

# Last-Minute Revision Notes – Engineering Chemistry

## PART A – Short Notes (Direct Q&A;)

- 1 Functionality → Number of reactive/bonding sites in a monomer. (Ex: Vinyl chloride = 2, Ethylene glycol = 2).
- 2 Effect of Molecular Weight (MWT) → ↑ MWT → ↑ tensile strength, toughness, T<sub>g</sub>; ↓ MWT → better processability, less strength.
- 3 Methods to determine MWT → Viscometry, Light scattering, Sedimentation equilibrium.
- 4 Primary vs. Secondary Battery → Primary: Non-rechargeable, irreversible (Alkaline). Secondary: Rechargeable, reversible (Li-ion).
- 5 EMF Series Significance → Predicts feasibility of redox reactions, hydrogen displacement, order of reactivity.
- 6 Cheminformatics → Data management of molecules + drug design (virtual screening, modeling).
- 7 Glass Electrode Principle → Ion-exchange, potential ∝ pH, measured using Nernst equation.
- 8 Chromogenic Materials → Change color under heat/light/voltage → Used in displays.
- 9 Top-down vs. Bottom-up Nanotech → (i) Approach (breakdown vs. build-up). (ii) Cost/precision difference.
- 10 Nanomaterial Synthesis → Laser ablation, CVD.
- 11 Electroactive Polymers (EAPs) → Change size/shape under electric field, flexible, lightweight, low cost.
- 12 Electrolytic vs. Electrochemical Cell → Electrolytic: Electrical → Chemical, Anode +ve, Cathode -ve; Electrochemical: Chemical → Electrical, Anode -ve, Cathode +ve.
- 13 Alkaline vs. Dry Cell → No leakage, longer shelf life, constant voltage, eco-friendly.
- 14 Li-ion Battery Recycling Methods → Thermal, Chemical, Electrochemical, Mechanical, Reconditioning.
- 15 Fuel Cells → Work like batteries, but don't run down; produce electricity + heat continuously.
- 16 NiMH Battery Reactions → Anode:  $\text{MH} + 2\text{OH}^- \rightarrow \text{M} + 2\text{H}_2\text{O} + 2\text{e}^-$ ; Cathode:  $\text{NiO(OH)} + \text{H}_2\text{O} + \text{e}^- \rightarrow \text{Ni(OH)}_2 + \text{OH}^-$ ; Overall:  $\text{MH} + 2\text{NiO(OH)} \rightarrow \text{M} + 2\text{Ni(OH)}_2$ .

## PART B – Long Questions (Condensed Points)

- 1 Glass Transition Temperature (T<sub>g</sub>): Definition, Properties, Factors (chain length, bulky groups ↑ T<sub>g</sub>; plasticizers ↓ T<sub>g</sub>).
- 2 Polyethylene: Preparation (polymerization of ethylene), Properties (lightweight, flexible, chemical resistant), Applications (packaging, containers, insulation).
- 3 Epoxy Resin: Prep (epichlorohydrin + bisphenol A), Properties (adhesive, resistant), Applications (coatings, adhesives, composites).
- 4 Piezoelectric Polymers (e.g., PVDF): Convert mechanical stress ↔ electrical signals; Applications: Sensors, actuators, biomedical devices.
- 5 EMF Series: Tabulated standard electrode potentials; Uses: predict cell feasibility, corrosion, displacement reactions.
- 6 Batteries: Lead-acid (Pb anode, PbO<sub>2</sub> cathode, H<sub>2</sub>SO<sub>4</sub> electrolyte). Fuel Cell (H<sub>2</sub> + O<sub>2</sub> → H<sub>2</sub>O). Hydrogen Fuel (PEC & PC methods, sustainability).
- 7 Biodegradable Polymers: Examples (PLA, PCL). Apps: biomedical (sutures, drug delivery), packaging. Role: supports circular economy + SDGs.
- 8 Nanomaterials & CNT Applications: Electronics (chips), Electrical (conductors), Mechanical (composites), Thermal (heat sinks), Construction (cement), Transport (lightweight vehicles), Energy (solar cells, batteries).

- 9 Environmental Effects of Energy Storage: Lead, Ni, Cd → toxic waste; EVs reduce CO<sub>2</sub> emissions and pollution.