

WATER



Physical properties of water:-

1. Pure water is colourless, odourless and tasteless.
2. It freezes at 0°C and boils at 100°C .
3. Water molecules are polar.
4. Water molecules are V-shaped.
5. Its density is 1g/cm^3 .
6. Pure water is poor conductor of electricity.

SOFT AND HARD WATER

SOFT WATER:-

- Water which produce lather readily with soap solution is called soft water.
- The dissolved impurities such as bicarbonates ,chlorides and sulphates of calcium and magnesium are **not** present in soft water.

HARD WATER

- **Does not produce lather with soap.**
- **It contains impurities like bicarbonates and chlorides, sulphates of calcium and magnesium.**

1.why hard water does not produce lather with soap?

- **Soap is sodium salt of fatty acids**
- **Soap react with dissolved impurities like bicarbonates or chlorides of calcium and magnesium to form a precipitate .**

Soft water

- Produce lather with soap
- Does not contain dissolved impurities like bicarbonates , chlorides of Ca and Mg
- Does not produce ppt with soap.

Hard water

- Not produce lather with soap
- contain dissolved impurities like bicarbonates , chlorides of Ca and Mg
- produce ppt with soap

Advantages of soft and hard water

Soft water

Soft water is suitable for

1. **Cooking**
2. **Bathing**
3. **Laundry purpose**
4. **Dying textiles**

Hard water

1. **Contain Ca and Mg ions required for health.**
2. **Does not dissolve out lead from lead pipe used in water supply system.**

Disadvantages of soft and hard water

Soft water

1. It dissolves the lead of pipes leading lead poisoning.
2. Does not contain salts of Ca and Mg which required for healthy life.

Hard water

1. Pulses does not cook well
2. Wastage of soap
3. Wastage of fuel in boilers
4. Not suitable for dying and printing , sugar industry etc...

Types of hardness

A) Temporary hardness

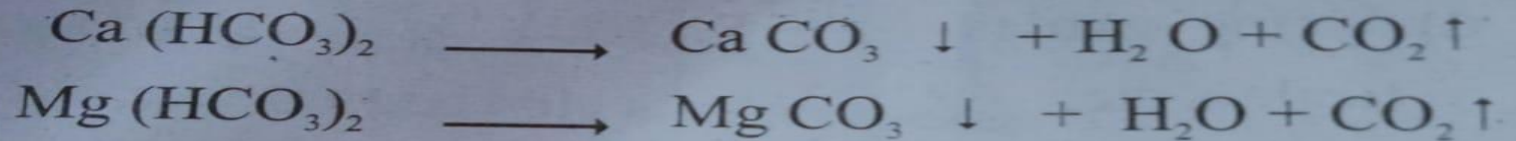
B) Permanent hardness

Temporary hardness:- caused by the presences of dissolved bicarbonates of Ca and Mg.

Methods of removing temporary hardness

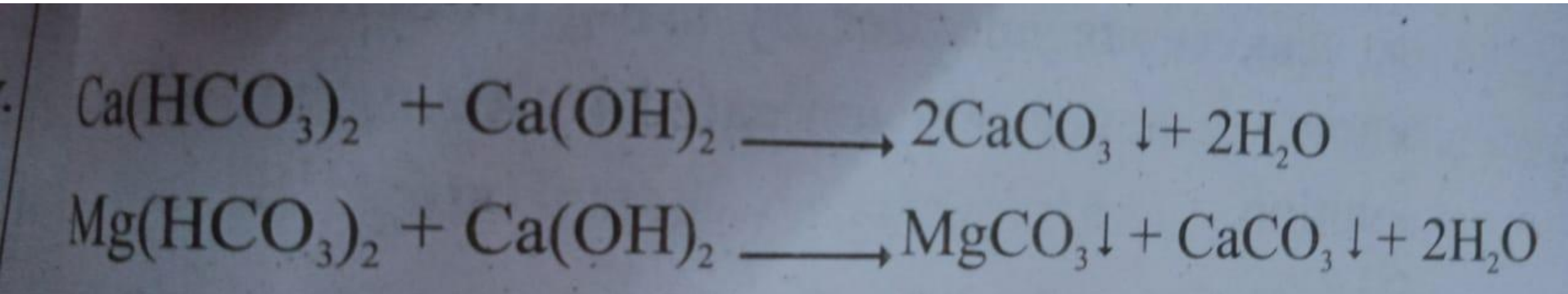
1.Boiling:

- ★ By boiling the dissolved bicarbonates decomposed to insoluble carbonates and CO₂ gases,
- ★ The precipitated carbonates are removed by filtration.



2) clarke's process

Required quantity of slaked lime Ca(OH)_2 is added to water, the Ca and Mg ions are precipitated as insoluble carbonates. It can be removed by filtration.



PERMANENT HARDNESS OF WATER

Caused by the presence of chlorides or sulphates of calcium and magnesium.

- It can be removed by ion exchange method

Ion exchange method

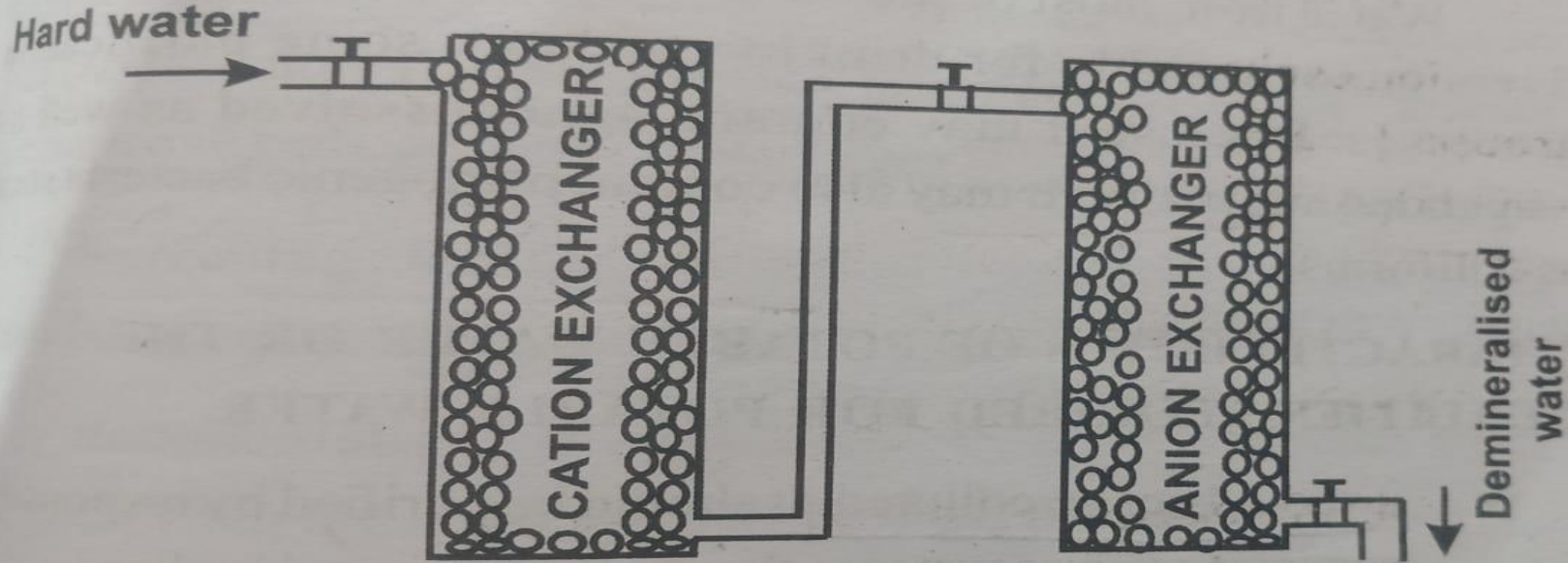
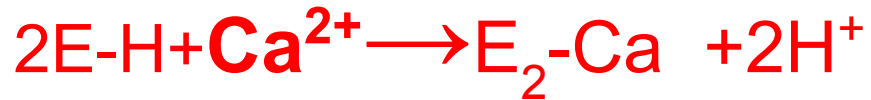


Fig - Demineralisation of water

- Hard water is first passed through a tank A packed with cation exchange resin, Then passed through tank B packed with anion exchange resins.
- Cation exchange resin (E-H) are capable of removing all positive cations like Ca^{2+} , Mg^{2+}



- This acidic water then passed through tank B contain anion exchange resin (E-OH) to remove all anions like Cl^- , SO_4^{2-} .



This method is also called as demineralisation of water

Potable water (drinking water)

Characteristics of potable water;

- 1. It should not be polluted.**
- 2. It should be free from pathogen**
- 3. It should be clear, odourless and safe to drink.**
- 4. It should not have bad taste.**
- 5. pH should be around 7.**
- 6. It should be reasonably soft.**

Treatment process to make potable water.

Q.what are the steps involving for the preparation of potable water for municipal supply?(15 marks)

There are mainly two steps:-

A) Clarification

The removal of coarse,dispersed and colloidal impurities from water, is called clarification.

It have

- 1)screening**
- 2)sedimentation**
- 3)coagulation**
- 4)filtration**

B) sterilization:-

The removal of all pathogenic micro organisms is called sterilization.

It can be done by

- a) sterilization by chlorine(chlorination)**
- b) sterilization by bleaching powder.**
- c) sterilization by ozone.**

clarification

1) screening:-

The removal of coarse soils , gravels, or silt from water by using bar screens or mesh screens.

2) sedimentation:-

Water is allowed to stand undisturbed in big tanks for 6 to 12 hours. This is to remove the suspended particles by settling down by the force of gravity.

3)coagulation:-

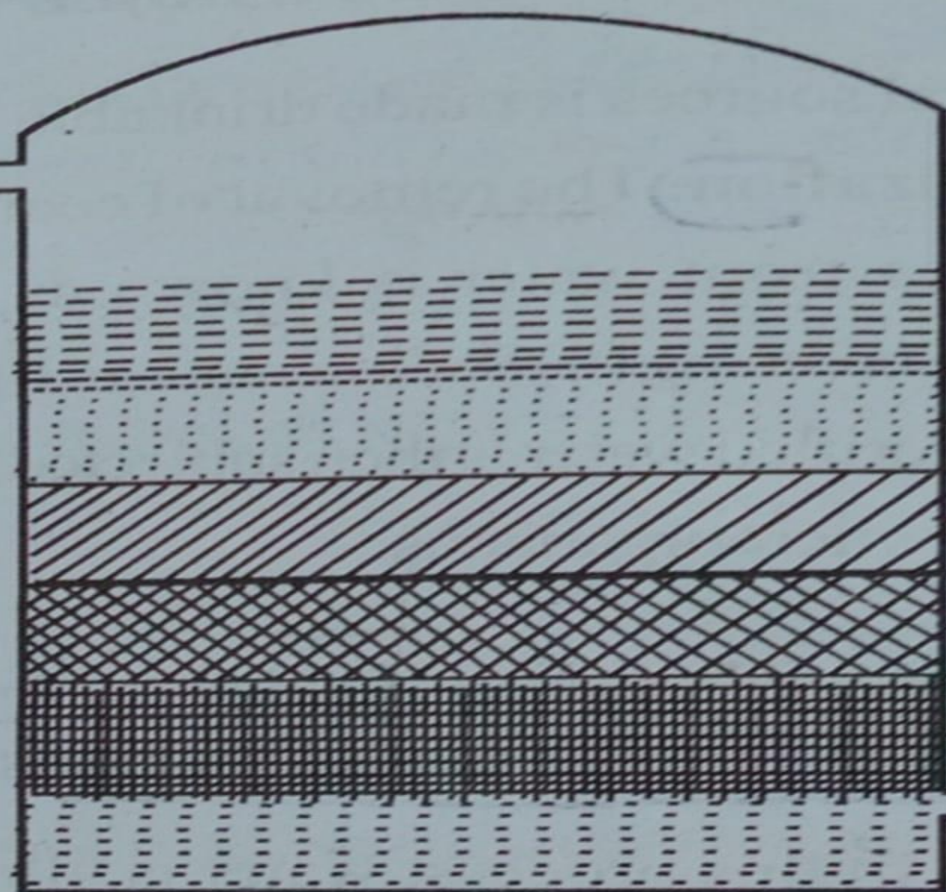
This is to remove the unsettled impurities of colloidal nature by forcing them to settle down by adding certain chemicals called coagulants. Ex-alum.

4) Filtration:-

The insoluble impurities are removed from water by means of filters.

- **Filtration tank is a rectangular tank made of concrete.**
- **Thick top layer sand placed over coarse sand layer and graded gravels**
- **It provided with an inlet for water and an outlet for clear water at the bottom.**
- **In pressure filter , the filtering material is kept in closed cylinder and water is forced in to the filter by pressure.**
- **This make the filtration make fast.**

Water
Inlet



Fine Sand

Coarse Sand

Fine Gravel

Coarse Gravel

Water Outlet

Filtration Tank

Sterilization

a) sterilization by chlorine(chlorination)

- Chlorine gas or chlorine water can be used.
- Cl reacts with water to form hypochlorous acid(HOCl).
- It dissociate to give nascent oxygen which destroys all germs.



2)sterilization by bleaching powder.

- 1 gm of bleaching powder (CaOCl_2) added to 1000L of water
- Hypochlorous acid(HOCl) and nascent oxygen produced which kill all the germs.
- $\text{CaOCl}_2 + \text{H}_2\text{O} \longrightarrow \text{Ca(OH)}_2 + \text{Cl}_2$
- $\text{Cl}_2 + \text{H}_2\text{O} \longrightarrow \text{HOCl} + \text{HCl}$
- $\text{HOCl} \longrightarrow \text{HCl} + (\text{o})$

3) **sterilization by ozone.**

Ozone gas (O_3) passed through water , nascent oxygen is generated . It kill all the germs.



FLOW CHART

Production of potable water for municipal supply

