



- x) What is the effect of high hardness in water on laundry? 2
- It enhances cleaning performance
  - It has no effect
  - It decreases detergent efficiency and causes fabric stiffness
  - It makes clothes softer.

**OR**

- b) Explain in detail about sources of water. 5
- c) What are the common types of impurities found in natural water sources? 5
- d) Explain the concept of water hardness. Discuss the difference between temporary and permanent hardness, including the chemical compounds responsible for each. 5
- e) Discuss the effects of hard water on household appliances, plumbing and industrial machinery. 5

**2. a) Multiple choice questions (Each question carry two marks)**

- i) Which compound is used as the source of lime in the lime-soda method? 2
- Calcium carbonate
  - Calcium hydroxide
  - Sodium hydroxide
  - Magnesium hydroxide
- ii) Which of the following types of hardness can be removed by the lime soda process? 2
- Only temporary hardness
  - Only permanent hardness
  - Both temporary and permanent hardness
  - None of the above
- iii) The technique used in cold lime soda process are 2
- Batch process
  - Conventional type
  - Sludge blanket type
  - All of the above
- iv) The zeolite used in the water softening process can be regenerated using: 2
- Sodium chloride solution
  - Sodium hydroxide solution
  - Calcium chloride solution
  - Magnesium chloride solution
- v) Which of the following is natural zeolite. 2
- Natrolite
  - Thomsonite
  - Laumonite
  - All of the above
- vi) What does "Zeolite" refer to in the context of water treatment? 2
- A chemical compound used for regeneration
  - A natural or synthetic resin used to exchange ions
  - A filtration medium
  - A disinfectant

- vii) What is the purpose of the deionization or ion exchange process? **2**
- Remove suspended solids
  - Disinfect water
  - Remove all types of ions from water
  - Increase water hardness
- viii) Which of the following resin is used to remove cations in the ion exchange process? **2**
- Anion exchange resin
  - Cation exchange resin
  - Mixed bed resin
  - None of the above
- ix) Which of the following ions would be removed by an anion exchange resin? **2**
- Calcium ions
  - Magnesium ions
  - Chloride ions
  - Sodium ions
- x) Which of the following method gives water having lowest residual hardness? **2**
- Ion exchange or Deionization process
  - Zeolite process
  - Lime soda process
  - Break point chlorination

**OR**

- Explain cold lime soda process for softening of water. **5**
- What is zeolite process of water softening? Explain the chemical reactions involved in the zeolite process. **5**
- Discuss advantages and disadvantages of hot lime soda process over cold lime soda process. **5**
- What is the principle behind the ion exchange process in water softening? Explain how hardness-causing ions are removed from water. **5**

\*\*\*\*\*

