

M.Sc. ENVIRONMENTAL SCIENCE
First Semester
Environmental Chemistry
(MEV - 02)

Duration: 3Hrs.

Full Marks: 70

Part-A (Objective) =20
Part-B (Descriptive)=50

(PART-B: Descriptive)

Duration: 2 hrs. 40 mins.

Marks: 50

1. Answer the following questions in brief (any five)

2 × 5 =10

- Calculate the hydrogen ion concentration in moles per litre of a solution whose pH is 5.40.
- Why phenol is acidic in nature? Explain.
- Define oxidation-reduction reactions with examples.
- Define the following terms
 - Open system
 - Closed system
 - Reversible process
 - Irreversible process.
- Write a short note on water hardness.
- What is humus? In which layer soil profile humus is found.
- What is soil texture? Write different mineral particles in soil with their diameter size.

2. Answer the following questions (any five)

3 × 5 =15

- Differentiate lyophobic colloids from lyophilic colloids.
- Discuss the role of CFC in removing ozone in the stratosphere with appropriate mechanism.
- Write a short note on atmospheric aerosols.
- Define entropy and write the mathematical relations of entropy with internal energy and enthalpy.
- Write the principles of Spectrophotometric method of Fluoride estimation in a water sample.
- What is soil profile? Give diagrammatic representation of a typical soil profile.
- Discuss the physical properties of water.

3. Describe the following questions in details (any five)

5 × 5 = 25

- a) Define pesticides. What are the uses of pesticides? Write briefly about the environmental effects of pesticides.
- b) What are surface active agents? Discuss the micellization process of surfactants. How surfactants are classified into various groups? Explain with examples.
- c) Define chemical potential and show that the total Gibbs free energy change for an open system
$$dG_{T,P} = \sum \mu_i dn_i$$
where μ_i and n_i are the chemical potential and number of moles of the i^{th} component, respectively.
- d) What is salt hydrolysis? Deduce the relations between hydrolysis constants (K_h) and the acid and base dissociation constants (K_a and K_b) for the hydrolysis of (a) salts of strong acid and weak base and (b) salts of weak acid and strong base.
- e) How soil is formed by chemical weathering process from a parent rock?
- f) Write the estimation method of either Arsenic or Mercury in a water sample.
- g) Discuss any one method of estimation of Dissolved Oxygen (DO) in water sample.

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(The figures in the margin indicate full marks for the questions)

Duration: 20 minutes

Marks – 20

PART A- Objective Type

1. Choose the correct answer from the following options:

1 × 20 = 20

- i) In the reaction: $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$,
(a) Water acts as a base
(a) Water acts as an acid
(b) Water acts as a neutral species
(c) Water acts as a solvent
- ii) The correct expression for pK_w is:
(a) $pK_w = pH + pOH$
(b) $pK_w = [\text{H}_3\text{O}^+][\text{OH}^-]$
(c) $pK_w = \log[\text{H}_3\text{O}^+] + \log[\text{OH}^-]$
(d) $pK_w = \log[\text{H}_3\text{O}^+] - \log[\text{OH}^-]$
- iii) Which of the following species is a Lewis base?
(a) BF_3 (b) BCl_3 (c) $(\text{CH}_3)_3\text{N}$ (d) HClO_4
- iv) Dispersion of a liquid into a solid is called:
(a) Sol (b) gel (c) emulsion (d) hydrosol
- v) Which of the following is not a characteristic of lubricants?
(a) Low freezing point
(b) Low boiling point
(c) Thermal stability
(d) Corrosion prevention
- vi) The characteristic of fumigants is:
(a) Kill fungi
(b) Kill snails
(c) Kill eggs of insects
(d) Produce gas or vapor intended to destroy pests in buildings or soil

- vii) Xenon is present in the atmosphere as a:
 (a) major component (b) minor component (c) trace component (d) appreciable component
- viii) Which one of the following is a major green house gas?
 (a) H₂O (b) CH₄ (c) N₂ (d) O₂
- ix) Which one of the following is not a form of energy?
 (a) Heat (b) Work (c) Internal energy (d) Volume
- x) Entropy of a system is a measure of
 (a) orderness (b) disorderness (c) pressure (d) free energy
- xi) Peroxyacyl nitrates are powerful:
 (a) catalysts for O₃ depletion (b) acid rain producer (c) greenhouse gas (d) eye irritant
- xii) Ozone layer is well-known for the absorption of which harmful radiations:
 (a) X-rays (b) UV rays (c) Visible rays (d) α – rays
- xiii) Ozone can be destroyed by a number of free radical catalysts, one of the most important radicals is:
 (a) iodine radical (b) ammonium radical (c) methyl radical (d) hydroxyl radical
- xiv) Which one will form a concentrated aqueous solution at 25°C:
 (a) CaSO₄ (b) SrSO₄ (c) PbSO₄ (d) Hg₂I₂
- xv) Diameter size of a fine sand particle is
 a) 0.2 – 2.0 mm b) 0.02 – 0.20 mm c) 2.0 – 5.0 mm d) less than 0.002 mm
- xvi) When soil colour is inherited from the parental material, it is called
 a) Genetic colour b) Acquired colour c) Lithochromic colour d) None of above
- xvii) Which of the following is not readily available for plants
 a) Hygroscopic water b) capillary water
 c) gravitational water d) none of above
- xviii) DO can be estimated by
 a) Winkler method b) Iodometric method
 c) both a & b d) none of above
- xix) Which of the following is responsible for water hardness
 a) Ca b) Mg
 c) both a & b d) none of above
- xx) Fluoride is estimated by
 a) Gravimetric method
 b) Alizarin S visual method
 c) Winkler method
 d) Nessler method
