V SHORT PROCEDURE

1.Determination of the amount of sodium carbonate and sodium hydroxide in a mixture by titration.

	Titration I	**Titration II**
Burette solution	Hydrochloric acid	Std Hydrochloric acid
Pipette solution	20ml of std Na_2CO_3 solution (0.05N)	20 ml of made-up mixture (Na_2CO_3+NaOH)
Indicator	Methyl orange	Phenolphthalein & Methyl orange
End point	Yellow to orange	Pink to colourless (I end point) Yellow to Orange (II end point)

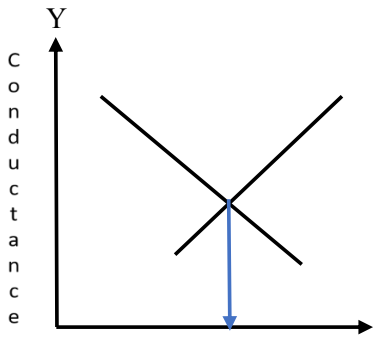
2.Determination of strength of an acid by conductometry.

Burette solution	NaOH solution	Equivalence mass of HCl = 36.47
Pipette solution	10 ml of made up HCl solution (Diluted till the cell is immersed properly)	

- Conductance is measured using conductivity meter.
- A conductance cell immersed in the diluted pipette solution (HCl)
- Each addition of 1ml of NaOH to in beaker solution conductance is measured.
- Initially the conductance decreases and at one point its starts increasing. The point at which the conductance starts increasing shows that the end point has reached.
- A plot of conductance against volume of NaOH gives the end point. The intersection of two lines and volume corresponds to the intersecting point to X axis is to be noted.
- A fair titration is conducted in same manner to get accurate end point (in portions of 0.1 ml)

- The strength of HCl is obtained using $V_1N_1=V_2N_2$

Model graph: [common for pilot and fair titrations]



3.Determination of hardness (Ca^{2+}) of water using EDTA – Complexometry method

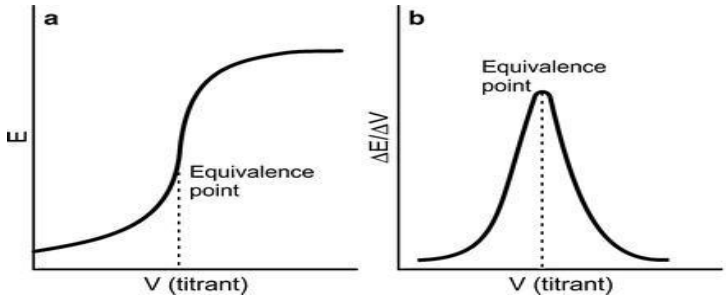
Titrations	**Burette solution**	**Pipette solution**	**Additional reagents**	**Indicator**	**Equivalence/end point**
Standardization of EDTA	EDTA solution	20ml of standard hard water	5ml of buffer solution (NH3-NH4Cl)	3-4 drops of EBT	Change of wine red to steel blue colour
Determination of total Hardness		20ml of sample hard water			
Determination of permanent hardness		20ml of boiled, filtered water sample			

Temporary Hardness = Total Hardness-Permanent Hardness

4.Determination of ferrous ion using potassium dichromate by potentiometric titration

Burette solution	Standard $K_2Cr_2O_7$
Pipette solution	10ml of made up Fe^{2+} solution
Additional reagents	10ml of dil.H_2SO_4 solution
Electrodes used	Pt and Calomel electrode
Equivalent mass of Fe^{2+} ions	55.85

- After each addition of 1ml of burette solution, the emf increases gradually.
- At the neutralization point there will be abrupt change in emf.
- From the plot of emf vs the volume of standard $K_2Cr_2O_7$, the end point obtained from the graph.
- Fair titration is conducted in similar manner by the addition of burette solution in portions of 0.1ml. the plot of E/V vs volume of $K_2Cr_2O_7$ gives the end point accurately.
- The amount of given solution is calculated using formula.



5.Estimation of amount of chloride content of a water sample

	Titration I	**Titration II**
Burette solution	$AgNO_3$	Std. $AgNO_3$
Pipette solution	20ml of std NaCl solution (0.02 N)	20 ml of made-up chloride solution
Additional reagent	-	-
Indicator	1 ml of 2% K_2CrO_4	1 ml of 2% K_2CrO_4
End point	Appearance of red ppt.	Appearance of red ppt.

6. Determination of molecular weight of polymer by viscosity average method

- From 1% stock solution of polymer five different dilutions are prepared by the following volumetric expressions,

$$V_1N_1 = V_2N_2$$

$$V_1 = \frac{V_2 \times N_2}{N_1}$$

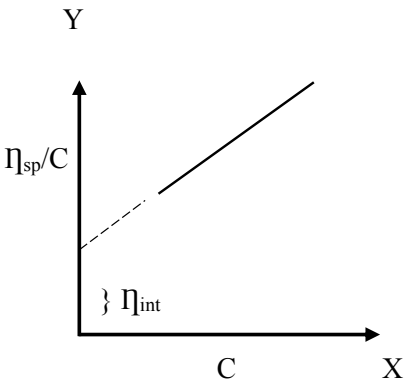
- t_0 time for solvent to flow into using Ostwald Viscometer. For solution of different concentration are t_1, t_2, t_3, t_4 and t_5 for the five (NB: only fixed amount 10ml or 12ml of prepared dilutions are taken in the viscometer).
- Relative viscosity is found out by using $\eta_{rel} = t_s/t_0$ [where t_s is = t_1, t_2, t_3,..]
- The specific viscosity η_{sp} is found out using the relation,

$$\eta_{sp} = \eta_{rel}^{-1}$$

- Reduced viscosity is also found out using $\eta_{red} = \eta_{sp}/C$.
- A plot η_{sp}/C Vs C gives a straight line for dilute solutions.
- By extrapolation, η_{int} is found out. Using Mark-houwink's equation,

$$M = (\eta int/k)^{1/\alpha} \text{ is found out}$$

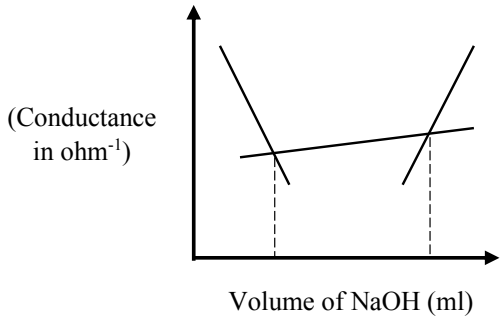
Model Graph



7. Determination of strength of mixture of acetic acid and hydrochloric acid by conductometry

Burette solution	0.5 N of NaOH
Pipette solution	20 ml of mixture of acids made up in 100ml SMF
Apparatus	Conductivity meter & Conductivity cell
End point	From graph 1st intersection point(A) corresponds to the neutralization of HCl 2nd intersection point(B) corresponds to the neutralization of CH_3COOH (NB: In calculating volume of NaOH that is used to neutralize CH_3COOH only, the value of A should be subtracted from B)

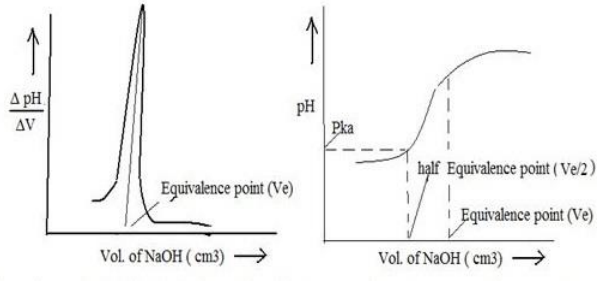
Sample graph



8. Determination of strength of an acid using pH meter

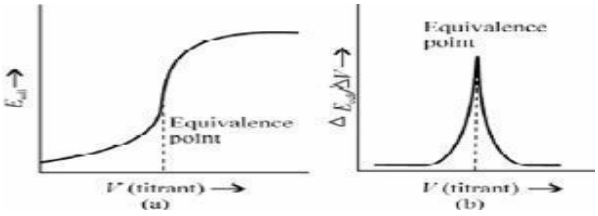
Burette solution	0.1 N of NaOH
Pipette solution	10 ml of made-up solution of HCl from 100ml SMF
Apparatus	Digital pH meter & Cell is also pH meter
End point	2 graphs are drawn. From the 2nd graph(b) the peak value meeting X axis is taken as end point.

Sample Graph



VI Sample Questions

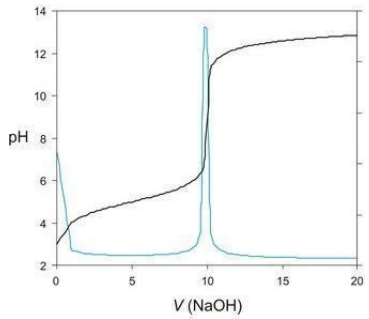
1. What is permanent and temporary hardness? Give salts responsible for permanent and temporary hardness in water.
2. Calculate permanent hardness for sample hard water if the volume of the boiled water sample pipetted is 100mL and volume of EDTA consumed is 13.4mL. The volume EDTA consumed for standard hard water sample is 19.6mL.
3. What type of reaction does silver nitrate and sodium chloride undergo?
4. Calculate the normality of $AgNO_3$ when12.5mL of it is consumed for 10mL of NaCl solution?
5. What are the ions responsible for alkalinity in water sample?
6. Give the type of reaction that is involved in the determination of amount of mixture of bases by titration?
7. Calculate the amount of Na_2CO_3 when the Phenolpthalein end point is 23.5 mL and Methyl orange end point is 46.9mL for 50 mL of made-up solution containing the mixture [pipette solution] when the Normality of acid is 0.0478N.
8. What happens to conductance when a solution is diluted?
9. When acid is titrated against base by conductometric method, the Conductance decreases and then increases. Why?
10. Calculate the Normality of acid when the intersection point from the graph meets at 8.9mL in x-axis for 10 mL of acid solution with 0.1N solution of base.
11. What is the oxidizing agent used in the potentiometric titration?
12. What is the indicator and reference electrode used in the potentiometric titration?
13. Calculate the amount of Fe^{2+} ions present in whole of the given solution if volume of pipette solution 10mL. Let us assume that the peak point in the following 2nd graph meet at 9.5mL for Potentiometric titration. Let the normality of the standard solution be 0.09N.



14. Give the structure for Polyvinyl alcohol and Polystyrene.
15. What is the solvent used for the dissolution of PVA and Why?
16. Intrinsic viscosity from the graph meeting at y-axis after extrapolating is 66 for the given polymer. Calculate Molecular weight when the k and α for PVA is $45.3 * 10^{-3}$ and 0.64 respectively.
17. What is the relation between pH and EMF of the cell for acid – base titration? Give the model graphs for the pilot and fair titrations. Find the peak point for the above graph and also calculate the

Normality of the acid if the normality of the base is 0.11N and pipette solution amount is 10mL.

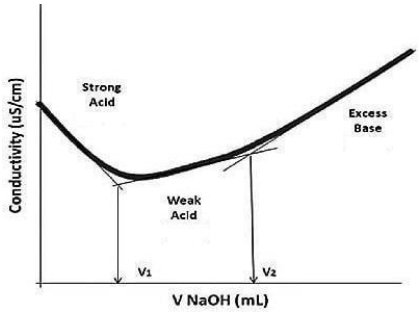
18. What are weak and strong acids? Give examples.



a. $CH_3COOH + Na+ + OH- \rightarrow ?$

b. $H+ + Cl- + Na+ + OH- \rightarrow ?$

19. Give reasons for the variation of curves in the graph given below. Let V1 be [from the graph] 5.8 mL and V2 be 10.7mL. Calculate the Normality of strong acid and weak acid if the N of the base be 0.6N



and the pipette solution be 20 mL.

N.B: The amount of Pipette solution, Normality is changed for few experiments.