

DEPARTMENT OF CHEMISTRY
NAMBOL L. SANOI COLLEGE, NAMBOL

QUESTION BANK FOR CHEMISTRY (ELECTIVE)
PREVIOUS 5 YEARS (2016-2020)

SEMESTER - II
PAPER-II / CHM 202 :

(SECTION-A) INORGANIC CHEMISTRY

UNIT-1: Acids and Bases

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

- (a) Give one limitation of Lewis theory of acids and bases. **(2019)**

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)

- (a) Write down the conjugate acids and bases of the following:
 CO_3^{2-} and H_2SO_4 **(2017)**
- (b) State with reason, which one of the pair H_2O , H_3O^+ will be stronger acid or stronger base. **(2018)**
- (c) Why is HI a stronger acid than HF? **(2019)**

SHORT ANSWER TYPE
(3 MARKS QUESTIONS)

- (a) Explain the different types of Lewis acid with appropriate examples. **(2017)**
- (b) Explain how molecules BF_3 , PF_5 and CO_2 behave as Lewis acids. **(2018)**
- (c) State and explain Lux-Flood theory of acids and bases with suitable example. **(2019)**

UNIT-2: Oxidation and Reduction

Very Short Answer Type Carrying 1 mark
(1 MARK QUESTIONS)

- (a) Why is standard electrode potential values for different electrode systems are different? **(2017)**
- (b) What is oxidation potential? **(2018)**
- (c) What is reduction potential? **(2019)**

SHORT ANSWER TYPE
(2 MARKS QUESTIONS)

- (a) Explain the uses of reduction potential to determine –
 (i) the relative strength of the reducing and oxidizing agents;
 (ii) whether a reaction will take place or not. **(2017)**
- (b) A solvent with high dielectric constant is termed as a good ionizing solvent. Give reason. **(2017)**
- (c) Metallic tin reacts with dilute nitric acid to form stannous nitrate and ammonium nitrate. Balance the reaction by oxidation number method. **(2018)**
- (d) Aqueous solution of sulfur dioxide reacts with hydrogen sulfide to form sulfur and water. Balance the reaction by oxidation number method. **(2019)**

SHORT ANSWER TYPE

(3 MARKS QUESTIONS)

- (a) Balance the following equation by oxidation number method :
 $\text{Zn} + \text{HNO}_3 \rightarrow \text{Zn}^{2+} + \text{N}_2\text{O} + \text{H}_2\text{O}$ (2017)
- (b) Show how the pH of the medium influences the e.m.f. of a cell. (2018)
- (c) "Concentration of the reacting species in a half cell greatly influence the potential of a system." Explain with suitable example. (2019)

UNIT-3: Non-aqueous solvents**Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) What are aprotic solvents? (2017)
- (b) What is leveling solvent? (2017)
- (c) Give an example of reaction in liquid SO_2 . (2018)
- (d) Mention the role of liquid ammonia as solvent in complex formation. (2018)
- (e) What are protogenic solvents? (2019)
- (f) Why do $[\text{N}(\text{CH}_3)_4]_2\text{SO}_3$ acts as a base in liquid SO_2 ? (2019)

SHORT ANSWER TYPE

(3 MARKS QUESTIONS)

- (a) Describe the reactions of liquid ammonia solvent under the following heads :
 (i) Solvolysis reactions
 (ii) Solvation reaction
 (iii) Amphoteric reaction (2017)

(5 MARKS QUESTIONS)

1. Explain the role of melting point, viscosity, dielectric constant, dipole moment and auto ionization in deciding the solubility of substances in various solvents. (2018)
2. (a) Give the reaction of the following in liquid NH_3 as solvents :
 (i) Protolysis of amino acids
 (ii) Amphoterism
 (iii) Complex formation
3. Show that NH_4Cl acts as a strong acid in liquid NH_3 . (2019)

UNIT-4: Chemistry of s-block elements**Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) Give one important application of alkaline earth metal in biological system. (2017)
- (b) Give a reason for hydration energy of the alkali metal decreases with increasing ionic radii. (2017)
- (c) What is diagonal relationship? (2018)
- (d) How does the basic strength of the alkaline earth metal hydroxides vary within the group? (2018)
- (e) Why do alkali metals not form bivalent cations? (2019)

SHORT ANSWER TYPE

(2 MARKS QUESTIONS)

- (a) Why do alkali metals have less tendency to form metal complexes with unidentate ligands but form highly stable complexes with ligands like crown ethers? (2018)

- (b) Why are the solutions of alkali metals in liquid ammonia blue-coloured and reducing in nature? (2019)

SHORT ANSWER TYPE

(3 MARKS QUESTIONS)

- (a) Arrange the ions Li^+ , K^+ , Na^+ , Cs^+ and Rb^+ in the increasing order of (i) degree of hydration and (ii) electrical conductivity. (2018)
- (b) Write three similar chemical reactions of Li and Mg which are different from other alkali metals. (2019)

(5 MARKS QUESTIONS)

1. Compare a typical alkali metal with a typical alkali earth metal with respect to (a) ionization potential, (b) ionic size, (c) reducing properties, (d) melting point and (e) solubility of their compounds. Account for similarities and differences. (2017)

(SECTION-B) ORGANIC CHEMISTRY**UNIT-1: Stereochemistry of organic compounds****Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) How many stereogenic centres are present in 2,3-dibromobutane? (2017)
- (b) Draw the Fischer structure of *erythro* form of 2,3-dibromobutane. (2018)
- (c) What are enantiomers? (2018)
- (d) What is stereogenic centre? (2019)

SHORT ANSWER TYPE

(2 MARKS QUESTIONS)

- (a) What are diastereomers? Give example. (2017)
- (b) Define centre of symmetry. Give an example. (2018)
- (c) Define geometrical isomerism. Write the structure of hexa-2E, 4E-diene. (2018)
- (d) List the symmetry elements of BCl_3 molecule. (2019)
- (e) What are meso-compounds? Give an example. (2019)

(5 MARKS QUESTIONS)

- (a) What are the axial bonds and equatorial bonds in the conformation of cyclohexane ring? Draw the structure of the most stable chair conformation of trans-1,2-dichloro cyclohexane. Give reason for its stability. (2017)
- (b) What are conformations? Draw the Newman projection structure of the conformational isomers of n-butane and give their stability order. (2018)
- (c) What are axial and equatorial bonds in the chair form of cyclohexane? Tertiary butyl cyclohexane does not undergo ring flipping. Give reason. (2019)

UNIT-2: Arenes and aromaticity**Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) Why are all the carbon-carbon bonds in benzene of the same length? (2017)
- (b) Draw the energy profile diagram of a general aromatic electrophilic substitution reaction. (2017)

- (c) The double bonds in benzene ring are resistant to addition reactions. Give reason. (2018)
 (d) Identify the electrophile involved in nitration reaction with HNO_3 and H_2SO_4 . (2019)
 (e) Why do the carbon-carbon bonds in benzene have the same in length? (2019)

SHORT ANSWER TYPE

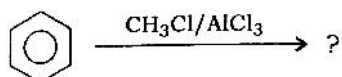
(2 MARKS QUESTIONS)

- (a) Using Hückel rule, explain the aromaticity of cyclopropenyl cation. (2017)
 (b) Write Hückel's rule for aromaticity. (2018)
 (c) Why is cyclopropenyl cation aromatic? (2019)

SHORT ANSWER TYPE

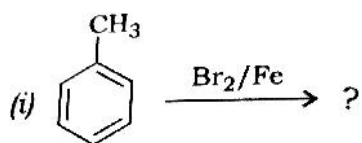
(3 MARKS QUESTIONS)

- (a) Give the product and provide the relevant mechanism of the following reaction :



(2018)

- (b) Write the products and provide plausible mechanism of the following reaction :



(2019)

UNIT-3: Alkyl halides and aryl halides**Very Short Answer Type Carrying 1 mark**

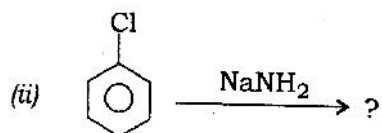
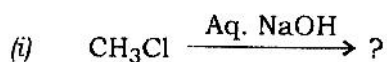
(1 MARK QUESTIONS)

- (a) Give the product formed when benzene diazonium chloride is treated with $\text{HCl}/\text{Cu}_2\text{Cl}_2$. (2017)
 (b) Why is chlorine in chlorobenzene deactivating the ring towards electro philic attack? (2018)
 (c) R-2-chlorobutane undergoes hydrolysis reaction with aqueous sodium hydroxide by $\text{S}_{\text{N}}1$ mechanism. What will be the burp products? (2019)

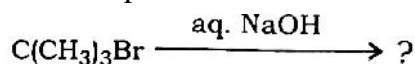
SHORT ANSWER TYPE

(3 MARKS QUESTIONS)

- (a) Give the product and provide the relevant mechanism of the reactions :

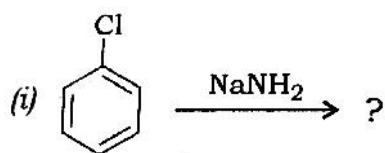


- (b) Give the product and write the relevant mechanism of the following reaction :



(2018)

- (c) Write the products and provide plausible mechanism of the following reaction :



(2019)

UNIT-4: Alcohols**Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) Write the systematic name of $\text{CH}_2\text{OHCH}_2\text{OH}$. (2017)
- (b) What is the systematic name of glycerol? (2018)
- (c) What are trihydric alcohols? (2019)

SHORT ANSWER TYPE

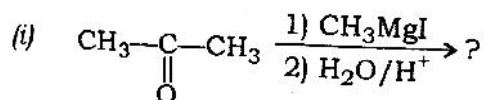
(2 MARKS QUESTIONS)

- (a) *meso*-Butane-2,3-diol has two chiral carbon atoms but is achiral in nature. Give reason. (2017)

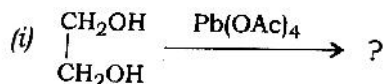
SHORT ANSWER TYPE

(3 MARKS QUESTIONS)

- (a) Give the product and provide the relevant mechanism of the reaction : (2017)



- (c) How will you convert acetaldehyde to propan-2-ol? What happens when glycerol is added slowly into a mixture of concentrated nitric acid and concentrated sulphuric acid? (2018)
- (d) Write the products and provide plausible mechanism of the following reaction : (2019)

**(SECTION-C) PHYSICAL CHEMISTRY****UNIT-1: Solutions****Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) What is the effect of adding 1 molar KCl solution on the lower solution at critical solution temperature of triethylamine water system? (2017)
- (b) Thermodynamically what are ideal solutions? (2017)
- (c) What is the effect of temperature on the solubility of gases in liquids? (2017)
- (d) State Nernst distribution law. (2017)
- (e) Why it is not possible to separate a mixture of ethanol and water (95.6: 4.4 ratio) by fractional distillation? (2018)
- (f) State Henry's law. (2018)
- (g) Define an ideal solution. (2018)
- (h) What are azeotropic mixtures? (2019)

SHORT ANSWER TYPE

(2 MARKS QUESTIONS)

- (a) What type of non-idealities are exhibited by (i) ethanol and water, (ii) water and acetic acid? Give reason for your answer. (2017)
- (b) Iodine is shaken with a mixture of water and carbon tetrachloride at constant temperature. Calculate the solubility of iodine in carbon tetrachloride, if the solubility in water at that temperature is $0.34 \text{ g litre}^{-1}$ and the distribution coefficient is 85. (2018)

- (c) What is critical solution temperature? What is the effect of impurities on the CST? (2018)
 (b) Explain why we cannot prepare absolute alcohol by fractional distillation. (2019)

SHORT ANSWER TYPE

(3 MARKS QUESTIONS)

- (a) State and explain Raoult's law. (2019)

UNIT-2: Dilute Solutions**Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) Define cryoscopic constant. (2019)

SHORT ANSWER TYPE

(3 MARKS QUESTIONS)

- (a) Calculate the osmotic pressure of 5% urea solution at 27 °C. (2017)
 (b) The boiling point of pure water is 100 °C and its latent heat of vaporization is 540 cal/g. Calculate its ebullioscopic constant.

(5 MARKS QUESTIONS)

- (a) What are colligative properties? Calculate the molecular mass of the compound, if a solution containing 10 g of the compound in 100 g of water lowers the vapour pressure from 17.5 mm of Hg to 17.4 mm of Hg at 20 °C. (2018)
 (b) Prove that $\Delta T_b = K_b \cdot m$. (2019)

UNIT-3: Colloids and Surface Chemistry**Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) What are emulsions? (2017)
 (b) A ferric hydroxide sol is precipitated by 2 ml of 9.0 m M KCl solution but the same sol is precipitated by same volume of 0.09 m M AlCl₃ solution. Which one of the two electrolytes has higher precipitating power? (2018)
 (c) What are emulsions? (2019)

SHORT ANSWER TYPE

(2 MARKS QUESTIONS)

- (a) Derive Langmuir adsorption isotherm. (2018)
 (b) Write in brief one optical property of a colloidal solution. (2019)

SHORT ANSWER TYPE

(3 MARKS QUESTIONS)

- (a) Write brief notes on Tyndall effect and Brownian movement. (2018)
 (b) Discuss the origin of charge of colloidal particles. (2019)

(5 MARKS QUESTIONS)

- (a) What are the basic assumptions of Langmuir adsorption of isotherm? Derive Langmuir adsorption isotherm. (2017)

UNIT-4: Thermodynamics-1**Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) What are extensive variables? **(2018)**
- (b) State zeroth law of thermodynamics. **(2019)**
- (c) Which of the following is an extensive property?
Molar mass, Volume, Density **(2019)**

SHORT ANSWER TYPE

(2 MARKS QUESTIONS)

- (a) Which of the properties, (i) 5 kg of sugar, (ii) 0.1 N solution of sodium chloride, (iii) refractive index of glass and (iv) molar heat of glucose, are extensive and intensive properties? **(2017)**
- (b) Show that $\left(\frac{dT}{dP}\right)_H = \tilde{\gamma}_T$, where symbols carry their usual meanings. **(2017)**
- (c) Calculate the work done when one mole of an ideal sulphur dioxide gas expands isothermally at 300 K from $3.64 \times 10^{-3} \text{ m}^3$ to $36.4 \times 10^{-3} \text{ m}^3$. **(2019)**

SHORT ANSWER TYPE

(3 MARKS QUESTIONS)

- (a) Calculate the work done when $1.6 \times 10^{-3} \text{ kg}$ of oxygen at 300 K expanded isothermally and reversibly till the volume is doubled. **(2017)**
- (b) Derive the relationship $\Delta H = \Delta E + \Delta nRT$, where the symbols have their usual significances. For the reaction
 $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$, what will be the ΔE value if ΔH is -44 kcal at 25 °C? **(2018)**
- (c) What is molar heat capacity of a system? For an ideal gas, show that $C_p - C_v = R$. **(2018)**
- (d) Show that

$$\tilde{\gamma}_T = -\frac{\left(\frac{dH}{dP}\right)_T}{C_p} \quad \textbf{(2019)}$$