

# **Procedure for determination of permanent hardness:**

1- Take exactly 250 mL of hard water by burette or pipette and put it in beaker(600 mL)

2-Boil it for 20-30 minutes ,and then cool it in a water bath of room temperature

3-Filter the solution through the filter paper ,and collect the filtrate in 250 mL volumetric flask and fill the flask with D.W. till the signal of the flask.

4-Take 50 mL of water from the volumetric flask and repeat all steps of the procedure of determination of total hardness of water .

5-The average volume of EDTA =  $V_2$

# Calculations:

$$1 \text{ ppm} = 1 \text{ mg /L} = 0.001 \text{ g/ L}$$

$$100 \text{ ppm} = 100 \text{ mg/L} = 0.1 \text{ g/L}$$

No. of mmoles of EDTA equivalent to Ca cause Total Hardness(Temporary + Permanent ) =  $M_1 V_1$

$$\text{No. of moles} = \frac{M_1 V_1}{1000}$$

$$\text{Mol} = \frac{\text{mass}}{M.\text{mass}}$$

$$\text{Mass} = \text{mol} \times M. \text{ mass (CaCO}_3\text{)}$$

$$\text{Mass of CaCO}_3 = \frac{M1V1}{1000} \times 100$$

When volume of hard water = 50 mL

$$\text{Mass of CaCO}_3 \text{ in 1 mL} = \frac{M1V1}{1000} \times \frac{100}{50}$$

$$\text{ppm of Total Hardness} = \frac{M1V1}{1000} \times \frac{100}{50} \times 10^6$$

$$\text{ppm of Permanent Hardness} = \frac{M1V2}{1000} \times \frac{100}{50} \times 10^6$$

$$\text{ppm of Temporary Hardness} = \frac{M1(V1-V2)}{1000} \times \frac{100}{50} \times 10^6$$