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Experiment - 1

Object: To determine hardness of water by HCl.

Apparatus: Burette, Pipette, conical flask, beaker, volumetric flask, water sample, std N/40 HCl, methyl orange.

Procedure:

- Wash all apparatus with dist. water.
- Fill burette with N/40 HCl, note intial reading.
- Pipette out 10 ml of water sample into conical flask, add 2 drop of methyl orange.
- Add HCl with constant string.
- Sharp colour change is noticed from Yellow to Cherry Red. Not the reading
- Repeat till 2 concordant reading
- Now, titrate with boil water in same manner.

Observation Table:

S.No	Vol of water sample taken	Vol of N/40 HCl consumed				A = a - b
		Before boiling	after boiling	concordant reading a	b	= 2 - 0.4
1	10 ml	2.0	0.4			=> 1.6
2	10 ml	2.0	0.4	2.0	0.4	
3.	10 ml	2.0	0.4			

Calculation:

Temporary hardness: $1.6 \times \frac{1000}{10} \times \frac{50}{40}$ mg/l

$= 200$ ppm

formula used = $\frac{A \times 1000}{10 \text{ of } N/40 \text{ HCl}}$

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Experiment = 2

Object: To determine the hardness of water sample by complexometric method using EDTA

Apparatus: Burette, pipette, conical flask, beaker, burner, std M/100 EDTA sol^n, Eriochrome Black T indicator, $NH_4Cl - NH_4OH$ buffer sol^n of pH 10, hard sample.

Procedure:

- Pipette out 10 ml of std hard water in conical flask.
- Add 1 ml of buffer sol^n, 2 drops of EBT as indicator.
- Titrate till colour changes wine red to Blue
- Repeat till concordant reading.
- Pipette out 10 ml of boiled water, add 1 ml of buffer sol^n and 2 drops of EBT
- Titrate with M/100 EDTA sol^n till blue colour appears.
- This corresponds to permanent hardness
- Now repeat with sample water.

Observation Table:

Titration: EDTA Vs Std. hard water (V$_1$ ml)

S.No	Vol of water	Burette reading: Initial	Burette reading: Final	Concordant Reading
1.	10 ml	0	7	7
2.	10 ml	0	7.5	
3.	10 ml	0	7	

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2. EDTA V/S Sample hard water (V_2 ml)

S.No.	Vol of water	Burette reading Initial	Burette reading final	Concordant Reading
1.	10 ml.	0	1.5	1.5
2.	10 ml	0	1.5	
3.	10 ml			

3. EDTA V/S Boiled water (V_3 ml)

S.No.	Vol of boiled water	Burette reading Initial	Burette reading final	Concordant Reading
1.	10 ml	0	0.5	
2.	10 ml	0	0.5	0.5
3.	10 ml.			

Calculation: Total hardness $= 1000 \times \frac{1.5}{7}$.

Permanent hardness $= 1000 \times \frac{0.5}{7} \Rightarrow$

Temporary hardness $= 1000 \left(\frac{1.5 - 0.5}{7} \right)$

$\Rightarrow 142.85$ ppm

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Experiment-3

Object: To determine the conductivity of given water samples by conductivity meter

Apparatus and reagent required -
Conductivity meter, water sample, distilled water, 0.01 N KCl solution, Beakers etc.

Procedure:
- ★ Switch on the conductivity meter for about 15 to 20 min. for its warm up.
- ★ Wash the conductivity cell in distilled water
- ★ Set the function switch to check position
- ★ Display must read 1.000 otherwise set it with CAL control knob of conductivity meter
- ★ Adjust the temperature knob to room temperature
- ★ Dip the washed and dried conductivity cell in the beaker containing sample solution.
- ★ After completion of experiment switch off the apparatus and put the cell in distilled water.

Observation:

$l/a = 0.984$

S. No	Water Sample Soln	Conductivity
1	A	0.50 x 0.984
2.	B	2.94 x 0.984
3	C	6.23 x 0.984

Result: The conductivity of given water sample are as follow

Sample	Conductivity
A	0.492
B	2.89
C	6.130

$\left[R = \frac{l}{a} \times \text{constant}\right.$

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