Chapter 1:- Water [Marks : 4 to 6]

What do you mean by hardness of water?

Ans: The amount of soluble or dissolved salts of calcium and magnesium is considered as the hardness of water. There are two types of hardness of water:

1. Permanent Hardness
2. Temporary Hardness

Permanent Hardness: The harness of water which is caused due to the presence of soluble or dissolving chlorides of calcium and magnesium is known as permanent hardness of water. It is also called as non-carbonate hardness. The hardness is called permanent because it can’t be removed from simple methods and need special types of chemical methods.

Temporary Hardness: The hardness of water which is caused due to the presence of bicarbonates of calcium and magnesium is known as temporary hardness of water. It is also known as carbonate hardness. It can be removed by simple methods.

**How can you remove the permanent hardness of water?**

We can remove the permanent hardness of water by following two methods:

1. By adding washing soda (Na2CO3):
2. By Permutit process:

**By adding washing soda (Na2CO3):**

When permanent hard water is treated with washing soda (Na2CO3) the soluble or dissolving chlorides and sulphates of calcium and magnesium are converted into insoluble carbonate of calcium and magnesium as well as soluble salts sodium chloride and sodium sulphate. The insoluble precipitates (substance) are removed by filtration process and the soluble salts are removed by distillation process.

CaCl2 + Na2CO3  🡺 CaCO3 + 2NaCl

MgCl2 + Na2CO3  🡺 MgCO3 + 2NaCl

**By Permutit Process:**

Permutit is the complex chemical compound and belongs to the class zeolite. It is hydrated sodium aluminum silicate (Na2Al2Si2O8.xH2O). Zeolites are naturally occurring minerals containing hydrated aluminum silicates. Both Permutit and zeolite can be represented as by the general formula Na2Z. where Z = Al2Si2O8.xH2O.

When hard water is treated with sodium zeolite the soluble ca­­­++ and Mg++ ions of hardwater are precipitates as Ca-zeolite and Mg-zeolite.

In general:

Na2Z + Ca++ 🡺2Na+ + CaZ (Calcium Zeolite)

Na2Z + Mg++ 🡺2Na+ + MgZ (Magnesium Zeolite)