

GUJARAT TECHNOLOGICAL UNIVERSITY

3 SEMESTER – OLD PAPER – WINTER 2025 TO SUMMER 2026 – QUESTION BANK

Subject Name & Code: Fundamentals of Water Quality Analysis - BE03013031

Chapter 1: Familiarization with lab ware and instruments

Repeated Questions:

1. Calibration of Laboratory Glassware (Theory):

- **Q.** Discuss the importance of the calibration process for laboratory glassware to ensure accurate analysis of water quality. / Discuss importance of calibration of glassware. **(WINTER 2025, 3 Marks; SUMMER 2026, 4 Marks)**

2. Uses of Laboratory Instruments and Glassware (Theory):

- **Q.** Write the uses of following instrument and glassware, also mention capacity of measurement. (i) BOD Incubator (ii) Hot Air Oven (iii) volumetric flask (iv) Volumetric pipette. / List the specific uses of a BOD Incubator, Hot Air Oven, and conductivity meter in a water quality laboratory. **(WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks OR)**

Other Important Questions:

1. Familiarization with Laboratory Glassware and Instruments (Theory):

- **Q.** State the significance of familiarization with laboratory glassware and measuring instruments for environmental analysis. **(SUMMER 2026, 3 Marks)**

Chapter 2: General Chemical concepts

Repeated Questions:

1. Oxidation-Reduction Reactions (Theory):

- **Q.** List the fundamental rule to be followed for balancing simple oxidation-reduction reactions and complex oxidation-reduction reactions. Explain with an example. / List the fundamental rules to be followed for balancing simple and complex oxidation-reduction reactions with a detailed example. **(WINTER 2025, 7 Marks; SUMMER 2026, 7 Marks)**

2. pH Calculations (Numerical):

- **Q.** Calculate the pH of a solution of (i) 0.6 M HCl, (ii) 0.8 M NaOH, and (iii) 0.25 M HNO_3 ? / Calculate the pH of the following solutions: (i) 0.5 M HCl, (ii) 0.7 M NaOH, and (iii) 0.5 M HNO_3 . **(WINTER 2025, 4 Marks; SUMMER 2026, 7 Marks OR)**

Other Important Questions:

1. Concentration Systems (Theory):

- **Q.** Define the following concentration systems used in water chemistry: Molarity, Normality, and Molality. **(SUMMER 2026, 3 Marks)**

2. Chemical Bonds and Types of Solids (Theory):

- **Q.** Explain the different types of chemical bonds in molecules with suitable examples. **(SUMMER 2026, 4 Marks)**
- **Q.** Draw a flowchart indicating different types of solids and write definition of each type of solids. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks)**

Chapter 3: Preparation of standard solutions

Repeated Questions:

1. Primary and Secondary Standard Solutions (Theory):

- **Q.** Differentiate between primary and secondary standard solutions. / Differentiate between primary and secondary standard solutions and provide one example for each. **(WINTER 2025, 3 Marks; SUMMER 2026, 4 Marks)**

Other Important Questions:

1. Primary Standards (Theory):

- **Q.** List three primary requirements for a chemical substance to be classified as a primary standard. **(SUMMER 2026, 3 Marks)**

2. Preparation and Standardization of Solutions (Numerical):

- **Q.** A chemist has to prepare two solutions for hardness and COD analysis. Determine the weight of chemicals required to prepare i) 2 L 0.01 M EDTA ii) 1.5 L 0.0141 N AgNO_3 . The solutions that he prepared are to be standardized, explain steps for standardization. **(WINTER 2025, 7 Marks OR)**

Chapter 4: Volumetric and Gravimetric Analysis

Repeated Questions:

1. Terms in Quantitative Analysis (Theory):

- **Q.** Define the terms: precipitation, filtration, Concentration and drying. / Define the following terms related to quantitative analysis: precipitation, filtration, and drying. **(WINTER 2025, 3 Marks OR; SUMMER 2026, 3 Marks)**

2. Sampling Techniques (Theory):

- **Q.** Write a short note on sampling techniques and comment type of sampling suitable for sampling from river. / Illustrate various sampling techniques for wastewater analysis and mention necessary precautions to be taken during the process. **(WINTER 2025, 3 Marks; SUMMER 2026, 4 Marks)**

Other Important Questions:

1. Gravimetric Analysis (Theory):

- **Q.** Discuss the precautions that must be observed to ensure an accurate gravimetric determination of sulfate concentration. **(WINTER 2025, 7 Marks OR)**

Chapter 5: Standards and criteria for water quality

Repeated Questions:

1. Irrigation and Bathing Water Quality Criteria (Theory):

- **Q.** Explain the purpose of laying guidelines for quality of irrigation water and water quality criteria for bathing water. / Analyze the guidelines for irrigation water quality and the primary water quality criteria for bathing waters. **(WINTER 2025, 4 Marks; SUMMER 2026, 7 Marks)**

2. Standard Methods and Water Quality Index (Theory):

- **Q.** List the purpose of standard methods and water quality index. / Describe the need for standard methods for water analysis and the purpose of the Water Quality Index. **(WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks OR)**

Other Important Questions:

1. Water Quality Standards, Criteria and Guidelines (Theory):

- **Q.** Differentiate between water quality standards, criteria, and guidelines with relevant examples. **(SUMMER 2026, 4 Marks OR)**
- **Q.** List the permissible limits for pH, Total Dissolved Solids (TDS), and Total Hardness as per IS 10500 drinking water standards. **(SUMMER 2026, 3 Marks)**

Chapter 6: Instrumental Analysis

Repeated Questions:

1. Lambert and Beer's Law (Theory):

- **Q.** State and explain Lambert and Beer's law and derive equation. / State and explain the fundamental principles of Lambert's and Beer's law. **(WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks OR)**

2. Glass Electrode for pH Measurement (Theory):

- **Q.** Draw a neat diagram of a glass electrode and explain its working principle for measuring the pH of a water sample. / Examine the working principle and components of a Glass Electrode for measuring the pH of a water sample. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks OR; SUMMER 2026, 7 Marks)**

Other Important Questions:

1. Turbidity Meter and Nephelometer (Theory):

- **Q.** Draw neat sketch of turbidity meter and nephelometer instruments. Highlight their components. [Diagram required – refer to the original question paper] **(WINTER 2025, 3 Marks)**
- **Q.** Explain the principle of Nephelometer and explain its components. **(WINTER 2025, 3 Marks OR)**

Chapter 7: Analysis of water quality parameters

Repeated Questions:

1. Determination of Chlorides (Theory):

- **Q.** Explain, with reactions, the importance of maintaining pH during the determination of chlorides. / Explain, with relevant chemical reactions, the importance of maintaining pH during chloride determination using the Argentometric method. / Examine the procedure for determining chlorides in water using the Mohr's method, including the reactions and the effect of the indicator. **(WINTER 2025, 7 Marks; SUMMER 2026, 7 Marks OR; SUMMER 2026, 4 Marks)**

2. Significance of TDS, Conductivity and Alkalinity (Theory):

- **Q.** Discuss the significance of Total Dissolved Solids (TDS) and conductivity in water. What is the relationship between the two? / Discuss the significance of Total Dissolved Solids (TDS) and Conductivity in water and explain the relationship between the two. **(WINTER 2025, 4 Marks OR; SUMMER 2026, 4 Marks)**
- **Q.** Explain the significance of alkalinity for water bodies and in wastewater treatment. / Summarize the environmental significance of alkalinity for natural water bodies and in wastewater treatment processes. **(WINTER 2025, 3 Marks OR; SUMMER 2026, 4 Marks OR)**

3. Determination of Total Hardness (Theory):

- **Q.** Explain the procedure for the determination of total hardness in water, and highlight the significance of each chemical used in the process. / Analyze the laboratory procedure for the determination of total hardness in water and highlight the role of each chemical used. **(WINTER 2025, 7 Marks; SUMMER 2026, 7 Marks)**

4. Sodium Adsorption Ratio (Numerical):

- **Q.** Calculate the Sodium adsorption ratio of water sample using following data: Sample A: $\text{Ca}^{2+} = 40.3 \text{ mg/L}$, $\text{Mg}^{2+} = 16.7 \text{ mg/L}$, $\text{Na}^+ = 12.7 \text{ mg/L}$; Sample B: $\text{Ca}^{2+} = 209.5 \text{ mg/L}$, $\text{Mg}^{2+} = 50.8 \text{ mg/L}$, $\text{Na}^+ = 200.5 \text{ mg/L}$. / Apply the formula to calculate the Sodium Adsorption Ratio (SAR) of a water sample and comment on its suitability for irrigation. $\text{Ca}^{2+} = 40 \text{ mg/L}$, $\text{Mg}^{2+} = 25 \text{ mg/L}$ and $\text{Na}^+ = 20 \text{ mg/L}$. **(WINTER 2025, 7 Marks; SUMMER 2026, 7 Marks OR)**

Other Important Questions:

1. Total Solids and Total Dissolved Solids (Theory):

- **Q.** Explain the standard method for the determination of Total Solids (TS) and Total Dissolved Solids (TDS) of a water sample collected from lake. Also, include the calculation formula. **(WINTER 2025, 7 Marks)**

2. Chlorides – Argentometric Method (Theory):

- **Q.** Explain the procedure for the determination of chlorides using the argentometric method. **(WINTER 2025, 4 Marks OR)**

3. Sulphate in Water and Wastewater (Theory):

- **Q.** Discuss the significance of sulphate in water and wastewater distribution and collection. **(WINTER 2025, 3 Marks)**

4. Hardness (Theory):

- **Q.** Classify the water based on level of Hardness and list the hardness causing cations & anions. **(WINTER 2025, 4 Marks OR)**
- **Q.** Apply the EDTA titration method to determine the total, calcium, and magnesium hardness of a given water sample. **(SUMMER 2026, 7 Marks)**

5. Hardness (Numerical):

- **Q.** A sample of water is found to contains following dissolving salts in milligrams per litre
 $\text{Mg}(\text{HCO}_3)_2 = 146$, $\text{CaCl}_2 = 222$, $\text{Ca}(\text{HCO}_3)_2 = 162$, $\text{MgSO}_4 = 80$ and $\text{MgCl}_2 = 190$. Calculate temporary and permanent hardness and total hardness. **(WINTER 2025, 7 Marks OR)**
