

Model Paper - I
Engineering Chemistry
 (Common to All branches)

Time : 3 hrs

Max. Marks : 75

Answer any Five questions. All questions carry equal marks.

- 1) a) Explain the following terms with suitable examples.
 - i) Specific conductance
 - ii) Equivalent conductance
 - iii) Molecular conductance
 b) How do you measure the equivalent conductance of an electrolyte ?
 If the resistance $\frac{N}{10}$ acid solution is 2.5×10^3 ohms when measured in a cell whose cell constant is 1.150. What will be the equivalent conductivity of the solution ?
- 2) a) What is electrochemical corrosion ? Explain the mechanism of electrochemical corrosion by taking rusting of iron as an example.
 - b) How are metals protected by cathodic protection ?
- 3) a) What are polymers ? How are they classified ?
 - b) Explain the free radical chain mechanism for the synthesis of polystyrene.
 - c) Write a short account on liquid crystal polymer.
- 4) a) What is hardness of water due to ? How is it expressed ? What are the types and units of hardness ?
 - b) Explain the determination of hardness of water by EDTA method.
 - c) Calculate the total, temporary and permanent hardness of a sample of water in degree French, degree Clarke, which showed the following analysis in ccm $\text{Ca}(\text{HCO}_3)_2 = 162$, $\text{MgCl} = 9.5$, $\text{CaSO}_4 = 13.6$, $\text{Mg}(\text{HCO}_3)_2 = 14.6$, organic matter = 12.5, $\text{NaCl} = 5.85$.
- 5) a) What are colloids and their applications in industry ?
 - b) Outline the applications of nanomaterials in the following fields.
 - i) Environmental pollution
 - ii) Consumer goods
- 6) a) What are fuels ? How are they classified ? Explain the advantages of solid fuels over liquid fuels.
 - b) How do you analyse flue gas by Orsats apparatus ?
 - c) Calculate the volume of air required for complete combustion of 1 cubic meter of a gaseous fuel having a composition of $\text{CO} = 46\%$, $\text{CH}_4 = 5\%$, $\text{H}_2 = 2\%$, acetylene = 1% and remaining CO_2 .
- 7) a) What is Gibbs phase rule ? Explain the different terms involved in phase rule ?
 - b) Give an application of phase rule to water system.
- 8) a) Give an account of composition and manufacture of portland cement.
 - b) Write a brief account on the following.
 - i) flash and fire point
 - ii) superconductor

Model Paper - II
Engineering Chemistry
(Common to All branches)

Time : 3 hrs**Max. Marks : 75****Answer any Five questions. All questions carry equal marks.**

- 1) a) State and explain Kohlrausch's law of independent migration of ions. What are the applications of Kohlrausch's law ?
b) Calculate the equivalent conductivity at infinite dilution for acetic acid from the following data. Equivalent conductance at infinite dilution for HCl, NaCl and CH₃COONa are respectively 436, 136 and 100 mho, Cm² equiv⁻¹.
- 2) a) What is corrosion ? Differentiate dry corrosion from wet corrosion. Explain the mechanism of pitting corrosion with a suitable illustrations.
b) Give a brief account on organic surface coatings.
- 3) a) Differentiate the following with suitable examples.
i) thermo plastic and thermoset resins
ii) chain and step polymerization
b) What is the composition of natural rubber ? Why is it elastic ? Explain the processing and vulcanization of natural rubber.
- 4) a) Explain the lime-soda process for the external treatment of boiler water with relevant chemical reactions involved .
b) Write a brief account on reverse osmosis for desalination of brackish water.
c) Calculate the amount of lime and soda required for the treatment of 1,000 litres of water containing the following dissolved salts. NaCl = 5.85 ppm, CaCO₃ = 50 ppm, Mg(NO₃)₂ = 14.8 ppm, CaCl₂ = 11.2 ppm, NaHCO₃ = 5.85 ppm
- 5) a) Explain the following properties of colloids with suitable examples.
i) Tyndall effect ii) Electrophoresis
b) What are nanomaterials ? How are they prepared ?
- 6) a) Give an account of the analysis of coal and its significance.
b) Explain the determination of calorific value by Junker's gas calorimeter.
c) Calculate the gross and net calorific value of coal having the following composition. C = 85%, H = 5%, S = 2%, N = 1%, the remainder ash. Latent heat of steam is 587 cal/gm.
- 7) a) With the help of a neat phase diagram explain the iron-carbon phase diagram.
b) What are two component systems ? How is it applicable to lead silver system ?
- 8) a) What are lubricants ? How are they classified ?
b) Explain the following properties.
i) cloud point ii) refractoriness and
iii) dielectric constant iv) viscosity

Model Paper - III
Engineering Chemistry
(Common to All branches)

Time : 3 hrs

Max. Marks : 75

Answer any Five questions
All questions carry equal marks.

* * * * *

- 1) a) What are single electrode potentials ? How are they measured and what is their significance ?
b) The emf of the cells obtained by combining the Zn and Cu electrodes of a Daniell cell with a normal calomel electrode are 1.083 V and -0.018 V respectively at 25 °C. If the potential of the calomel electrode is -0.28 V, find the emf of the Daniell cell.
- 2) a) What are the factors influencing the rate of corrosion ?
b) Give an account of the following metallic coatings with neat sketches.
i) Galvanization ii) Cementation
- 3) How are the following polymers prepared ? What are their properties and applications ?
i) Bakelite ii) PVC iii) Buna - S iv) Polyester
- 4) a) What are scales ? How are they formed ? What are the disadvantages and methods of prevention of scales ?
b) Give a brief account on electrodialysis for purification of water.
c) A zeolite softener was completely exhausted after purifying 1000 litres of water ? The softener required 100 litres of NaCl solution containing 120 mg / l. What is the total hardness of the water sample ?
- 5) a) Explain the different types of adsorption ?
b) What are adsorption isotherms ? Derive an expression for Langmuir adsorption isotherm ?
c) Write brief account on i) electro-osmosis ii) defense application of nanomaterials
- 6) a) Differentiate the following.
i) Catalytic cracking from thermal cracking
ii) liquid fuels from gaseous fuels.
b) What is meant by HCV and LCV of a fuel ? How do you determine the calorific value of a gaseous fuel.
- 7) a) What is meant by heat treatment of steel ?
b) What are the different crystalline changes which takes place during heat treatment ?
c) Explain the hardening and annealing of steel
- 8) a) Explain the different types of mechanism of lubrication.
b) What are refractories ? How are they classified ?
c) Give a comparative account on insulators, conductors, superconductors.

Model Paper - IV
Engineering Chemistry
 (Common to All branches)

Time : 3 hrs

Max. Marks : 75

Answer any Five questions
All questions carry equal marks.

- 1) a) What are concentration cells ? Explain the measurement of the emf of a concentration cell and its application.
 b) The emf of the cell
 $\text{Ag} | \text{AgI} \text{ in } 0.05 \text{ M KI} | \text{Sol } \text{NH}_4\text{NO}_3 | 0.05 \text{ M AgNO}_3 | \text{Ag}$ is 0.788 at 25 °C. The activity co-efficient of KI and silver nitrate in the above solution is 0.90 each. Calculate
 i) the solubility product of AgI and
 ii) the solubility of AgI in pure water at 25°C
- 2) a) Explain the following different types of corrosion mechanisms with their chemical reactions and neat sketches.
 i) Differential aeration corrosion ii) Water-line corrosion
 iii) Corrosion followed by evolution of oxygen
 b) What is electroplating ? How are metals protected by electroplating and give an account of its applications.
- 3) a) What are plastics ? How are they classified ?
 b) Explain the compounding and the following fabrication techniques.
 i) injection moulding ii) extrusion moulding
 c) Give an account of the conducting polymers and their applications.
- 4) a) Explain the mechanism of purification of water by ion-exchange process and give its significance ?
 b) Write an account on caustic embrittlement of boiler plates.
 c) 0.01 gm of CaCO_3 was dissolved in dilute HCl and the solution was made upto 1 litre with distilled water. 100 ml of this solution required 28 ml of EDTA for titration. 100ml of water sample required 30 ml of same EDTA solution for titration. After boiling 100 ml of this water cooling, filtering etc required 15 ml of EDTA for titration. Calculate temporary and permanent hardness of water.
- 5) a) Derive an expression for BET adsorption isotherm and its application.
 b) Write short notes on i) micelles ii) applications of nanomaterials in medicine
- 6) a) What is meant by knocking of petrol engines ? What is the structure of knocking, its disadvantages and prevention ?
 b) Explain the following.
 i) Bergius process ii) Natural gas
- 7) a) Explain the following with suitable examples.
 i) phase ii) component iii) degree of freedom iv) annealing
 b) What is meant by eutectic point ? How is it applicable to two component systems like lead - silver system.
- 8) a) What is the composition of portland cement ?
 b) Explain the criteria of a good refractory material.
 c) Write a brief account on applications of superconductors.

Model Paper - V
Engineering Chemistry
 (Common to All branches)

Time : 3 hrs

Max. Marks : 75

Answer any Five questions. All questions carry equal marks.

* * * * *

- 1) Differentiate a) Primary, secondary and fuel cells.
 b) Metallic, electrolytic and electrochemical cells.
 c) What is a single electrode potential for a half cell for Zn electrode dipped in a 0.05 M Zn solution ? ($E^\circ = 0.763$ volts)
- 2) a) Why metals undergo corrosion ? What are the units to express corrosion ? Give a brief account of different types of corrosion.
 b) How are the metal surfaces prepared before giving a protective coating ?
 c) Give an account of the protection of metal surface by metal cladding ?
- 3) a) What is meant by degree of polymerization ? Explain the different types of polymerization.
 b) Write short notes on the following.
 i) Thiokol rubber ii) Fibre reinforced plastics iii) Nylon
- 4) a) What are zeolites ? How are they classified ? What is their composition ? Explain the softening of boiler feed water by zeolite process.
 b) Give an account of the reasons, disadvantages and prevention of boiler corrosion.
 c) Calculate the amount of lime and soda required for purification of 10,000 litres of H_2O containing the following dissolved salts per litre : $CaSO_4 = 13.6$ mg, $MgCO_3 = 14.6$ mg, $CO_2 = 4.4$ mg, $HCl = 3.65$ mg, $Al_2(SO_4)_3 = 34.2$ mg, $NaCl = 11.7$ mg. 10% excess chemical were added.
- 5) a) Differentiate the following with suitable examples.
 i) Adsorption and absorption ii) Lyophilic and lyophobic sols
 b) Write a brief account on the following.
 i) Chemisorption ii) Preparation of nano materials iii) Electrodialysis
- 6) a) What is calorific value of a fuel ? What are the units to express calorific value ? Differentiate HCV from LCV.
 b) Explain the Fischer - Tropsch process for the synthesis of petrol.
- 7) a) Give a brief account on eutectic characteristics and its applications.
 b) How is iron-carbon phase diagram applicable to heat treatment process of annealing and hardening
- 8) a) Give an account of setting and hardening of cement with suitable chemical equations involved.
 b) Differentiate electrical insulators from thermal insulators.
 c) Give a brief account on
 i) Pour point ii) Dimensional stability of refractories