AXAY SIR'S

Chemistry with a *Purpose*

AXAY SIR'S CHEMiSTRY

FOR

JEE/NEET/IIT

CONCEPT NOTES

**Hard and soft Water**

Always connected

PH:9426340530

SATELLITE branch &
DAHRNIDHAR branch

Hard : does not form leather with soap

Soft : does form leather with soap

Causes of Hardness

- ✓ Due to presence of bicarbonates, chlorides, sulphate, calsium magnesium
- ✓ When hard water comes in the contact with soap, the Ca(+2) Mg(+2) of hard water reacts with to form curdy white ppts.
- ✓ So we have to use more amount of soap

$$2C_{17}H_{35}COO^- \ Na^+ \ + \ Ca^{(2+)} ==== \ 2(C_{17}H_{35}COO)_2 \ Ca \ + \ NaCL$$
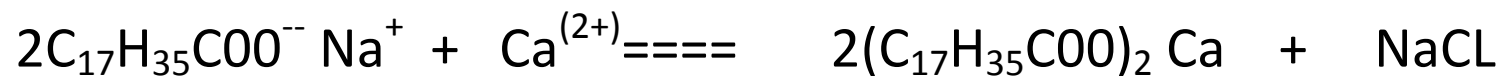
Sodium stearate　　　　　　　　Calsium stearate

Soap   white ppts.

Types of hardness

    (1) Temporary hardness

    (2) Permanent hardness

Temporary hardness

Cause: Due to presence of bicarbonates of Ca, Mg,e.g. $Ca(HCO_3)_2$, $Mg(HCO_3)_2$

Removal of TH

(1)   Boiling and filtration

  On boiling Ca-Mg bicarbonates gives CO_2 and insoluble carbonates

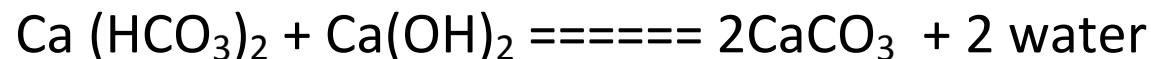$Mg(HCO_3)_2$=====With heat === $MgCO_3 + 2CO_2 + H_2O$

This carbonates can be removes by filtration

This method is called <u>Clark's method</u>

(2)   Hard ness can be removed by adding **lime water** ($Ca(OH)_2$

Which gives ppts. of carbonates which can be removed by filtration

$Ca (HCO_3)_2 + Ca(OH)_2$ ====== $2CaCO_3$ + 2 water

PERMANENT HARDNESS

(non carbonate hardness)

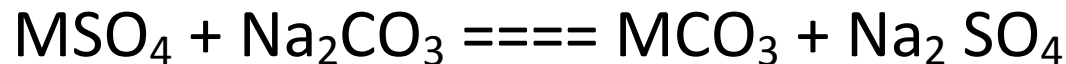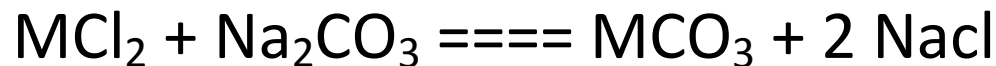**Causes:** due to presence of soluble chlorides, sulphates of Ca and Mg like cacl2,$MgCl_2$ Mg SO_4

Removal of P.Hard ness
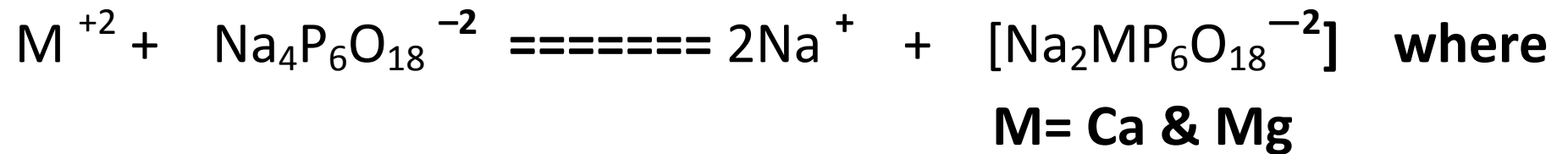
Cannot be removed by boiling of filtration Methods

(1) <u>Chemical method</u>

- ✓ By adding washing soda
- ✓ Particular calculated amout of washing soda added to water which gives carbonates of Ca and Mg

$MCl_2 + Na_2CO_3 ==== MCO_3 + 2 Nacl$

$MSO_4 + Na_2CO_3 ==== MCO_3 + Na_2 SO_4$

(2) By use of Sodium hexametaphosphate $(Na_6P_6O_{18})$-know as Calgon (Calsium gone)commercially

By using hexa… Ca and Mg can be made ineffective

$(Na_6P_6O_{18}) ======= 2Na^+ + Na_4P_6O_{18}^{--2}$

$M^{+2} + Na_4P_6O_{18}^{-2} ======= 2Na^+ + [Na_2MP_6O_{18}^{-2}]$ **where**

M= Ca & Mg

(3) **Ion exchange method** (Drawback : Can remove only ca and mg)
- ✓ **Ca and Mg** will be exchanged by Na
- ✓ Mineral used is Zeolite($Na_2AlSi_4O_{12}$)-Sodium calsium silicate
- ✓ Ziolite complex structure formed by Al,Si,Oxygen
- ✓ There is a void(Space) like that in honeycomb in which sodium ions are present
- ✓ When hard water passes over particles of zeolite

✓ Some sodium metals comes out from ziolite and mix with the solution and Ca+2 and Mg+2 enter into their places. this is exchange .

$$2Na^+Z^{--} + Ca^{+2} ===== Ca^{+2}(Z)_2 + 2Na^+$$

Na_2Z(Sodium zeolite) + $CaCl_2$(Hard water) ====== CaZ(Left in tank) + 2NaCl

(4) Synthetic Resin Method

✓ Synthetic organic exchanger called ion exchanger resin

✓ Can remove Na,ca mg , Cl-,SO4-2,Hco3-

✓ Ion exchange resins are giant organic molecules of high molecular masses

✓ They are giant molecules with cooH or SO3H group.

✓ R-SO3H reacts with NaCl and convert into R-Na

✓ When hard water passes throught Ca and Mg ions are removed from hard water

$$R\text{-}Na + M^{+2} \textbf{ (Ca/Mg)} ====== R_2M + 2Na^+$$

$$2 R\text{-}COO^-H^+ (resin) + CaCl_2 (Hard\ water) ==== (RCOO)_2Ca + 2H^+ + 2Cl^{--}$$