P. P. SAVANI UNIVERSITY

Fifth Semester of B.Sc. Examination

Dec.-2021

SSES3150-Environmental Chemistry

14.12.2021, Tuesday **Time: 12:30 p.m. to 03:00 p.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

Section-I (Total Marks - 30)

Q.1 Short Questions **[10]**

1.1 Objectives **[05]**

1.1a The theory of ionization stems from a doctoral dissertation completed by:

- **A** Svanstrom in 1993
- **B** Arrhenius in 1887
- **C** Amedeo Avagadro in 1889
- **D** Jacob Berzilius 1848

1.1b Fundamental concept of solubility product is :

- **A** All solids, no matter how insoluble, are soluble to some degree.
- **B** All solids, no matter how insoluble, are insoluble to some degree.
- **C** All liquids, no matter how insoluble, are soluble to some degree.
- **D** All liquids, no matter how insoluble, are insoluble to some degree.

1.1c The adverse effect that unrelated ions often have upon solubility of some relatively insoluble substances is:

- **A** Binary mixture
- **B** Tyndall effect
- **C** Common ion effect
- **D** Diverse ion effect

1.1d At certain mole ratios have vapor pressures less than either of the components and, consequently, at these ratios have boiling points that are greater than either of the components. This property is exhibited by which class binary mixtures?

- **A** Class I binary mixtures
- **B** Class II binary mixtures
- **C** Class III binary mixtures
- **D** Class IV binary mixtures

1.1e Finely divided $CaSO_4$ dissolves to the extent of:

- **A** 2.15 g/L at 25°C
- **B** 2.08 g/L at 25°C
- **C** 2.54 g/L at 25°C
- **D** 2.67 g/L at 25°C

1.1f The movement of a solvent through a membrane that is impermeable to a solute is:

- **A** Ionization product
- **B** Solvent extraction
- **C** Dialysis
- **D** Osmosis

1.1g The equilibrium constant, K is known as:

- **A** Distribution coefficient
- **B** Substitution coefficient
- **C** Molar ratio
- **D** None of the above

1.1h Butane occurs in how many isomeric forms?

- **A** 1
- **B** 4
- **C** 2
- **D** 6

1.1i Ozonides react readily with water to form:

- **A** Aldehydes
- **B** Ketones
- **C** Alcohols
- **D** Ozone

1.1j Pyrrole and pyrrolidine are examples of compounds having:

- **A** 2 membered ring containing N
- **B** 3 membered ring containing N
- **C** 4 membered ring containing N
- **D** 5 membered ring containing N

1.2 Answer the Following: (True/False/Short Question/Fill in the Blanks) **[05]**

1.2a An amphoteric hydroxide does not form complexes with hydroxides. (True/False)

1.2b Define mole fraction.

1.2c Define catalysis.

1.2d Write a chemical reaction for formation of formaldehyde by oxidation of methanol

1.2e The carbon atoms in aromatic compounds have only one covalent bond in contrast to those with aliphatic compounds with two. (True/False)

Q.2 Short Notes (attempt any two) **[06]**

A Explain the principles of solvent extraction.

B What are heterocyclic compounds? Give example along with chemical structure.

C What are haloacetic acids (HAA)? Write structures of mono, di and trichloroacetic acids

Q.3 Explain in detail (attempt any two) **[14]**

A Define binary mixtures. Explain class I binary mixtures with the help of diagram.

B What are hydroxyacids? Give 2 examples. How lactic acid is optically active? Explain.

C What are complex sugars or disaccharides? Explain the chemical structure and properties of sucrose, maltose and lactose.

Section-II (Total Marks - 30)

Q.1 Short Questions (10)

1.1 Objectives (05)

1.1a DDT is an example of:

- **A** Organic phosphorous pesticide
- **B** Chlorinated pesticide
- **C** Carbamate pesticide
- **D** None of the above

1.1b Many consider colloids in water to be those particles with diameter less than:

- **A** 1 micrometer
- **B** 100 micrometer
- **C** 1000 micrometer
- **D** 10 micrometer

1.1c Fog and smog are examples of colloidal dispersions of?

- **A** Solids in air
- **B** Liquids in air
- **C** Solids in liquid
- **D** Liquid in liquid

1.1d The most common method of destabilizing hydrophobic colloids is by:

- **A** Addition of electrolytes
- **B** Removal of electrolytes
- **C** Freezing of colloids
- **D** None of the above

1.1e Photochemical smog is formed by the reaction between:

- **A** Carbons and oxides of nitrogen
- **B** Carbons and amines
- **C** Hydrocarbons and oxides of oxygen
- **D** Hydrocarbons and oxides of nitrogen

1.1f What is the range of CO_2 acidity?

- **A** 1 to 4
- **B** 4 to 8
- **C** 8 to 10
- **D** None of the above

1.1g The permissible limit to discharge COD is:

- **A** Less than 250 mg/L
- **B** Less than 25 mg/L
- **C** Less than 5 mg/L
- **D** Less than 500 mg/L

1.1h The Winkler method is used to determine:

- **A** Alkalinity
- **B** Dissolved oxygen
- **C** Ammonia
- **D** Sulfate

1.1i Denitrification is:

- **A** Conversion of nitrogen gas (N_2) into nitrate (NO_3^-)
- **B** Ammonium (NH_4^+) is oxidized and converted into the nitrate (NO_3^-)
- **C** Conversion of nitrate (NO_3^-) into nitrogen gas (N_2)
- **D** None of the above

1.1j Soxhlet apparatus is used for determination of:

- **A** Grease
- **B** Volatile acids

C Fatty acids
D All of the above

1.2 Answer the Following: (True/False/Short Question/Fill in the Blanks) [05]

1.2a Define hydrophilic colloids.

1.2b Soaps and detergents are excellent emulsifying agents. (True/False)

1.2c Under _____ conditions sulfate ion is reduced to sulfide ion. (Fill in the blanks)

1.2d Name any one method to determine volatile acids in wastewater.

1.2e Write any one application of BOD data.

Q.2 Short Notes (attempt any two) [06]

A What are fats, oils and waxes?

B Explain Tyndall effect.

C Define BOD and COD. Why COD values are always higher than BOD values?

Q.3 Explain in detail (attempt any two) [14]

A Explain colloidal dispersions of solids in liquids.

B Explain nitrogen cycle with the help of flow diagram.

C Explain sulfur cycle with the help of flow diagram.