R. S. M. PUBLIC SCHOOL, SUPAUL

CHEMISTRY (043)

PRACTICAL FILE

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AIM – To prepare M/20 solution of oxalic acid and with its help find out the molarity of the given $KMnO_4$ solution.

Theory –

chemical Equation –

$$2KMnO_4 + H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5[O]$$

$$\left[\begin{matrix} COOH \\ | \\ COOH \end{matrix} \cdot 2H_2O + [O] \xrightarrow{60^\circ - 70^\circ C} 2CO_2 + 3H_2O \right] \times 5$$

$$2KMnO_4 + 2H_2SO_4 + 5(COOH)_2 \cdot 2H_2O \rightarrow K_2SO_4 + 2MnSO_4 + 18H_2O + 10CO_2$$

Indicator → $KMnO_4$ is it self an indicator

End point → Colourless to Permanent Pink colour.

Procedure –

We weight 126 gm of oxalic acid crystals and dissolve it in 250 ml water to prepare M/20 oxalic acid solution in 500ml measuring flask.

We take a burette and rinse it with $KMnO_4$ solution after cleaning.

Add 25 ml dilute H_2SO_4 to the solution.

Now we note the initial point of burette and perform titration for the purpose. and note the end point after getting end point.

∵ we repeat the process 3-4 times to get correct reading.

Calculation –

∵ 1000 ml of (M) oxalic acid = 126 gm of oxalic acid crystals

∴ 1000 ml of 0.05 oxalic acid = 126×0.05 gm of oxalic acid

∴ 250 ml of 0.05 oxalic acid = $\frac{126 \times 0.05 \times 250}{1000}$

= 1.575 gm of Oxalic acid.

Observation –

No. of reading	Vol. of M/20 oxalic acid	Burette reading in ml. Initial	Final	Difference	Concurrent reading
01	25 ml	1.0	25.9	24.9	
02	25 ml	5.0	29.7	24.7	24.7
03	25 ml	0.0	24.7	24.7	
04	25 ml.	5.8	30.5	24.7	

Calculation

Molarity of $KMnO_4$ solution

From the over all balanced chemical equation, it is clear that 2 moles of $KMnO_4$ reacts with 5 moles of oxalic acid.

$$\frac{M_{KMnO_4} \times V_{KMnO_4}}{M_{\text{oxalic acid}} \times V_{\text{oxalic acid}}} = \frac{2}{5}$$

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$$\Rightarrow \frac{M_{KMnO_4} \times x}{\frac{1}{20} \times 20} = \frac{2}{5}$$

$$\Rightarrow x \times M_{KMnO_4} = \frac{2}{5} \times \frac{1}{20} \times 20$$

$$\Rightarrow M_{KMnO_4} = \frac{2}{5x} = \frac{2}{5 \times 24.7} = 0.01M.$$

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AIM:- Preparation of M/20 solution of ferrous ammonium sulphate (Mohr's salt). Find out the molarity and strength of given $KMnO_4$ solution.

Chemical equation –

$KMnO_4 + H_2SO_4 \rightarrow K_2SO_4 + 2MnO_4 + 3H_2O + 5[O]$

$[2FeSO_4(NH_4)_2SO_4 \cdot 6H_2O + H_2SO_4 + [O] \rightarrow Fe_2(SO_4)_3 + 2(NH_4)_2SO_4 + 13H_2O] \times 5$

$2KMnO_4 + 8H_2SO_4 + 10FeSO_4(NH_4)_2SO_4 \cdot 6H_2O \longrightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 10(NH_4)_2SO_4 + 68H_2O$

Ionic equation –

$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{+2} + 4H_2O$

$Fe^{+2} \longrightarrow Fe^{+3} + e$

$MnO_4^- + 8H^+ + 5Fe^{+2} \longrightarrow 5Fe^{+3} + Mn^{+2} + 4H_2O.$

Indicator – $KMnO_4$ is itself an indicator.

End point – Colourless to permanent pink colour. ($KMnO_4$ in burrete).

Apparatus – Measuring flask, burrete, pipete, stand, ...

Procedure – 250 ml of M/20 Mohr's salt solution is prepared, by dissolving 4.9 gm

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of Mohr's salt in 250 ml water.

Now we rinse a burrete with $KMnO_4$ solution and filled it with $KMnO_4$ solution. We add one test tube about 25 ml dilute H_2SO_4 to the solution in titration flask.

We note the initial readiting of burrete. We add $KMnO_4$ solution from burrete to titration flask, till the permanent light pink coloured solution is obtained.

We note the final reading of burrete. The process is repeated 4 times to get concurrent final readings.

No. of experiment	Vol. of M/20 Mohr's salt	Burrete reading (ml)			Concurrent reading
		Initial	Final	Diff.	
01	25 ml	1.0	25.9	24.9	
02	25 ml	5.0	29.7	24.7	24.7 ml
03	25 ml	0.0	24.7	24.7	
04	25 ml	5.8	30.7	24.9	

Calculation —

Molarity of $KMnO_4$

From chemical equation it is clear that 2 moles of $KMnO_4$ reacts with 10 moles of Mohr's salt.

$$\therefore \frac{M_{KMnO_4} \times V_{KMnO_4}}{M_{Mohr's\ salt} \times V_{Mohr's\ salt}} = \frac{2}{10}$$

$$\Rightarrow \frac{M_{KMnO_4} \times 24.7}{\frac{1}{20} \times 25} = \frac{2}{10}$$

$$\Rightarrow M_{KMnO_4} = \frac{\frac{2}{10} \times \frac{1}{20} \times 25}{24.7}$$

$$= \frac{1}{4 \times 24.7} = \frac{1}{98.8} = 0.01M.$$

Precautions —

(i) $KMnO_4$ solution should be prepared carefully.

(ii) Readings should be taken properly.

(iii) Apparatus should be rinsed properly.

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AIM — Test for Carbonylic acid.

Theory — Carbonylic acid turns blue litmus to red. Carbonylic acid reacts with $NaHCO_3$ to give CO_2 gas with effervescence.

Litmus Test :— Carbonylic acid turns blue litmus to red. We add some drops of acid on blue litmus paper, it turns red. The hydroxyl group in $-COOH$ is more acidic, it has replaceable H^+ in aqueous medium.

$$R-\overset{O}{\overset{\|}{C}}-O-H \xrightarrow[\text{medium}]{\text{Aqueous}} R-\overset{O}{\overset{\|}{C}}-O^- + H_3O^+$$

Result — Red colour of litmus paper shows that the given sample is an acid.

2. $NaHCO_3$ Test — We take small amount of $NaHCO_3$ in a test tube and add the given sample in it. A gas is evolved with effervescence, which turns lime water milky.

$$NaHCO_3 + R-COOH \rightarrow R-COONa + CO_2 + H_2O$$

$$Ca(OH)_2 + CO_2 + 2H_2O \rightarrow \underset{\text{Milky white}}{CaCO_3} + 3H_2O$$

ESTER TEST :-

Theory - Carboxylic acid reacts with alcohol in presence of H_2SO_4 to give ester which is recognised by pleasant fruity smell.

$$R-\overset{O}{\overset{\|}{C}}-O-H + C_2H_5OH \rightarrow R-\overset{O}{\overset{\|}{C}}-O-C_2H_5 + H_2O$$

Ester.

Procedure :- A small quantity of organic acid is taken in a test tube and 5 drops of C_2H_5OH is added to it along with 1-2 drops of conc. H_2SO_4. Test tube is heated gently.

A pleasant fruity smell is produced.

Result - Fruity smell confirms that the given sample is carboxylic acid

AIM – Preparation of potash alum $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$.

Theory – Potash alum is prepared by dissolving equimolar amount of potassium sulphate and aluminium sulphate in minimum amount of water containing 2-3 drops of conc. H_2SO_4. The solution thus obtained is subjected to crystallization which yields the crystals of potash alum.

$$K_2SO_4 + Al_2(SO_4)_3 + 8H_2O + 6H_2O \rightarrow K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$$

174 gm	666 gm	948 gm
⇓	⇓	⇓
1.74×4	6.66×4	9.48×4
⇓	⇓	⇓
6.98	26.63	37.92
≈ 7 gm	≈ 26.6 gm	≈ 38 gm

Materials required

Two beakers of 250 ml, china dish, funnel, stand, tripod, wire gauze, a glass rod, filter paper.

Procedure – we take 7 gm of K_2SO_4 in a clean test tube and add minimum amount of distilled water to dissolve it.

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In another test tube we take 26.6 gm of $Al_2(SO_4)_3 \cdot 24H_2O$ and dissolve it in minimum amount of distilled water. Also add 2-3 drops of conc. H_2SO_4. Now we take both the solutions in a beaker.

Now we heat the mixture of solutions to crystallization point.

Now, the hot solution is allowed to cool to minimum temp. As the solution cools down, crystals of potash alum separates out.

Observation -

* colour of crystals - colourless
* shape of crystals - octahedral
* weight of crystals - 38 gm.

Precautions:

* K_2SO_4 and $Al_2(SO_4)_3$ should be dissolved in minimum volume of distilled water.
* Few drops of conc. H_2SO_4 should be added
* wash the crystals with ice cold water

AIM - Preparation of Mohr's salt.
$FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$.

Theory - Mohr's salt is prepared by dissolving equimolar mixture of $FeSO_4$ and $(NH_4)_2SO_4$ in water containing a few drops of conc. H_2SO_4. The resulting solution is then subjected to crystallization → a light green crystal is obtained.

$FeSO_4 \cdot 7H_2O + (NH_4)_2SO_4 \rightarrow FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$ -

277.85	132	391.85
= 13.89	= 6.6	= 19.59
= 0.05 mole	= 0.05 mole	= 19.6 gm

Materials required - Two beakers, glass rod, funnel, wire gauze, filter paper, stand -

Chemicals -

Ferrous sulphate - 13.9 gm
Ammonium sulphate - 6.6 gm
H_2SO_4 - 2 ml
C_2H_5OH - 5 ml.

Procedure – we take 13.9 gm ferrous sulphate and 6.6 gm ammonium sulphate in a clean 250 ml beaker.

Now we take 50 ml distilled water in a 250 ml beaker and add 2 ml H_2SO_4 in it slowly, and heat it.

We pour the boiled acidic water into 250 ml beaker containing ferrous sulphate and ammonium sulphate with stirring. We filter the solution to remove any suspended impurity.

We take the filtrate on china dish and heat it on wire gauze placed on tripod, with a burner to concentrate the solution. When crystallization point is reached. We cool the saturated solution obtained with the help of ice cold water. On cooling crystals of Mohr's salt are obtained.

Observation – weight of crystal = 19 gm app.
colour = light green
shape – Monoclinic

Precaution

* Apparatus should be cleaned properly
* Adding of H_2SO_4 should be slow.
* Chemicals should be weighed carefully.

Aim:- To analyse the given inorganic salt into cation and anion.

Theory- The identification of radicals present in a given inorganic salt, inorganic salts consist of two parts cations and anions, i.e.
* Acidic radicals (anions)
* Basic radicals (cations)

Experiment	Observation	Inference
1. Physical examination	White powder with smell of ammonia	Ammonium salt is present
2. A pinch of salt is heated with NaOH	Gas is evolved with smell of ammonia and turns moist litmus blue.	NH_4^+ is present.
3. A pinch of salt is taken in test tube and add dil HCl	A colourless and odourless gas is evolved	
Gas is passed through lime water	It turns milky white	Gas is CO_2

	Experiment	Observation	Inference
4.	when excess of gas is passed through milky soln.	Milky colour dissapears	CO_3^{-2} confirmed.

Result – Given salt is $(NH_4)_2CO_3$

Cation – NH_4^+
Anion – CO_3^{-2}

Aim - To analyse the presesce of Br^- in the given salt.

Experiment	Observation	Inference
1. A small quantity of solid is taken in a dry test tube and equal amount of HNO_3 is added. Then a drop of conc. H_2SO_4 is added and mixture is heated.	Brown coloured gas with pungent smell is evolved	Br^- may be
2. A strip paper is saked in the iodine and put near the mouth of test tube	Blue colour is developed on strip paper.	Br^- may be
3. Small quantity of H_2SO_4 is taken in the test tube and solid sample is added with HNO_3. After that $AgNO_3$ is added.	A cream precipitate is ($AgNO_3$) formed	Br^- confirmed

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Result — Bromide ion is present in the salt.

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PROJECT FILE

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Project Work - 01

Topic :- Study of diffusion of a solid into a liquid.

Introduction :- In a liquid, a molecule is surrounded by its neighbours and it can travel only a fraction of diameter. It is because of the fact that its neighbours move aside for a moment before colliding.

If there is an initial concentration gradient in the liquid, then the rate at which the molecules of the liquid spread and the solution becomes homogeneous, is proportional to the concentration gradient.

Rate of diffusion $\propto$ Concentration gradient

Rate of diffusion = D × Concentration gradient

D = Diffusion coefficient

If the value of D is larger than the molecules, diffusion will be fast and if the value of D is less than molecules then diffusion is slow.

When a substance is brought in contact with other, they intermix, this property of substance is called diffusion.

The process of diffusion takes place fastly in gases, to a lesser extent in liquids. In solids diffusion does not take place. But when we observe diffusion of solid in liquid is slow.

If a solid is placed in contact with a solvent in which it is soluble, some portion of solid gets dissolved.

The molecules of solute are in random motion due to collision between them and with solvent molecules.

Objective

Rate of diffusion depends on:-

* Temperature - As temperature increase kinetic energy of particles increases, so that rate of diffusion increases.
* Size of particles - As the size of particles increases, rate of diffusion decrease.
* Mass of particles -
As the mass of particles increases, rate of diffusion decreases.
* EXPERIMENT
Diffusion of $CuSO_4$ in water.

Requirements

* $CuSO_4$ crystals
* 100 ml beaker
* Distilled water

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Procedure

2 gm of $CuSO_4$ crystals are taken in 100 ml beaker. 50 ml of water is added to the beaker and is allowed to stand for few minutes. The colouration water is observed. Now, it is allowed to stand till all the crystals of $CuSO_4$ get dissolved.

After some times colour of water turns blue

Conclusion –

When a soluble solid like $CuSO_4$ crystals, $KMnO_4$, sugar, salt (NaCl) are brought in contact with water (liquid), intermixing of substances take place.

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EXPERIMENT – 02

To study the effect of temp. on rate of diffusion.

Requirements – $CuSO_4$ crystals, 200ml beaker, watch glass, wire gauze, burner, tripod, thermometer, stop watch

Procedure:–

Take 5gm of $CuSO_4$ crystals in three separate beakers. Pour 100ml distilled water in one beaker, cover this beaker with watch glass.

Pour 100ml of cold water in second beaker slowly.

Place the third beaker containing 100ml of water on a tripod stand for heating.

Now, observe diffusion process taken place in each beaker.

Record the time taken for the diffusion of $CuSO_4$ crystals in all the beakers.

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EXPERIMENT – 02

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Now, observe diffusion process taken place in each beaker.

Record the time taken for the diffusion of $CuSO_4$ crystals in all the beakers.

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Observation

S.N	Temp. of water	Time taken in minutes.
01	25'C	15
02	10'C	20
03	70'C	10

Conclusion:-
The rate of diffusion of $CuSO_4$ crystals in water is in the order

Beaker-3 > beaker-1 > beaker-2

Thus, rate of diffusion increases with increase in temp.