

**DEPARTMENT OF CHEMISTRY**  
**NAMBOL L. SANOI COLLEGE, NAMBOL**

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

**SEMESTER - IV**  
**PAPER-IV / CHM 404 :**

**(SECTION-A) INORGANIC CHEMISTRY**

**UNIT-1: Chemistry of Lanthanides**

**Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) Write the general electronic configuration of lanthanides. (2017)  
(b) Why are lanthanides known as rare earth metals? (2018)  
(c) Write the general electronic configuration of f-block elements. (2018)  
(d) Give one of the uses of lanthanide compounds. (2019)

**SHORT ANSWER TYPE**

(2 MARKS QUESTIONS)

- (a)  $\text{Eu}^{2+}$  is a strong reducing agent. Explain it. (2017)  
(b) Write two consequences of lanthanide contraction. (2019)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (a) How do the lanthanides react with HCl, water and oxygen? (2017)  
(b) Write a brief note on the oxidation states of lanthanones on the basis of electronic configuration. (2019)

**(5 MARKS QUESTIONS)**

1. What is lanthanide contraction? How does it affect the physical and chemical properties of the elements of lanthanide series? (2018)

**UNIT-2: Chemistry of Actinides**

**Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) What are actinides? (2017)  
(b) Mention the position of actinides in the periodic table. (2017)  
(c) Give the electronic configuration of uranium (Atomic No. 92). (2017)  
(d) Why are actinides radioactive? (2018)  
(e) What is the reason for actinide contraction? (2018)  
(f) Why do actinides have a higher tendency to form complexes than lanthanides? (2019)

**SHORT ANSWER TYPE**

(2 MARKS QUESTIONS)

- (a) Give the variation in magnetic properties and reducing power of actinides. (2019)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (a) "Actinide elements are highly electropositive and chemically very reactive." Illustrate it. (2017)  
 (b) Give three important similarities between later actinides and later lanthanides. (2018)  
 (c) Explain the production of plutonium by giving chemical reactions. (2019)

**UNIT-3: Chemistry of noble gases****Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) Mention one source from which helium can be obtained. (2017)  
 (b) What are clathrate compounds? (2018)  
 (c) Give one use of noble gases. (2019)

**SHORT ANSWER TYPE**

(2 MARKS QUESTIONS)

- (a) Why are noble gas compounds common in Xe? (2017)  
 (b) Describe briefly the isolation of noble gases. (2018)  
 (c) Discuss the structure and bonding in xenon tetrafluoride. (2019)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (a) What are clathrate compounds of noble gases? Describe the clathrate compounds of noble gases with quinol. (2017)  
 (b) Discuss the structure and properties of XeF<sub>2</sub>. (2018)  
 (c) Write the principle and briefly explain separation of noble gases by Dewar's charcoal method. (2019)

**UNIT-4: Hard and soft acids and bases****Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) What is symbiosis? (2019)  
 (b) What is the theoretical basis of hardness and softness of acids and bases? (2019)

**SHORT ANSWER TYPE**

(2 MARKS QUESTIONS)

- (a) What is symbiosis? Give examples. (2017)  
 (b) Describe example. 'symbiosis' with suitable example. (2018)  
 (c) Discuss the theoretical basis of hardness and softness of acids and bases. (2018)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (a) Describe the application of SHAB principle in the occurrence of ores and minerals in nature and poisoning of metal catalyst. (2018)

**(5 MARKS QUESTIONS)**

- Discuss the applications of HSAB principle with examples. How can electronegativity be used to explain hardness and softness of acids and bases? (2017)
- What is Pearson's HSAB principle? On the basis of the principle – (2019)
  - identify the feasible reaction of the following:
    - $\text{LiI} + \text{CsF} \rightarrow \text{LiF} + \text{CsI}$
    - $\text{BeF}_2 + \text{HgI}_2 \rightarrow \text{HgF}_2 + \text{BeI}_2$
  - arrange the hydrogen halides in increasing stability.

**(SECTION-B) ORGANIC CHEMISTRY****UNIT-1: Carboxylic acids****Very Short Answer Type Carrying 1 mark**

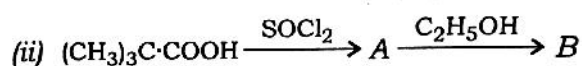
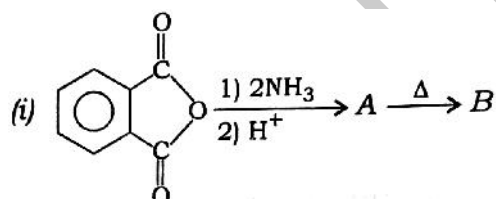
(1 MARK QUESTIONS)

- What happens when toluene is oxidised with  $\text{KMnO}_4$  solution? (2017)
- Give the reaction to convert malic acid into maleic acid. (2018)
- What is the specificity of Hell-Volhard-Zelinsky reaction? (2018)
- Why is chloroacetic acid stronger than acetic acid? (2019)

**SHORT ANSWER TYPE**

(2 MARKS QUESTIONS)

- Give the synthesis of malic acid starting from succinic acid. (2017)
- Identify the products A and B formed in the following reactions : (2018)



- How can acetic acid be converted to ethanol? (2019)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- Explain the 'stepped up' of carboxylic acid series via acid chlorides in the form of reactions. (2018)
- Write the synthesis of citric acid starting from glycerol. (2019)

**UNIT-2: Carboxylic acid derivatives****Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- What is the reactivity order of acyl derivatives of carboxylic acid towards nucleophiles? (2017)
- The  $-\text{NH}_2$  in carboxylic acid amides is not basic. Give reason. (2019)

**SHORT ANSWER TYPE**

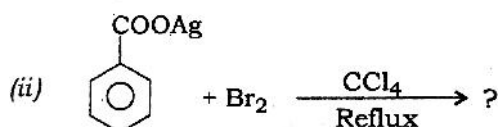
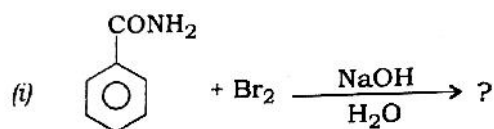
(2 MARKS QUESTIONS)

- (a) Write the reaction steps to convert acetyl chloride into (i) acetic anhydride and (ii) acetamide. (2017)
- (b) Identify the products A and B formed in the following reaction : (2018)
- (i)  $\text{CH}_3\text{CHO} + \text{BrCH}_2\text{COOC}_2\text{H}_5 + \text{Zn} \xrightarrow{\text{ether}} \text{A}$   
 $\xrightarrow{\text{H}_3\text{O}^+} \text{B}$

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (a) Complete the following reactions and provide relevant mechanisms : (2017)



- (b) Write the mechanism of acid catalyzed nucleophilic acyl substitution reaction. (2018)

(5 MARKS QUESTIONS)

- (a) How can acetyl chloride be converted to ethyl acetate? Write a plausible mechanism of the reaction when the ester is hydrolyzed in the presence of an acid catalyst. (2019)

**UNIT-3: Organometallic compounds****Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) What happens when diethyl zinc reacts with ethyl alcohol? (2017)
- (b) Why are organolithium compounds more reactive than Grignard reagent? (2018)
- (c) What happens when triethylaluminium is treated with zinc chloride in dry ether? (2019)

**SHORT ANSWER TYPE**

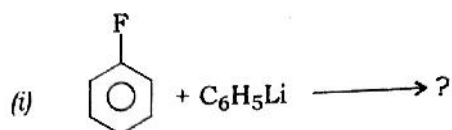
(2 MARKS QUESTIONS)

- (a) How is  $\text{CH}_3\text{MgI}$  used in the preparation of (i) 2-propanol and (ii) t-butyl alcohol? (2017)
- (b) Dry ether cannot be used as solvent in the synthesis of organolithium compounds. Give reason. (2019)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (a) Complete the following reaction and provide relevant mechanisms : (2017)



- (b) How do Grignard reagents react with primary, secondary and tertiary amides? (2018)
- (c) Grignard reagents can be used for detection of active hydrogen atoms in organic compounds. Explain with an example. (2019)

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

(1 MARK QUESTIONS)

- (a) Write the monomer of Teflon. (2017)
- (b) Give the structure of 'silicone rubber'. (2017)
- (c) Give the repeating unit of polyurethane polymers. (2018)
- (d) Name the plasticiser used to soften polyvinyl chloride which is stiff and hard. (2018)
- (e) What are blended fibres? (2019)
- (f) Identify the monomer of Nylon-6. (2019)

**SHORT ANSWER TYPE**

(2 MARKS QUESTIONS)

- (a) What are synthetic rubbers? Give an example. (2019)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (b) Write the mechanism of anionic polymerization of caprolactam to produce Nylon-6. (2019)

**(5 MARKS QUESTIONS)**

- (a) What types of monomer undergo addition polymerization? Discuss the mechanism for the polymerization of styrene in the presence of benzoyl peroxide. Mention the configuration of such polymers. (2017)
- (b) Write two points to differentiate thermoplastics from thermosetting plastics. Discuss the mechanism of polymerization of isobutene in the presence of  $\text{BF}_3$  catalyst at low temperature. (2018)

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

(1 MARK QUESTIONS)

- (a) What is acid-base catalysis? (2017)
- (b) What is autocatalysis? (2018)
- (c) What is contact catalysis? (2019)

**SHORT ANSWER TYPE**

(2 MARKS QUESTIONS)

- (a) Give one example of homogeneous catalysis and one example of heterogeneous catalysis. (2017)
- (b) What are specific acid catalyzed reactions and generalized acid catalyzed reactions? (2018)
- (c) Write Michaelis-Menten equation for an enzyme catalyzed reaction. What is the dimension of the Michaelis-Menten constant? (2019)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (a) Discuss Michaelis-Menten mechanism of enzyme catalysed reactions. (2017)
- (b) Discuss the intermediate compound formation theory of catalysis. (2018)
- (c) Write a brief note on intermediate compound formation theory of catalysis. (2019)

**UNIT-2: Ionic equilibria-I****Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (a) What is degree of ionization? (2018)
- (b) What is ionic product of water? (2018)
- (c) How does degree of dissociation of a weak electrolyte vary with dilution according to Ostwald's dilution law? (2019)
- (d) What happens to the degree of dissociation of ammonium hydroxide when ammonium chloride is added to its solution? (2019)

**SHORT ANSWER TYPE**

(2 MARKS QUESTIONS)

- (a) Calculate the pH of a solution by mixing 25 ml of 0.2 M HCl with 50 ml of 0.25 M NaOH at 25 °C. (2017)
- (b) Discuss the common-ion effect with an example. (2018)
- (c) Derive Henderson equation for pH of an acid buffer. (2019)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (a) Derive Henderson equation which is used for the calculation of pH of a buffer solution. (2018)
- (b) Aqueous solution of ammonium acetate is neutral. Verify it by calculating the pH of the solution. (Given that  $pK_a$  of acetic acid = 4.75,  $pK_b$  of ammonium hydroxide = 4.74 and ionic product of water =  $1.0 \times 10^{-14}$ ). (2019)

**(5 MARKS QUESTIONS)**

- (a) What is a buffer solution? Discuss buffer action of both acidic buffer and basic buffer solutions. (2017)

**UNIT-3: Ionic equilibria-II****Very Short Answer Type Carrying 1 mark**

(1 MARK QUESTIONS)

- (b) What is solubility product? (2017)
- (d) Name an indicator which can be used for the titration of  $\text{Na}_2\text{CO}_3$  versus  $\text{H}_2\text{SO}_4$ . (2018)
- (e) Suggest a suitable indicator for titration of hydrochloric acid against ammonium hydroxide. (2019)

**SHORT ANSWER TYPE**

(2 MARKS QUESTIONS)

- (a) Why is  $\text{H}_2\text{S}$  gas passed in alkaline medium to precipitate  $\text{Ni}^{2+}$ ,  $\text{Co}^{2+}$  and  $\text{Mn}^{2+}$  in group III B? (2017)
- (b) Define solubility and solubility product. (2018)
- (c) Explain Quinonoid theory of acid-base indicator using phenolphthalein as an example. (2019)

**SHORT ANSWER TYPE**

(3 MARKS QUESTIONS)

- (a) Phenolphthalein is not a suitable indicator for the titration of strong acids versus weak bases. Explain it. (2017)
- (b) Calculate the solubility product of  $\text{La}(\text{OH})_3$  whose solubility is  $7.8 \times 10^{-4} \text{ mol.dm}^{-3}$ . (2018)
- (c) The solubility of silver chloride at 25°C is  $1.05 \times 10^{-5}$  moles per litre. Calculate the solubility product if the salt is 80% dissociated in its saturated solution. (2019)

**UNIT-4: Phase equilibria-I****Very Short Answer Type Carrying 1 mark****(1 MARK QUESTIONS)**

- (a) Give the definition of a phase. **(2017)**
- (b) Write down the formula of Gibbs phase rule. **(2017)**
- (c) What is triple point' in phase diagrams? **(2017)**
- (d) What is degree of freedom? **(2018)**
- (e) What is the phase of a mixture of two immiscible liquids at room temperature? **(2019)**

**SHORT ANSWER TYPE****(3 MARKS QUESTIONS)**

- (a) Draw a neat phase diagram of water system and explain it in brief. **(2017)**

**(5 MARKS QUESTIONS)**

- (a) Draw a neat labelled phase diagram of water system and explain it. **(2018)**
- (b) State phase rule and explain with a neat diagram of water system. **(2019)**