Aim: Determine the total hardness of given water samples.

Introduction:

Hardness in water is due to the presence of dissolved salts of calcium and magnesium. It is unfit for drinking, bathing, washing and it also forms scales in boilers. Hence it is necessary to estimate the amount of hardness producing substances present in the water sample. Once it is estimated, the amount of chemicals required for the treatment of water can be calculated. The estimation of hardness is based on complexometric titration. Hardness of water is determined by titrating with a standard solution of ethylene diamine tetra acetic acid (EDTA) which is a complexing agent. Since EDTA is insoluble in water, the disodium salt of EDTA is taken for this experiment. EDTA can form four or six coordination bonds with a metal ion. Two type of hardness is present in water first is temporary hardness and second is permanent hardness. Temporary hardness is due to the presence of bicarbonates of calcium and magnesium ions. It can be easily removed by boiling. Permanent hardness is due to the presence of chlorides and sulphates of calcium and magnesium ions. This type of hardness cannot be removed by boiling.

Requirements:

Water sample
Burette 25-30ml
Glass funnel
Pipette 1ml
Flask
Dropper
Measuring cylinder

Reagents: EDTA, Eriochrome Black-T, NH_2CL, Ammonia Buffer, Magnesium Carbonate, 90% ethyl alcohol, Distilled water.

Reagent preparation:

1. EDTA solution: 4gm EDTA and 0.1gm magnesium bicarbonate dissolve in 800 ml distilled water.

2. Eriochrome Black-T: 0.4gm Ericrome Black T, 4.5 gm hydroxylmine hydrochloride add in 100ml 95% ethyl alcohol.

3. Ammonia Buffer: Stock A: 16.9gm of NH_4CL in 143ml of conc. NH_4OH, Stock B: 1.25gm magnesium salt of EDTA dissolve in 50 ml distilled water. Mix both stock solutions and dilute to 250ml with DDW. Dilute 10ml of the solution to 100ml with DDW.

Procedure:

1. The burette is filled with standard EDTA solution to the zero level.

2. Take 50ml sample water in flask. If sample having high Calcium content then take smaller volume and dilute to 50ml.

3. Add 1ml Ammonia buffer.

4. Add 5 to 6 drop of Ericrome black – T indicator. The solution turns into wine red colour.

5. Note the initial reading.

6. Titrate the content against EDTA solution. At the end point colour change from wine red to blue colour.

7. Note the final reading and record it. Repeat the process till we get concordant value.

8. Take 50ml sample in another flask and boiled it. (Add distilled water to get final volume of water.)

9. Repeat step 3-7.

Calculations:

S.No.	Water sample (50ml)	Initial Value	Final Value	Ml of EDTA
1				
2				
3				

Total hardness of water mg/L (CaCO3 Scale) = ml of EDTA used (unboiled) $*10^3$

/ml of sample

Permanent hardness of water mg/L (CaCO3 Scale) = ml of EDTA used (boiled)

$*10^3$ /ml of sample

Temporary hardness of water mg/L (CaCO3 Scale) = Total hardness of water - Permanent hardness of water

Observation:

The colour of soluble distilled water and R.O water instantly changed into blue while tap water and pond water turned wine red when Ericrome black T was added and therefore after turned blue when titrated against EDTA solution.

Result:

 The collected water sample contains Total hardness = _____ppm

Permanent hardness = _____ppm

Temporary hardness = _____ppm