Engineering Chemistry Important Questions PDF

Engineering Chemistry usually covers molecular structure and spectroscopy, electrochemistry and corrosion, water technology, fuels and combustion, and polymers with advanced materials. High-scoring questions include MO diagrams, Nernst equation numericals, hardness calculations, EDTA method, Dulong's formula, bomb calorimeter and preparation of common polymers.

Key takeaways

- Molecular structure: MO diagrams of N2 and O2, bond order and magnetic behaviour, basics of UV, IR and NMR.
- Electrochemistry: Nernst equation, cells and batteries, and corrosion mechanisms with prevention methods.
- Water: hardness in ppm as CaCO3, EDTA method, lime-soda, zeolite, ion exchange and boiler troubles.
- Fuels and polymers: calorific value, Dulong's formula, proximate and ultimate analysis, and polymer preparation.
- These are practice questions based on common syllabus topics, not verified past papers.

About these important questions

These are **practice questions** built from topics that appear in most Indian B.Tech syllabi for Engineering Chemistry, including AKTU and universities that follow the AICTE model curriculum. They are **not verified past papers**, and we do not claim that any question will appear in your exam. Unit numbers and topic order differ between universities, so first match each unit below with your own university syllabus. For real previous papers, use your university's official archive. AKTU students can download them from the AKTU old question paper page.

Each unit lists key definitions, derivations or theory questions, numericals with short answer outlines, and long-answer questions. Use the outlines to check your method, then write full solutions yourself.

Unit 1: Molecular Structure and Spectroscopy

Key definitions: molecular orbital theory, bonding and antibonding orbitals, bond order, hybridisation, crystal field theory (basic), Beer-Lambert law, chromophore, auxochrome, chemical shift.

Important questions:

- Draw the MO energy level diagram of N2 and O2. Find the bond order and explain why O2 is paramagnetic. Answer outline: N2 has bond order 3 and no unpaired electrons; O2 has bond order 2 and two unpaired electrons in π* orbitals.
- Compare valence bond theory and MO theory.
- Explain the principle of UV-visible spectroscopy and the types of electronic transitions (σ to σ*, n to π*, π to π**).
- Explain the principle of IR spectroscopy and the regions of the IR spectrum used to identify functional groups.
- Explain the basic principle of NMR spectroscopy and what chemical shift tells us.

Numerical: A solution absorbs light with a given molar absorptivity and path length; use A = εcl to find the concentration.

Unit 2: Electrochemistry and Corrosion

Key definitions: electrode potential, standard hydrogen electrode, reference electrodes (calomel), EMF of a cell, concentration cell, primary and secondary batteries, fuel cell, dry and wet corrosion.

Derivations and theory:

- Derive the Nernst equation and write it at 298 K: $E = E^\circ - (0.0591/n) \log Q$.
- Explain the electrochemical (wet) theory of corrosion with hydrogen evolution and oxygen absorption.
- Explain the working of the lithium-ion battery and the hydrogen-oxygen fuel cell.

Numericals (answer outline):

- Calculate the EMF of a Daniell cell at 298 K for given concentrations of Zn^{2+} and Cu^{2+}. Outline: $E = E^\circ cell - (0.0591/2) \log([Zn^{2+}]/[Cu^{2+}])$.
- Find the single electrode potential of a metal in a solution of given concentration.

Long-answer questions: Factors affecting corrosion. Methods of prevention: cathodic protection (sacrificial anode and impressed current), metallic coatings (galvanising and tinning) and protective coatings.

Unit 3: Water Technology

Key definitions: hardness, temporary and permanent hardness, ppm, degree of hardness, alkalinity, BOD, COD, softening, scale and sludge, priming and foaming, caustic embrittlement.

Numericals (answer outline):

- Water contains 162 mg/L of $Ca(HCO_3)_2$. Find its hardness. Outline: hardness as $CaCO_3$ = 162 x 100/162 = 100 ppm (temporary).
- Calculate total, temporary and permanent hardness from EDTA titration readings for a water sample.
- Calculate the amount of lime and soda needed to soften a given volume of water from the list of impurities.

Long-answer questions:

- Explain the EDTA method for estimating hardness, with indicator and reactions.
- Explain the zeolite process and the ion exchange process with diagrams, and compare them.
- Describe boiler troubles (scale and sludge, priming and foaming, caustic embrittlement, boiler corrosion) and their prevention.
- Explain reverse osmosis for desalination.

Unit 4: Fuels and Combustion

Key definitions: calorific value, gross (HCV) and net (LCV) calorific value, proximate and ultimate analysis, cracking, knocking, octane number, cetane number, flue gas analysis.

Numericals (answer outline):

- Find HCV and LCV of a coal sample from its percentage composition using Dulong's formula. Outline: HCV = (1/100)[8080C + 34500(H - O/8) + 2240S] kcal/kg, and LCV = HCV - 0.09H x 587 kcal/kg.
- Calculate the gross calorific value from bomb calorimeter data, including water equivalent and corrections.
- Calculate the volume of air needed for complete combustion of 1 kg of a given fuel.

Long-answer questions: Explain proximate analysis and the significance of each result (moisture, volatile matter, ash, fixed carbon). Explain the bomb calorimeter with a diagram. Explain knocking and how octane and cetane numbers are defined.

Unit 5: Polymers and Advanced Materials

Key definitions: monomer, degree of polymerisation, addition and condensation polymerisation, thermoplastic and thermosetting polymers, glass transition temperature, conducting polymers, biodegradable polymers.

Important questions:

- Give the preparation, properties and uses of Nylon-6,6, Bakelite, PVC and Teflon.
- Explain the mechanism of free radical addition polymerisation.
- What are conducting polymers? Explain doping in polyacetylene.
- Write short notes on biodegradable polymers and their importance.
- Explain the Grignard reagent and its applications (if organometallics are in your syllabus).
- Write short notes on nanomaterials, graphene and liquid crystals (if advanced materials are in your syllabus).

How to score well in Engineering Chemistry

- Write balanced chemical equations in every answer. They are the fastest way to show the examiner you know the process.
- Learn the hardness and calorific value formulas exactly, with units. These numericals are almost always present.
- Draw labelled diagrams for the bomb calorimeter, zeolite softener, ion exchanger and fuel cell.

- Use the multiplication factor (molar mass of $CaCO_3$ divided by the molar mass of the salt) carefully in hardness questions.

Short-answer (2-mark) questions for Engineering Chemistry

Short questions test definitions and one-line results. Practise answering each in two to four lines:

1. Define bond order. Find the bond order of O_2. (Answer: 2.)
2. State the Beer-Lambert law.
3. What is a chromophore?
4. Write the Nernst equation at 298 K.
5. Differentiate between galvanic and electrolytic cells.
6. Why does galvanised iron resist corrosion better than tinned iron when scratched?
7. Define temporary and permanent hardness.
8. Why is EDTA used in hardness estimation?
9. What is caustic embrittlement?
10. Define HCV and LCV.
11. What is the significance of octane number?
12. Differentiate between thermoplastic and thermosetting polymers.

A 7-day revision plan for Engineering Chemistry

Use this plan in the last week before the exam. Adjust it to the units and weightage in your own syllabus.

- **Day 1 (Unit 1, Molecular Structure and Spectroscopy):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 2 (Unit 2, Electrochemistry and Corrosion):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 3 (Unit 3, Water Technology):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 4 (Unit 4, Fuels and Combustion):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 5 (Unit 5, Polymers and Advanced Materials):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 6:** attempt one full three-hour practice paper made from these questions, or an official previous paper from your university archive.
- **Day 7:** go through your formula sheet, the short-answer list and every question you got wrong in the practice paper.

Frequently asked questions

Which Engineering Chemistry numericals come up most often?

Hardness of water in ppm, lime-soda requirement, Dulong's formula for HCV and LCV, bomb calorimeter calculations and the Nernst equation are the most common numerical types.

How do I calculate hardness quickly?

Multiply the amount of each hardness-causing salt by 100 and divide by its molar mass. That gives the hardness as CaCO3 equivalent in mg/L, which is the same as ppm.

Are diagrams needed in chemistry answers?

Yes. Diagrams for the bomb calorimeter, ion exchange, zeolite process, fuel cell and MO energy levels make long answers clearer and easier to mark.

Are these questions from real past papers?

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