to be titrated in the cold and in the presence of dil. H_2SO_4 .
- 2) The readings should be taken coinciding with the upper meniscus of the burette.
- 3) Sufficient quantity of dilute sulphuric acid must be added to oxalic acid solution in titration flask before titration.
- 4) While sucking the oxalic acid solution in the pipette, care must be taken so that no solution comes into the mouth. The solution is toxic and poisonous.
- 5) Small quantities of KMnO_4 must be added at a time and shaken till it is decolorized - before adding the next lot.