

B.Sc. (Part-I) (NEP) Semester-I  
**SEC04 - Water Treatment-I**

Time : Two Hours



Max. Marks : 40

Notes : 1. All questions are compulsory and carry marks as indicated.

**1. A) Multiple Choice Questions (Each question carry **two** marks).**

- i) Which of the following ions is primarily responsible for water hardness? 2
  - a) Sodium ( $\text{Na}^+$ )
  - b) Calcium ( $\text{Ca}^{2+}$ )
  - c) Chloride ( $\text{Cl}^-$ )
  - d) Nitrate ( $\text{NO}_3^-$ )
- ii) What is the basic unit of measurement for water hardness? 2
  - a) Parts per million (ppm)
  - b) Moles per liter (mol/L)
  - c) Kilograms per liter (kg/L)
  - d) Grams per liter (g/L)
- iii) Which type of water source is typically affected by seasonal variations in precipitation? 2
  - a) Groundwater
  - b) Surface water
  - c) Glacial water
  - d) Ocean water
- iv) Which water source is least likely to be influenced by surface pollution? 2
  - a) River
  - b) Well
  - c) Lake
  - d) Reservoir
- v) What is the main difference between surface water and groundwater? 2
  - a) Surface water is found underground, while groundwater is found on the surface.
  - b) Surface water is more likely to be polluted than groundwater.
  - c) Groundwater is always cleaner than surface water.
  - d) Surface water can be used for irrigation, but groundwater cannot.
- vi) Which of the following is a common chemical impurity found in drinking water? 2
  - a) Calcium carbonate
  - b) Sodium chloride
  - c) Nitrate
  - d) All of the above
- vii) Which of the following is a method for removing suspended solids from water? 2
  - a) Reverse osmosis
  - b) Sedimentation
  - c) Distillation
  - d) Adsorption
- viii) Which type of impurity is most commonly removed by boiling? 2
  - a) Microorganisms
  - b) Heavy metals
  - c) Dissolved salts
  - d) Organic compounds
- ix) What is the effect of hard water on soap? 2
  - a) It enhances lather formation
  - b) It reduces lather formation
  - c) It makes soap more effective
  - d) It increases soap consumption

- 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) How is groundwater different from surface water as a source 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) What is the byproduct of the lime-soda process? 2
- Sodium chloride
  - Sludge containing calcium carbonate and magnesium hydroxide
  - Sodium sulphate
  - Magnesium chloride
- 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 can reduce the effectiveness of the zeolite process? 2
- High temperature of water
  - Low concentration of hardness ions
  - Presence of iron or manganese
  - High pH of water
- 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**
- a) Anion exchange resin                      b) Cation exchange resin  
c) Mixed bed resin                              d) None of the above
- ix) Which of the following ions would be removed by an anion exchange resin? **2**
- a) Calcium ions                                      b) Magnesium ions  
c) Chloride ions                                      d) Sodium ions
- x) Which of the following method gives water having lowest residual hardness? **2**
- a) Ion exchange or Deionization process  
b) Zeolite process  
c) Lime soda process  
d) Break point chlorination

**OR**

- B) What are the advantages and disadvantages of the lime soda method compared to other water softening techniques like ion exchange? **5**
- C) What is zeolite process of water softening? Explain the chemical reactions involved in the zeolite process. **5**
- D) What chemicals are used for regenerating cation and anion exchange resins, and how are they selected? **5**
- E) What is the principle behind the ion exchange process in water softening? Explain how hardness-causing ions are removed from water. **5**

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