**MJCET**

**ENGINEERING CHEMISTRY-I (BE ¼)**

**QUESTION BANK**

**UNIT-III, WATER CHEMISTRY**

1.Define hardness of water? Why do we express hardness in terms of CaCO3 equivalents.

2. Name the salts responsible for the temporary and permanent hardness of water .

3. What is EDTA? Write its structure and uses.

4. Explain the principle behind the color change from wine red to blue of the indicator in the EDTA titration of hardness estimation of water.

5. Give the principle of determination of hardness of water by EDTA method.

6. Give the chemical reactions involved in determination of hardness of water by EDTA titration.

7. Distinguish between temporary and permanent hardness?

8. What are the units of hardness of water? Give the relationship between various units.

9. What is the method to remove temporary hardness? Write the chemical reaction involved.

10. What are the disadvantages of hard water when used for domestic purposes and industrial purposes?

11. Specifications of domestic and industrial water are different. Explain.

12. Distinguish between i) softening and demineralization ii) desalination and deionization of water.

13.what are the chief sources of water?

14. Which is the purest form of water? why?

**PART-B**

13. Describe ion exchange process of softening of water. What are its advantages over other methods?

14. Give the chemical reactions involved during i)softening of water by ion exchange resins and

ii)regeneration of exhausted ion exchange resin.

15. What is reverse osmosis process of desalination of brackish water? What are its advantages?

16. What is meant by alkalinity in water? What are the different types?

17. How the carbonate and bicarbonate alkalinity is determined experimentally in a water sample?

18. Distinguish between i) internal and external treatment of water. ii) Boiler scales and sludges.

19. What are the requirements of boiler feed water? What are the problems of using hard water in boilers?

20. What are scales and sludges? What are their ill effects?

21. Explain the formation of calcium sulphate scales.

22. How can scale formation be prevented .

23. Write short note on priming and foaming.

24. Why boiled water is not 100% safe for drinking.

25. What are the specifications of potable water?

26.Explain the following steps involved in purification of water for domestic purpose

i) Coagulation and sedimentation.ii) filtration by using gravity filters.

28. Explain the term i) PPM and ii) blow-down operation.

29. What is disinfection of water? Mention the methods of disinfection of water by

i) Chlorination and ii) ozone treatment.

30. What is ‘breakpoint chlorination’? what are its advantages?

31. Explain the determination of hardness of water by EDTA method.

**Numerical problems**

1. A 100 ml sample of water contains 12 mg of MgSO4 (Mol. Wt. = 120) and 22.2 mg of CaCl2 (Mol.Wt. = 111). Calculate the hardness in ppm units.(Ans=30ppm)
2. A sample of water contains 21.9 mg of Magnesium bicarbonate, 19.0 mg of MgCl2 33mg CaCl2 and 18 mg of MgS04 per liter. Calculate the temporary and permanent hardness of this sample (At. Wt Mg = 24, Ca = 40, S = 32, Cl = 35.5) (Ans=150ppm and 65ppm)
3. A sample of water contains the following impurities :Mg(HCO3)2=29.2 mg/l, Ca(HCO3)2 =32.4,CaCl2=22.2 mg/l, MgSO4=120 mg/l and NaCl =40 mg/L. Calculate temporary hardness and permanent hardness in ppm. (Ans=40ppm and 120ppm)
4. 60 ml of standard hardness containing 1 mg of pure CaCO3 per ml consumed 22 ml of EDTA. 40 ml of water sample consumed 20 ml of EDTA solution using EBT indicator. 40 ml of water sample after boiling, filtering consumed 15 ml of EDTA. Calculate the temporary and permanent hardness of water sample. (Ans=338ppm and 1022ppm)
5. 100 ml of a sample of hard water required 15 ml of 0.01 M EDTA for titration using EBT indicator. 100 ml of sample was boiled and filtered. The filtrate is made up to 100 ml with distilled water. This made up solution required 8 ml of 0.01 M EDTA solution for titration. Calculate the total, permanent and temporary hardness of the sample of hard water in terms of ppm units. (Ans=150ppm,80ppm and 70ppm)
6. 50 ml of a sample of water consumed 20 ml of 0.01 M EDTA. The same water after boiling consumed 12 ml of same EDTA. Calculate the total, temporary and permanent hardness of water.

( Ans= 400ppm,160ppm and 240ppm)

1. A 100 ml of sample hard water neutralizes exactly 12 ml of 0.12N HCl using

Methyl orange as indicator. Determine the type of alkalinity. (Ans= HCO3- =720ppm)

1. 100 ml of water sample on titration with N/50 HCl requires 8 ml of acid upto (P) end point and 9 ml of acid upto (M) end point. Calculate the type of alkalinity present.

(Ans=CO3-2=160ppm,HCO3-=10ppm)

1. 100 ml of water sample required 30 ml of N/50 H2SO4 for neutralization upto (P) end point. After this methyl orange was added to this and further acid required was again 30 ml calculate alkalinity of water.(Ans= CO3-2 =60ppm)
2. 100ml of sample required 4 ml of N/50 H2SO4 for neutralization upto (P) end point. Another 16 ml of same acid was needed for further titration upto (M) end point. Determine the type of alkalinity.(Ans= CO3-2 =80ppm, HCO3- =80ppm)