

A PRACTICAL FILE ON

Engineering Chemistry Practical File

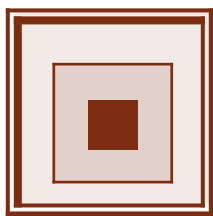
B.Tech First Year • Laboratory record

Submitted in partial fulfilment of the practical examination requirements

BACHELOR OF TECHNOLOGY

in

B.Tech I Sem, Section D



SUBMITTED BY

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PROGRAMME

B.Tech I Sem, Section D

Department of Chemistry

YOUR ENGINEERING COLLEGE, BHUBANESWAR

Session 2025–26

CERTIFICATE

This is to certify that Sourav Patnaik, a student of B.Tech I Sem, Section D, has satisfactorily completed the practical work in Engineering Chemistry prescribed by the Department of Applied Chemistry during the academic session 2025-26.

The experiments recorded in this file were performed by the student in the laboratory under my supervision, and the observations and results are the student's own.

Dr. Smita Mohanty
Subject Teacher

External Examiner
Date: -----

Dr. B. K. Das
Head of Department

Acknowledgement

I would like to express my sincere gratitude to my subject teacher, Dr. Smita Mohanty, for guidance and encouragement throughout the practical sessions, and for patiently clearing my doubts in the laboratory.

I am also thankful to Dr. B. K. Das, Head of Department, for providing a well-equipped laboratory, and to the laboratory staff for their help in arranging the apparatus for every experiment.

Finally, I thank my parents and classmates for their constant support while I completed this practical file.

Sourav Patnaik

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2	pH-metric titration of a strong acid with a strong base	22 Jul 2025		
3	Viscosity using Ostwald's viscometer	05 Aug 2025		
4	Chloride content of water by Mohr's method	19 Aug 2025		

Write the page number of each experiment in the remarks column once the file is complete.

Laboratory Safety Rules

- Wear a lab coat and closed shoes
- Never taste or smell chemicals directly
- Report any breakage or spill to the teacher at once
- Switch off and unplug equipment after use
- Wash hands before leaving the laboratory

Experiment 1: Total hardness of water by EDTA method

Date: 08 Jul 2025

Page No.: ____

Teacher's sign: _____

Aim

To determine the total hardness of a given water sample by the EDTA titration method.

Apparatus / Materials Required

- Burette, pipette, conical flask
- Standard EDTA solution (0.01 M)
- Ammonia buffer (pH 10), Eriochrome Black T indicator

Theory

Calcium and magnesium ions form a wine-red complex with Eriochrome Black T at pH 10. EDTA forms more stable complexes with these ions, so at the end point the indicator is released and the colour changes to blue.

$$\text{Hardness (ppm as CaCO}_3\text{)} = \frac{V(\text{EDTA}) \times M \times 100 \times 1000}{V(\text{sample})}$$

Procedure

1. Pipette 50 mL of the water sample into a conical flask.
2. Add 2 mL of buffer and 2–3 drops of indicator.
3. Titrate with EDTA until the colour changes from wine red to blue.
4. Repeat for concordant readings.

Observations

S. No.	Initial (mL)	Final (mL)	Volume of EDTA (mL)
1	0.0	12.6	12.6
2	12.6	25.0	12.4
3	25.0	37.4	12.4

Observation table (sample readings – replace with your own)

Calculations

Concordant volume = 12.4 mL.

Hardness = $12.4 \times 0.01 \times 100 \times 1000 / 50 = 248$ ppm.

Result

Result

Total hardness of the water sample = 248 ppm as CaCO_3 (sample result).

Precautions

- Maintain pH 10 with buffer.
- Add the indicator in small amount.

Experiment 2: pH-metric titration of a strong acid with a strong base

Date: 22 Jul 2025

Page No.: ____

Teacher's sign: _____

Aim

To determine the strength of HCl by titrating against standard NaOH using a pH meter.

Apparatus / Materials Required

- pH meter with glass electrode
- Beaker, burette, magnetic stirrer
- 0.1 N NaOH, HCl sample, buffer solutions

Theory

During the titration of a strong acid with a strong base, the pH changes slowly at first and then rises sharply near the equivalence point. The point of maximum slope on the pH curve gives the end point.

Procedure

5. Calibrate the pH meter with standard buffers.
6. Take 20 mL of HCl in a beaker and dip the electrode.
7. Add NaOH in 1 mL steps, noting the pH after each addition; use 0.2 mL steps near the end point.
8. Plot pH against volume and $\Delta\text{pH}/\Delta V$ against volume.

Observations

Vol. NaOH (mL)	pH
0	1.10
10	1.60
18	2.40
19.8	3.70
20.0	7.00
20.2	10.30
22	11.70

Observation table (sample readings – replace with your own)

Result

Result

The equivalence point is at 20.0 mL; normality of HCl = 0.10 N (sample result).

Precautions

- Rinse the electrode with distilled water between uses.
- Stir gently and steadily.

Experiment 3: Viscosity using Ostwald's viscometer

Date: 05 Aug 2025

Page No.: ____

Teacher's sign: _____

Aim

To determine the viscosity of a given liquid relative to water using an Ostwald viscometer.

Apparatus / Materials Required

- Ostwald viscometer, stand and clamp
- Stopwatch, pipette, rubber tube
- Specific gravity bottle, distilled water and the given liquid

Theory

The time taken by a fixed volume of liquid to flow through a capillary depends on its viscosity and density. Comparing with water gives the relative viscosity.

$$\eta_1 / \eta_2 = (d_1 t_1) / (d_2 t_2)$$

Procedure

- Clean and dry the viscometer and clamp it vertically.
- Fill a fixed volume of water and note the flow time between the two marks.
- Repeat with the given liquid.
- Find the densities with a specific gravity bottle.

Observations

Liquid	Flow time (s) trial 1	Trial 2	Mean t (s)	Density (g/mL)
Water	62	63	62.5	0.997
Given liquid	85	86	85.5	0.873

Observation table (sample readings – replace with your own)

Result

Result

Relative viscosity of the given liquid = 1.20 (sample result).

Precautions

- Keep the temperature constant.
- The viscometer must be vertical.

Experiment 4: Chloride content of water by Mohr's method

Date: 19 Aug 2025

Page No.: ____

Teacher's sign: _____

Aim

To determine the chloride content of a water sample by argentometric titration (Mohr's method).

Apparatus / Materials Required

- Burette, pipette, conical flask
- Standard AgNO_3 solution (0.02 N)
- Potassium chromate indicator

Theory

Silver nitrate reacts with chloride ions to form a white precipitate of silver chloride. After all chloride has reacted, the next drop of silver nitrate forms red-brown silver chromate with the indicator, marking the end point.

$$\text{Chloride (mg/L)} = \frac{V(\text{AgNO}_3) \times N \times 35.45 \times 1000}{V(\text{sample})}$$

Procedure

13. Pipette 50 mL of the water sample into a flask.
14. Add 1 mL of potassium chromate indicator.
15. Titrate with AgNO_3 until a faint red-brown colour persists.
16. Repeat for concordant readings.

Observations

S. No.	Initial (mL)	Final (mL)	Volume (mL)
1	0.0	8.3	8.3
2	8.3	16.4	8.1
3	16.4	24.5	8.1

Observation table (sample readings – replace with your own)

Result

Result

Chloride content of the water sample $\approx$ 115 mg/L (sample result).

Precautions

- The sample should be neutral (pH 7–8).
- Swirl constantly near the end point.

Viva Voce: Frequently Asked Questions

Q1. What is least count?

The smallest value that an instrument can measure accurately.

Q2. Why are multiple readings taken?

To reduce random errors and obtain a more reliable mean value.

Q3. What is a systematic error?

An error that shifts all readings in the same direction, such as a zero error.

Q4. Why is a graph preferred over a single calculation?

It averages out random errors and shows whether the relationship is linear.

Q5. What is the difference between accuracy and precision?

Accuracy is closeness to the true value; precision is closeness of repeated readings to each other.

Bibliography

- Laboratory manual issued by the department / school.
- Prescribed textbook for the subject (latest edition).
- Class notes and practical demonstrations by the subject teacher.