

# DEPARTMENT OF CHEMISTRY

## QUESTION BANK (Hons.) +3 2nd Year Science

### Semester - III

### Inorganic Chemistry

Core – V

#### Group-A

Each question carries 1 mark.

1. The metal found in nature is called ----- .
2. All the ores are ----- but all the ----- are not ores.
3. Highly electropositive metals are extracted by ----- process.
4. Sulphide ore of copper is -----.
5. Reduction of  $\text{Cr}_2\text{O}_3$  to Cr by Al is called ----- process.
6. In carbon reduction process ----- is used as reducing agent.
7. In electrolytic reduction , ----- is extracted at cathode .
8.  $\Delta G = \Delta H - T \Delta S$  .
9.  $\text{Ni} + 4\text{CO} \xrightarrow{60^\circ\text{C}}$  -----.
10. In Mond's process, ----- metal is extracted.
11. Ellingham diagram is a plot of ----- versus -----.
12. Froth flotation process is used for concentration of ----- ores.
13. In Zone refining, ----- technique is adopted .
14. Van Arkel process is used for purification of ----- metal.
15. HSAB represents -----.
16. Hard acid has ----- polarising power.
17. Soft acid has ----- size.
18. Hard acid has ----- oxidation state.
19.  $\text{Li}^+$ ,  $\text{Be}^{+2}$ ,  $\text{Cr}^{+3}$  etc are ----- acids.

20.  $\text{Cu}^+$ ,  $\text{Hg}^{+2}$ ,  $\text{Pb}^{+2}$  etc are ----- acids.
21.  $\text{F}^-$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{Cl}^-$  etc are ----- bases.
22. According to Bronsted - Lowry theory, acids are ----- and bases are ----.
23. According to Lewis theory, acids are ----- and bases are ----.
24. Conjugate acid of  $\text{H}_2\text{O}$  is ----.
25. Conjugate base of  $\text{HSO}_4^-$  is ----.
26. ----- is an amphoteric substance.
27. Alkali metals have ---- electro negativity and ----- heat of atomization.
28. ----- is the most powerful reducing agent in aqueous solution.
29. ----- is the most electronegative element in the periodic table.
30. ----- is the most electropositive element in the periodic table.
31. A macrocyclic poly ether which contains the repeating unit  $(-\text{CH}_2-\text{CH}_2-\text{O}-)_n$  is called -----.
32. The poly cyclic compounds having bridge donor atoms like O, N and S which bind the metals and most ions very strongly are called -----.
33. The elements of second period which diagonal to elements of third period are called ----- elements.
34. In solid state  $\text{BeCl}_2$  has ----- chain structure.
35. Carbon differs from rest of the elements in group 14 due to its ----- property.
36. Allotropic forms of sulphur are -----.
37. Structure of  $\text{Se}_8$  is -----.
38. ----- is formed on heating orthoboric acid.
39. B-B bonds in Boranes are ----- type bond.
40. General formula of Boranes is -----.
41. ----- is called inorganic benzene.
42. Graphene is -----.
43. Structure  $\text{ClO}_3^-$  is -----.
44. Structure  $\text{ClO}_4^-$  is -----.
45. The structure of  $\text{H}_3\text{PO}_4$  is -----.

46.  $P_2O_5$  in water forms -----.
47. Interhalogens are the compounds of -----.
48. The structure of  $IF_5$  /  $IF_7$  /  $IF_3$  is -----/ -----/ -----.
49. The hybridization of  $IF_5$  /  $IF_7$  /  $IF_3$  is -----/ -----/ -----.
50. Pseudo halogens are -----.
51. The sickness bends is called -----.
52. ----- is used for the treatment of tumor.
53. The structure of  $XeF_2$  /  $XeF_4$  /  $XeO_3$  is -----/ -----/ -----.
54. Borazine is -----.
55. Silicone is -----.

### **Group-B**

**Each question carries 1.5 mark.**

1. Give the differences between ore and minerals.
2. In which form the most electropositive metals and b) less electropositive or weak metals occur in nature.
3. Based on standard electrode potential value( $E^\circ$ ) which type of metal oxide can be reduced.
4.  $E^\circ_{Cu^{2+}/Cu} = +0.34V$ . Can it be easily oxidised or reduced?
5. What is zone refining? Give one example.
6. Using principle of standard electrode potential, which type of metal cannot be easily reduced.
7. Give one limitation of Ellingham diagram.
8. Give one advantage of Ellingham diagram.
9. Find the conjugate acid and base of HCl and  $H_2O$ .
10. Give one limitation of Bronsted-Lowry concept.
11. Define Lewis acid.
12. Define Lewis acid.
13. Define Bronsted acid.
14. Define Bronsted acid.
15. Define soft acid and soft base.

16. What is the effect of inductive effect on strength of Lewis acid?
17. What is the effect of inductive effect on strength of Lewis base?
18. Give one limitation of HSAB principle.
19. Why  $B^{3+}$  is not formed.
20.  $NF_3$  is gas and inert in nature. Why?
21. Define inert pair effect.
22. Explain diagonal relationship.
23. Define catenation. Give one example.
24. Define allotropy. Name two allotropic form of phosphorus.
25. Give example of interstitial hydrides.
26. What are covalent hydrides? Give one example.
27. Why  $CO_2$  is called dry ice?
28. Why  $Ti^{+}$  compounds are more stable than  $Ti^{3+}$ ?
29. Why oxygen is a gas at room temperature but other members are solid?
30. Why phosphorus acids act as a reducing agent?
31. What happens when  $HNO_3$  react with  $N_2O_5$ .
32. Which type of hybridisation is there in  $IF_7$  molecule?
33. What are boranes?
34. Why boric acid cannot be titrated against sodium hydroxide?
35. How is boron nitrides prepared from boron oxide?
36. What is  $B_{10}H_{14}$ .
37. What are polyhalide ions?
38. What are pseudohalogen ions?
39. Describe the structure of  $ICl_3$ .
40. Give one method of preparation orthophosphoric acid.
41. What are graphite compounds?
42. What are interhalogen compounds?
43. Write the chemical formula of metaboric acid.
44. What is the hybridisation of boron in diborane?
45. Why noble gases form compounds with  $F_2$  and  $O_2$ ?
46. Why noble gases are inert in nature?
47. Give two uses of neon gas.
48. What are clathrates?
49. Complete the reaction  $XeF_6 + SiO_2 \longrightarrow$

50. Give the hybridization and structure of  $\text{XeF}_2$ /  $\text{XeF}_4$ /  $\text{XeF}_6$ /  $\text{XeO}_3$ /  $\text{XeO}_4$ /  $\text{XeOF}_2$ /  $\text{XeOF}_4$ /  $\text{XeO}_2\text{F}_2$ .

### **Group-C**

**Each question carries 2.5 mark.**

1. Explain Thermite process with example.
2. Describe electrolytic Kroll process to extract metals.
3. Describe Van-Arkel de Boer process to purify metal.
4. How do metals occur in nature? Explain with example.
5. What is zone refining? Explain with example.
6. Write note on hydrometallurgy.
7. Give advantages of Ellingham diagram.
8. Give limitations of Ellingham diagram.
9. Give Parke's process of refining lead.
10. What is liquation? Explain.
11. Give three usefulness of Ellingham diagram.
12. Define Bronsted-Lowry concept of acids and bases with examples.
13. Define Lewis concept of acids and bases with examples.
14. Give limitations of Bronsted-Lowry concept of acids and bases.
15. Give limitations Lewis of concept of acids and bases.
16. Give comparison between Bronsted-Lowry and Lewis concepts of acids and bases.
17. What is protolysis? Explain with example.
18. What is hard and soft acids? Give example of each.
19. What is hard and soft bases? Give example of each.
20. Give characteristics of hard acids.
21. Give characteristics of soft acids
22. Give characteristics of hard bases.
23. Give characteristics of soft bases.
24. What is Pearson's HSAB- principle? Explain.
25. Give limitations of Pearson's HSAB- principle.
26. What are covalent hydrides? Give two method of preparation .

27. Although  $\text{Li}^+$  small size and high ionization enthalpy, it is strong reducing agent than other alkali metals. Why?
28. Explain why is  $\text{B}^{+3}$  ion not formed.
29. Why is  $\text{SnCl}_2$  a solid while  $\text{SnCl}_4$  is a liquid?
30. What is dry ice? Why is it so called?
31. Why is  $\text{Al}^{+3}$  ion not exist in solid state but exist in aq . solution?
32.  $\text{Tl}^+$  compounds are more stable than  $\text{Tl}^{3+}$  compounds. Why?
33. Why is  $\text{CO}_2$  is a gas while other oxides of group 14 elements are solids?
34.  $\text{SnCl}_2$  is less stable and better reducing agent than  $\text{PbCl}_2$ . Why?
35. Why is  $\text{H}_2\text{O}$  a liquid while  $\text{H}_2\text{S}$  is a gas?
36.  $\text{OF}_4$  does not exist but  $\text{SF}_4$  is a strong Lewis acid. Explain.
37. What is inert pair effect? Explain with one example.
38. What is diagonal relationship? Explain.
39. What is allotropy? Explain different allotropic form of carbon with example.
40. Give the anomalous behaviour of Be among its family members.
41. What are nido boranes and orachnoboranes?
42. Why is  $\text{BH}_3$  not exist but  $\text{BF}_3$  exist?
43. How is orthoboric acid prepared from borax? Give the action of heat on it.
44. How is diborane prepared by Stocks method? Give its action on excess  $\text{NH}_3$
45. What are carboranes? Give one preparation of it.
46. What are poly halide ions? Give two examples of poly halides.
47. What are pseudohalogens? Give two examples.
48. Why are the noble gases inert/ do not form diatomic molecules/ mono atomic?
49. Why noble gas compounds involve only  $\text{O}_2$  and  $\text{F}_2$ ?
50. Define clathrates. Explain.
51. Explain the structure of  $\text{XeF}_2$ /  $\text{XeF}_4$ /  $\text{XeF}_6$ /  $\text{XeOF}_2$ /  $\text{XeO}_2\text{F}_2$  /  $\text{XeOF}_4$ /  $\text{XeO}_3$ /.  
 $\text{XeO}_4$  .

## Group-D

**Each question carries 8 marks.**

1. State and explain Ellingham diagram for reduction of metal oxide to metals.
2. Use of Ellingham diagram to explain the reduction of metal oxides with either carbon to carbon monoxide.
3. Describe Mond's process and zone refining method for purification of metals.
4. Explain in details the refining of metals by Hydrometallurgy.
5. Describe Bronsted-Lowry concept of acids and bases with suitable examples. How it explains the relative strength of acids and bases ?
6. What are amphiprotic substances in terms of Bronsted-Lowry concept of acids and bases? Explain monoprotic and polyprotic acids and bases. Give limitation of this concept.
7. Define Lewis acids and Lewis bases. Describe the effect of substituent's on strength of Lewis acids and Lewis bases.
8. Define hard acids, hard bases, soft acids and soft bases. Give one example in each case. How will you know whether an acid or base is hard or soft?
9. What is HSAB principle? Give its application and limitations.
10. What is inert pair effect? How it explains  $\text{Bi}^{+5}$  is stronger oxidant than  $\text{P}^{+5}$  and  $\text{TiCl}_3$  is more stable than  $\text{InCl}_3$ .
11. Describe the relative stability of different oxidation state of s and p- block element with suitable example.
12. Explain the preparation, properties and structure of beryllium nitrate. Also give the chemistry of ionic hydrides.
13. What are the anomalous behaviour of fluorine. Write three points regarding the anomalies in first and second rows elements.
14. What are hydrides ? How are these classified? Give their chemistry.
15. Give preparation, properties and structure of orthoboric acid.
16. Describe the preparation properties and structure of peroxydisulphuric acid.
17. What are polyhalides ? Give their preparation and properties.
18. Give two methods to prepare diborane. How does it react with i) diethyl ether ii) trimethyl boron iii)  $\text{NH}_3$  (limited) and excess. Describe its structure also.

19. Name different oxyacids of phosphorous and chlorine. Give preparation of (any two) orthophosphoric acid. Give its acidic nature, its action with ammonia and explain its structure.
20. Name different oxides of nitrogen. Give the preparation ( any one), properties( three of any one) and structure of any one of them.
21. Explain the structure,nature of bonding and preparation of a)  $\text{XeF}_2$  b)  $\text{XeF}_4$  .
22. Describe the shape of noble gas compounds on the basis of VSEPR theory.  
a)  $\text{XeF}_6$  b)  $\text{KrF}_2$  c)  $\text{XeO}_3$
23. What are polymers? Explain the classification of inorganic polymers. Give their general characteristics.
24. Describe different types of silicones with special references to synthesis of silicone rubbers, silicone greases, silicone oils, silicone resins.
25. What are aluminosilicates ? Explain different types of aluminosilicates.
26. What are zeolites and ultramarines ? Give their applications.
27. What are co polymeric resins? Give their structure and uses.

### Semester - III

## Organic Chemistry

Core – VI

### Group-A

**Each question carries 1 mark.**

1.  $\text{SN}^1/\text{SN}^2/\text{SN}^i$  stands for -----.
2. The reactivity order of HX towards alcohol is -----.
3. The reaction of methane with chlorine in diffused sunlight gives -----.
4. Lucas reagent is -----.
5. The reactivity order of alcohol to Lucas reagent is -----.
6. The addition of HX to propene follows ----- rule.
7. The addition of HX to propene in the presence of organic peroxide follows ----- rule.
8. A reaction of ethyl bromide with NaI is ----- reaction.
9. The order of  $\text{SN}^2$  reaction is -----.
10. In  $\text{SN}^2$  reactions, the nucleophile always attack from ----- side.
11. In  $\text{SN}^1$  reactions, the nucleophile always attack from ----- side.
12. The product obtained from  $\text{SN}^2$  reaction is named as -----.

13. The order of reactivity of alkyl halides in  $\text{SN}^2$  reaction is -----.
14. The order of reactivity of alkyl halides in  $\text{SN}^1$  reaction is -----.
15. The order of reactivity of alkyl halides in  $\text{SN}^i$  reaction is -----.
16. The reaction of ethyl bromide with KCN gives -----.
17. The reaction of ethyl bromide with KCN gives -----.
18. The reaction of methyl iodide with  $\text{KNO}_2$  gives -----.
19. The reaction of methyl iodide with  $\text{AgNO}_2$  gives -----.
20. Chlorobenzene is o-, p- directing but -----.
21. Elimination addition mechanism is also called ----- mechanism .
22. The low reactivity of vinyl chloride is due to -----.
23. Grignard's reagent is -----.
24. When Grignard's reagent reacts with active hydrogen compounds ----- is formed.
25. When formaldehyde reacts with methyl magnesium iodide and then on acid hydrolysis forms -----.
26. The formula of 1- methyl cyclohexanol is -----.
27. The IUPAC name of p-cresol is -----.
28. When acetaldehyde is reduced with  $\text{LiAlH}_4$  ----- is formed.
29. Alcohols are liquids due to -----.
30. Alcohols are water soluble due to -----.
31. When ethene is treated with Baeyer's reagent ----- is formed.
32. Between Phenol and ethanol, ----- is more acidic.
33. Between Phenol and p-nitro phenol ----- is more acidic.
34. When alcohol is treated with carboxylic acid in presence of dehydrating agent, --- ----- is formed. This process is known as -----.
35. When ester is hydrolysed by alkali, the process is known as -----.
36. The formation of ether by heating of sodium or potassium alkoxide or phenoxide alkyl halide is known as ----- reaction.
37. When o- allyl ether of phenol is converted to o- allyl phenol by the action of heat is known as ----- reaction.
38. Collin's reagent is ----- and used for preparation of -----.
39. PCC is ----- and used as -----.
40.  $\text{C}_6\text{H}_5\text{CHO} + \text{KOH} \longrightarrow$  -----.
41.  $\text{C}_6\text{H}_5\text{CH}=\text{CH}-\text{CHO} \xrightarrow{\text{NaBH}_4}$  -----.

42.  $\text{CH}_3\text{CH}_2\text{CHO} \xrightarrow{\text{dil KOH}}$  -----.
43.  $\text{CH}_3\text{COCH}_3 + 3 \text{NaIO} \longrightarrow$  -----.
44. Chloral is heated with caustic potash to give -----.
45. Between formic acid and acetic acid ----- is stronger acid.
46. ----- is formed when ammonium acetate is heated.
47. ----- is formed when acetamide is heated with bromine in presence of KOH.
48. ----- is formed when ethyl adipate is treated with sodium ethoxide and then on heating.
49. ----- is formed when cyclohexanone is heated with Zn-Hg /HCl.
50. ----- is formed when benzene is heated with conc.  $\text{H}_2\text{SO}_4$ .

### Group-B

**Each question carries 1.5 marks.**

1. Arrange  $1^\circ$ ,  $2^\circ$  and  $3^\circ$  alkyl halides in the order of their reactivity towards  $\text{SN}^2$  reaction.
2. How is Iodo-benzene produced from benzene diazonium chloride?
3. Arrange  $\text{CH}_3\text{COOH}$ ,  $\text{CH}_3\text{OH}$  and  $\text{C}_6\text{H}_5\text{OH}$  in the order of their acidic nature.
4. What happens when ethylene glycol is oxidised with lead tetra acetate?
5. What is that oxidising agent used preferably to get an aldehyde from primary alcohol?
6. How does acetone react with alkaline solution of hydrazine?
7. What is active methylene group? Give an example of a compound containing such group.
8. Arrange the different classes of acid derivatives in orders of their reactivity towards hydrolysis.
9. How can you get trans glycol from ethylene?
10.  $(\text{CH}_3)_2\text{C} = \text{O} \xrightarrow{\text{HI}}$  ----- + -----
11. What products are obtained when excess of ethyl alcohol is heated with conc.  $\text{H}_2\text{SO}_4$  to about  $140^\circ\text{C}$ ?
12. How can you prepare ethyl thio-alcohol from ethyl alcohol?

13. What do you mean by carbanion ?
14. Arrange the leaving group ability in SN<sup>1</sup> reaction – Ots, -- OH and OAc.
15. Which one of the following is dicarboxylic acid and tricarboxylic acid ?
16. Write down the structure of Benzyne intermediate.
17. Write down structure of diazonium salt.
18. Write down the structure of diazonium salt.
19. Between EtSH and EtOH which one is more nucleophilic towards SN<sup>2</sup> nucleophilic reaction?
20. Between primary and tertiary alcohol which one will have faster rate of SN<sup>1</sup> nucleophilic substitution reaction in polar protic solvent?
21. What do you mean by enolate ?
22. Arrange the following organic compound in ascending order as per the acidic strength: Phenol, Benzoic acid, Ethanol.
23. What do you mean by oxidation in organic chemistry ?
24. Give an example of SN<sup>1</sup> reaction .
25. Give two factors which favour SN<sup>1</sup>/ SN<sup>2</sup> reaction.
26. Give one example of Wurtz reaction .
27. Give one example of Wurtz-Fittig reaction .
28. Give one example of Sandmeyer reaction .
29. Give one example of Fittig reaction .
30. Convert chloro benzene to aniline.
31. Convert bromo benzene to iodobenzene.
32. What happens when Cl<sub>2</sub> is passed through boiling toluene?
33.  $2 \text{C}_6\text{H}_5\text{Br} + 2\text{Na} \xrightarrow{\text{Dry ether}}$
34. What happens when alcohol reacts with red hot copper?
35. What happens when ethyl alcohol reacts with conc. H<sub>2</sub>SO<sub>4</sub> at 140 °C ?.
36. How will you convert ethanol into ethane?
37. How is phenol obtained from aniline?
38. Name the primary alcohol which responds iodoform reaction?
39. Give an example of Pinacol- Pinacolone rearrangement.
40. Give an example of Reimer Tiemann reaction..
41. Give an example of Williamson's reaction..
42. Give an example of Bouvaelt Blanc reduction.
43. Give an example of Claisen Schmidt reaction.

44. Give an example of cannizzaro reaction.
45. Give an example of clemmensen's reduction.
46. Give an example of Hoffmann bromamide reaction
47. Give an example of Wolff Kishner reduction.
48. Give an example of Curtius rearrangement.
49. Give an example of Reformatsky reaction.
50. Give an example of Claisen condensation reaction.

### **Group-C**

1. Write a note on Pinacol- Pinacolone rearrangement.
2. Write a note on Reimer Tiemann reaction..
3. Write a note on Williamson's reaction..
4. Write a note on Bouvaelt Blanc reduction.
5. Write a note on Claisen Schmidt reaction.
6. Write a note on cannizzaro reaction.
7. Write a note on clemmensen's reduction.
8. Write a note on Hoffmann bromamide reaction
9. Write a note on Wolff Kishner reduction.
10. Write a note on Curtius rearrangement.
11. Write a note on Reformatsky reaction.
12. Write a note on Claisen condensation reaction.
13. Write a note on of Wurtz reaction .
14. Write a note on of Wurtz-Fittig reaction .
15. Write a note on Sandmeyer reaction .
16. Write a note on Fittig reaction.
17. Write a note on Lucas test.
18. Write a note on Kolbe –Schmidt reaction.
19. Write a note on Fries rearrangement.
20. Write a note on Claisen rearrangement.
21. Write a note on Beckmann rearrangement.
22. Write a note on Benzil- Benzilic acid rearrangement.
23. Write a note on Michael
24. Write a note on keto-enol tautomerism.
25. Write a note on Claisen condensation reaction.

26. Give the mechanism of ester formation from alcohol and acid in presence of acid catalyst.
27. Give the mechanism of ester formation from alcohol and acid in presence of base catalyst.
28. Give the mechanism of formation of ethene from ethanol.
29. Give the mechanism of formation of ether from ethanol.
30. Give the mechanism of reduction of aldehyde to alcohol by  $\text{LiAlH}_4$ .
31. Why does allyl chloride give nucleophilic substitution reaction but chlorobenzene is not.
32. Why does ethyl chloride give nucleophilic substitution reaction but chlorobenzene is not.
33. Why does benzyl chloride give nucleophilic substitution reaction but chlorobenzene is not.
34. Why does allyl chloride give nucleophilic substitution reaction but vinyl chloride is not.
35. Why does benzyl chloride give nucleophilic substitution reaction but vinyl chloride is not.
36. Why does benzyl chloride give precipitation reaction with  $\text{AgCl}$ ?
37. Why does chlorobenzene not give precipitation reaction with  $\text{AgCl}$ .
38. Give the mechanism of reaction of ethene with Bayer's reagent.
39. Give the mechanism of reaction of ethene with  $\text{OsO}_4 / \text{O}_3$ .
40. Give the mechanism of reaction of ethanal with  $\text{HCN}$  in presence of base.
41. Give the mechanism of reaction of acetone with 2,4-DNP.
42. Why is chlorobenzene ortho and para directing but deactivating?
43. Why is phenol ortho and para directing and activating?
44. Why is benzoic acid meta directing and deactivating?
45. Why is benzaldehyde meta directing and deactivating?
46. How is Grignard's reagent prepared? Give example.
47. What are organometallics? Give examples.
48. What is organolithium compound? Give examples.
49. How can you synthesize acetic acid/ ethanol/ acetone/ acetaldehyde/benzene/ ethane/ ethyl amine from Grignard's reagent?
50. How can you synthesize propanoic acid / MEK /acetone /adipic acid / pentane-2,4-dione/ acetyl chloride from AAE/ Malonic ester?

### Group-D

**Each question carries 8 marks.**

1. (a) Discuss the mechanism of diazotisation. Starting from benzene diazonium chloride,

How can you prepare.

(i) Benzene (ii) Phenol

2. (a) Discuss the mechanism of  $SN^1$  reaction with example.

(b) How can you prepare Acetic Acid and methyl amine from a suitable organo magnesium compound?

3. (a) Discuss the mechanism of -

(i) Pinacol-Pinacolone rearrangement (ii) Reimer Tiemann Reaction

(b) How can you prepare phenol from.

(i) Cumene (ii) Chlorobenzene

(c) How does phenol react with –

(i)  $Br_2$  water (ii) Dil.  $HNO_3$ .

4. (a) Write the mechanism of the following reaction.

(i) Benzil-Benzilic acid rearrangement (ii) Aldol condensation

(b) Starting from diethyl malonate synthesize the following compounds.

(i) Propionic Acid (ii) Acetoacetic Acid

(iii) Cinnamic Acid (iv) Barbituric Acid

5. (a) Write the mechanism of the following reaction.

(i) Claisen condensation (ii) Reformatsky Reaction

6. (a) What happens when

(i) Tartaric Acid is reduced with HI.

(ii) Lactic Acid is reduced with Fenton's reagent

(iii) Maleic Acid is heated for a prolonged period.

(i)  $Br_2$  water (ii) Dil.  $HNO_3$

(b) How does phenol react with –

(i) Br<sub>2</sub> water

(ii) Dil. HNO<sub>3</sub>

7. (a) What happens when benzene is heated with conc. H<sub>2</sub>SO<sub>4</sub> containing SO<sub>3</sub>?

Discuss with mechanism.

(b) How can you convert ethylene to epoxy ethane?

(c) What happens within diethyl thio-ether is hydrolysed with alkali solution.

8. (a) What happens when Methyl magnesium bromide reacts with ethylene epoxide and the product is hydrolysed.

(b) What happens when epoxy ethane is reduced with LiAlH<sub>4</sub>?

(c) What happens when anisole reacts with HI at 100<sup>0</sup>C.

9. Define and explain SN<sup>1</sup> and SN<sup>2</sup> reaction with stereo chemistry.

10. Explain the Benzyne mechanism of nucleophilic substitution reaction.

11. With suitable mechanism predict the generation of correct product (answer two)

a) Describe Pinacol- Pinacolone rearrangement with an example

b) Discuss Claisen rearrangement with an example.

c) Describe Reimer Tiemann reaction with an example.

12. Write notes on any two with mechanism

a) Discuss Claisen reaction with an example.

b) Describe Benzoin condensation reaction with an example.

c) Explain Michael addition with an example.

13. Discuss the preparation and synthetic reaction application of acid chloride and amide.

14. Discuss and outline the mechanism of acid and alkaline hydrolysis of ester and amide.

15. Write notes on

a) Hofmann- bromamide reaction.

b) Curtius rearrangement.

16. Write notes on any two

a) Effect of solvent on SN<sup>1</sup> and SN<sup>2</sup> reaction

b) Wittig reaction

c) Reformatsky reaction

17. Write notes on

a) Effect of bulky group on  $SN^1$  and  $SN^2$  reaction

b)  $SN^i$  reaction

c) Baeyer-Villiger oxidation

18. How can you prepare phenol from a) Benzene diazonium salt b) Cumene . Give the mechanism of Williamson reaction for preparation of ether.

19. How is acetone prepared from a) isopropyl alcohol b) acetyl chloride c) propene. Give the reaction of acetaldehyde with a) HCN b) 2,4-DNP

20. How can you prepare AAE from Claisen condensation reaction. How can you synthesize a) MEK b) Adipic acid c) 1,3- diketone from AAE.

## Physical Chemistry

## Core – VII

### Group-A

1. Ice and water consist of ----- phases system.
2. Water – ethanol consists of ----- phases.
3. Benzene and water consist of ----- component system.
4.  $CaCO_3(s)$ ,  $CaO(s)$  and  $CO_2(g)$  consist of ----- component system.
5.  $CaCO_3(s)$ ,  $CaO(s)$  and  $CO_2(g)$  consist of ----- phase system.
6.  $F = C - \text{ ----} + 2$ , complete the equation.
7. When  $F = 0$  called ----- system.
8. At triple point,  $F = \text{-----}$ .
9. When two components do not form any compound and on solidification they simply form an intimate mixture is known as -----.
10. When two components form a solid compound up to its melting point is called -----.
11. When two components form a solid compound which decomposes before attaining its melting point is called -----.

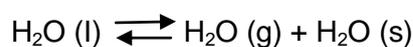
12. When two components form a solid solution which stable only up to transition temperature is called -----.
13. The solid solutions are of ----- type.
14. Amorphous solid are also called -----.
15. ----- phases can't coexist in a one component system.
16. Acetic acid – chloroform – water is a ----- component system.
17. The phase rule for Acetic acid – chloroform – water system is -----.
18. The mixture of a composition in which vapour pressure maximum and boiling point minimum is called -----.
19. Mixtures of liquid which boil at constant temperature like a pure liquid such that the distillate has the same composition as that of liquid mixture are called -- -----.
20. The process of separating mixtures of two or more liquids having close boiling point by repeated distillation and condensation is called -----.
21. Nernst's distribution law represents  $K_D =$  -----.
22. The change in distribution co-efficient for  $1^{\circ}\text{C}$  rise in temperature is called - -----.
23. The unit of rate of the reaction is -----.
24. The unit of rate constant of the zero order reaction is -----.
25. The unit of rate constant of the first order reaction is -----.
26. The unit of rate constant of the second order reaction is -----.
27. Decomposition of  $\text{N}_2\text{O}_5$  is ----- order reaction.
28. Combination  $\text{H}_2$  and  $\text{I}_2$  is ----- order reaction.
29. Decomposition of  $\text{NH}_3$  in the presence of Pt is a ----- order reaction.
30. Hydrolysis of ester in acid catalyst is a ----- order reaction.
31. Half life of first order reaction is -----.
32. Half life of zero order reaction is -----.
33. Half life of second order reaction is -----.

34. The minimum energy required to the reactant to be able to react chemically is called -----.
35. The total energy required to the reactant to be able to react chemically is called -----.
36.  $E_a = E_{th}$  - -----.
37.  $k = A$  -----.
38. Collision theory of reaction rate is given by -----.
39. A catalyst is a substance that ----- the rate of chemical reaction without itself being used of in the chemical reaction.
40. The catalyst is ----- chemically at the end of the reaction.
41. The catalyst does not alter the position of ----- in a reversible reaction.
42. The catalyst does not ----- the reaction.
43. The activity of catalyst is enhanced by the presence of a substance called --- -----.
44. The catalyst is ----- in its action.
45. The substance which adsorbs the gases is called -----.
46. Amylase is a ----- catalyst.
47. Pepsin catalyses protein to -----.
48. Chemiadsorption is also known as -----.
49. Adsorption isotherm is a plot between ----- and ----- of a gas at constant temperature.
50. The force acting in physical adsorption is called -----.

### **Group-B**

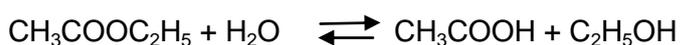
**Each question carries 1.5 marks.**

1. How many components are present in the following systems?



2. What do you mean by degrees of freedom?

3. What is the molecularity of the following reaction?



4. What is the unit of second order rate constant?

5. Define threshold energy. What is the relationship between kinetic energy, threshold and activation energy?

6. Define physical adsorption.

7. What is the force existed in physical adsorption?

8. Define phase rule.

9. Define pseudo uni-molecular reaction.

10. Give example of a two component system.

11. What are the important characteristics of a catalyst?

12. Give example of a zero order reaction.

13. Give example of a 1st order reaction.

14. Give example of a 2nd order reaction.

15. Give example of an uni-molecular reaction.

16. Define 1st order reaction with an example.

17 Define zero order reaction with an example.

18. Define 2nd order reaction with an example.

19. Decomposition of  $\text{PCl}_5$  is which order reaction?

20. What is an ideal solution?

21. What is a non ideal solution?

22. What is a miscible liquid?

23. What is CST?

24. What is a binary solution?

25. What is azeotropes?

26. Define rate law with an example.

27. Define activation energy.

28. Give Arrhenius equation.

29. Define Nernst distribution law.

30. Give unit of zero order reaction.

31. Give unit of 1st order reaction.

32. Give unit of 2nd order reaction.

33. Give unit of rate of the reaction.

34. What is a eutectic point?

35. What is an adsorption?
36. What is absorption?
37. What is an adsorption isotherm?
38. What is an adsorbate and adsorbent? Give one example of each.
39. What is a catalyst? Give one example.
40. What is specificity of a catalyst?
41. What is selectivity of a catalyst?
42. What is enzyme catalysis? Give one example.
43. What is the enzyme catalyst used for fermentation of glucose?
44. What is acid-base catalysis? Give one example.
45. What is chemisorption?
46. What is physical adsorption? Give one example.
47. What is metastable equilibrium?
48. Give Clausius –Clapeyron equation.
49. Give one example of three component system.
50. What is collision theory of reaction rate ?

### **Group-C**

**Each question carries 2.5 marks.**

1. What do you understand by triple point in water system?
2. What do you understand by triple point in sulphur system?
3. Define phase. Explain with example.
4. Define component. Explain with example.
5. Define degree of freedom. Explain with example.
6. Define phase rule. Give the number of phases for boiling water.
7. Predict the number of components, phases and degrees of freedom. For the reaction  $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2 (\text{g})$ .
8. Define and explain eutectic point.
9. Define and explain congruent melting point.
10. Define and explain incongruent melting point.
11. What is a freezing mixture? What is the condition s of a good freezing mixture?
12. Define and explain invariant.
13. Justify why the fusion curve in the phase diagram of water has a negative slope?
14. Why is triple point of water is not identical with its freezing point.

15. Why is three phases cannot coexist in a one component system.
16. Define and explain Raoult's law.
17. What is azeotropic mixture? Explain.
18. Can we separate azeotropic mixture by distillation? Why do we call it a mixture?
19. What is CST? Explain.
20. What is UCST? Explain.
21. What is LCST? Explain.
22. State and explain ideal solution.
23. State and explain non-ideal solution.
24. Write a note on minimum boiling azeotrope.
25. State Nernst distribution law with equation.
26. What are the essential conditions for the validity of distribution law?
27. Explain distribution equation for the solute associates in one of the solvents.
28. Explain distribution equation for the solute dissociates in one of the solvents.
29. Explain distribution equation for the solute enters into chemical combination with one of the solvents.
30. What are the applications of distribution law?
31. What is solvent extraction? Explain.
32. What do you mean by rate law and rate equation? Explain.
33. What is zero order reaction? Give one example and the unit of rate constant of it.
34. What is first order reaction? Give one example and the unit of rate constant of it.
35. What is second order reaction? Give one example and the unit of rate constant of it.
36. Derive rate constant of zero order reaction.
37. What is activation energy? Explain.
38. What is Arrhenius equation? Explain.
39. How can you determine order of a reaction by method of half change?
40. How can you determine order of a reaction by method of differential method?
41. How can you determine order of a reaction by method of isolation method?
42. How can you determine order of a reaction by method of method of trial?
43. Define catalysis. Give example of each of homo and heterogeneous catalyst.
44. Give the general character of catalyst.
45. What is specificity and selectivity of a catalyst? Explain with example.

46. Give the difference between adsorption and absorption.
47. Define physical adsorption. What are the factors affecting it?
48. Define chemical adsorption. What are the factors affecting it?
49. What is adsorption isotherm? Explain.
50. Why is physical adsorption multimolecular where as chemical adsorption .are unimolecular?

### **Group-D**

**Each question carries 8marks.**

1. State and derive Nernst distribution law. What are its important applications?
2. Explain the following terms :-
  - (a) Azeotrope
  - (b) Triple point
  - (c) Eutectic mixture
3. (a) Describe KI - H<sub>2</sub>O system on the basis of phase rule.  
 (b) Explain critical solution temperature. 4.

Discuss in brief:-

- (a) NH<sub>4</sub>Cl in equilibrium with its dissociation product is an one component system.
- (b) Sulphur system ay any of its triple point is a non-variant system.
5. Derive mathematical expression for the rate constant of a reaction,  $A+B \rightarrow$  Product, following second order kinetics.
6. What is a consecutive reaction? What down the differential rate expression, for the reaction  $A \rightarrow B \rightarrow C$ , Draw the concentration and time plot.
7. Explain Arrhenius equation. Discuss Arrhenius concept of activation energy. Write graphical representation of activation energy diagram.
8. Describe Lindemann mechanism of unimolecular reaction with a suitable example.
9. Derive an expression for the kinetics of enzyme catalysis expressed by Michaelis – Menten equation.

10. Derive Langmuir adsorption isotherm equation. Show the conditions under which it becomes identical with Freundlich adsorption isotherm equation.
11. State phase rule. Explain the various terms used in it. Discuss the derivation of phase rule from thermodynamic consideration.
12. Explain the terms giving one example of each. i) Degree of freedom ii) Metastable equilibrium iii) Eutectic point iv) Triple point
13. How does the phase diagram of KI- H<sub>2</sub>O and Pb-Ag system differ from each other.
14. Describe Clausius –Clapeyron equation for the equilibrium liquid ↔ vapour. How will you obtain the heat of vaporisation using this equation.
15. Write notes on (a) three component system: water-chloroform-acetic acid (b) CST.
16. Discuss the distillation under a constant pressure of a complete miscible binary liquid mixture having a boiling point maximum and a boiling point minimum.
17. Define ideal solution and deduce expressions for  $\Delta G_{\text{mix}}$ ,  $\Delta S_{\text{mix}}$  and  $\Delta H_{\text{mix}}$  for solution of liquids with almost similar nature.
18. Define activation energy and activated complex. Draw diagram to explain i) Exothermic reaction ii) Reversible reaction.
19. Write notes on
  - i) Opposing reaction
  - ii) Parallel reaction
  - iii) Chain reaction
20. Write notes on i) Freundlich isotherm ii) Langmuir adsorption isotherm iii) Gibbs' adsorption isotherm

## Semester – IV

### Inorganic Chemistry

### Core – VIII

#### Group-A

Each question carries 1 mark.

1. Write the IUPAC name of  $K_2[Hgl_4]$ .
2. Give one example of outer orbital complex.
3. Write the formula of hexanitrito-o-cobaltate(III) ion.
4.  $Cu^+$  is colourless but  $Cu^{2+}$  is blue coloured. Explain.
5. In octahedral strong field the no. of unpaired electrons in  $Co^{3+}$  is \_\_\_\_\_.
6.  $Ni^{4+}$  compounds are less stable than  $Pt^{4+}$  compounds. Why?
7. Give one reaction in which  $TiCl_4$  acts as an oxidant.
8. Why Eu exhibits +2 oxidation state but La does not ?
9. What is lanthanide contraction?
10. Why blood is red in Colour?
11. What do you mean by labile complex?
12. Anhydrous  $CuSO_4$  is colourless but  $CuSO_4 \cdot 5 H_2O$  is blue in colour. Why?
13. Why Cu(I) is diamagnetic while Cu(II) is paramagnetic ?
14. What are lanthanides?
15. Give two example of bidentate ligand.
16. What is Heme?
17. What is effect of  $C_v$  and  $C_p$  when these are deficient in biological system.
18. Write IUPAC name of  $Na_3 [Co (CO)_4 ]$  .
19. What are low spin and high spin complexes?
20. What is chelating ligand?
21. What is actinide contraction?
22. Give general electronic configuration of lanthanides.
23. Give general electronic configuration of actinides.
24. What are essential trace elements?

25. Why transition elements are coloured?
26. What are labile and inert complexes?
27. Give one example of labile complex and inert complex.
28. What is electro neutrality principle?
29. Write structure of a complex (C.N =4) which show geometrical isomerism.
30. Write structure of a complex (C.N =6) which show geometrical isomerism.
31. Explain generally there is an increase in density of elements from titanium (Z = 22) to copper (Z = 29) in the first series of transition elements.
32. Why transition elements and their compounds are generally found to be good catalysts in chemical reactions?
33. Why zinc is not regarded as a transition element?
34. Explain Copper (I) ion is not known in aqueous solution.
35. Why Manganese exhibits the highest oxidation state of +7 among the 3d series of transition elements.
36. Why  $\text{Cr}^{2+}$  is reducing in nature while with the same d-orbital configuration ( $d^4$ )  $\text{Mn}^{3+}$  is an oxidising agent.
37. Complete  

$$\text{Cr}_2\text{O}_7^{2-} (\text{aq}) + \text{Fe}^{2+} (\text{aq}) + \text{H}^+ (\text{aq}) \rightarrow$$
38. Why transition metals and their compounds generally exhibit a paramagnetic behaviour?
39. Explain why the enthalpies of atomization of transition metals are quite high.
40. Which metal in the first transition series (3d series) exhibits +1 oxidation state most frequency?
41. Which of the following cations are coloured in aqueous solutions and why?  
 $\text{Sc}^{3+}$ ,  $\text{V}^{3+}$ ,  $\text{Ti}^{4+}$ ,  $\text{Mn}^{2+}$ .
42. Write two consequences lanthanide contraction.
43. Why the highest oxidation state of a transition metal is usually exhibited in its oxide.
44. Why  $\text{Co}^{2+}$  is easily oxidised in the presence of a strong ligand ?
45. What are the transition elements? Write two characteristics of the transition elements.
46. What is meant by 'disproportionation'? Give an example of a disproportionate reaction in aqueous solution.
47. Write the equation of preparation of potassium permanganate.

48. Write one chelating agent used in medicine.

49. What is the medicinal use of cis- platin.

50. Which vitamin is cyanocobalamine.

### **Group-B**

**Each question carries 8 marks.**

1. What are the postulates of Werner's Co-ordination theory? Give its drawbacks.

2. Explain Crystal Field Splitting in an Octahedral Complex. What is crystal field stabilization energy?

3. What are transition elements? Discuss the following properties of transition element

(3<sup>rd</sup> Series) :

(a) Colour

(b) Oxidation states

(c) Magnetic Properties

4. What are Latimer diagrams? Give their applications.

5. Describe the chemistry of complexes of +III state of iron.

6. Discuss the chemistry of CrO<sub>3</sub> & TiO<sub>2</sub>.

7. Discuss the causes and effects of Lanthanide contraction.

8. What are actinides? Discuss their oxidation states and colours.

9. Describe the function of haemoglobin in transport of oxygen.

10. Describe the toxicity of Cd and Pb. Give reasons for their toxicity

11. What are salient features of CFT? How do d – orbital energy level split? When a transition metal ion is placed in an octahedral field of ligands.

12. Describe effect of John-Teller effect in octahedral complexes. Explain [NiCl<sub>4</sub>]<sup>2-</sup> but [Ni (CO)<sub>4</sub>] is diamagnetic though both are tetrahedral.

13. What are transition elements? Discuss the magnetic character, colour and complex forming tendency of first row transition elements.
14. Explain catalytic property of transition metals. Also explain salts of Zinc, cadmium and Mercury are white.
15. Explain the stability of various oxidation states of transition metals in term of their emf value.
16. Discuss the chemistry of complexes of +3 state of iron. How Fe(II) and Fe(III) states are stabilised.
17. a) Give the chemistry of +3 and +4 oxidation state of Titanium.  
 b) Why Mn(II) states have pale pink or white colour.  
 c) Describe the chemistry of Co (+1) and Co (-1) complexes.
18. What is lanthanide contraction? Describe the cause and consequences of lanthanide contraction.
19. What are actinides? Give their electronic configuration. Explain why actinides show wide range of oxidation states than the lanthanides.
20. Discuss the structure of Haemoglobin and its role in oxygen transport.
21. What do you mean by the term Toxicity ? In what way mercury, lead and cadmium act as toxic elements.

## Organic Chemistry

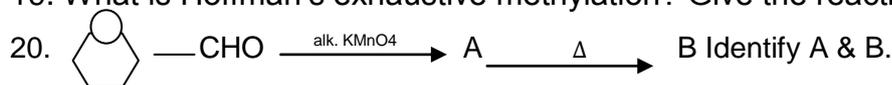
Core-IX

### Group-A

Each question carries 1 mark.

1. Which position of Anthracene is most reactive towards electrophilic substitution reaction?
2. Arrange Aniline, diphenyl amine and benzyl amine in increasing order of their basic nature.
3. What is the product obtained by the reaction of dimethyl amine with nitrous acid.
4. Among pyridine, pyrrole and piperidine which is most basic.
5. Write any one medical importance of cocaine.
6. What product is obtained by the reaction of alkyl halide with  $\text{KNO}_2$ ?
7.  $\text{CH}_3\text{Br} \xrightarrow{\text{KCN}} \text{A} \xrightarrow{\text{H}_3\text{O}^+} \text{B}$  (Identify A & B)

8. What is the hybrid state of the sulphur atom of thiopene?
9. Write the structure of Nicotine.
10. What is Neral?
11. Give one test to distinguish 1<sup>o</sup>, 2<sup>o</sup> and 3<sup>o</sup> amines.
12. Why is aniline a weak base?
13. What is a diazonium salt? Give one example.
14. What happens when BDC is heated with CuCl? Give the reaction.
15. Give one method of preparation of anthracene.
16. Why is pyridine susceptible for nucleophilic substitution reaction?
17. Why is indole aromatic?
18. Though morphine is analgesic, but not used as medicine. Explain.
19. What is Hoffman's exhaustive methylation? Give the reaction.



21. Arrange aniline, O-nitroaniline and 2,4,6 – trinitro aniline in the order of their basic nature.
22. What is the product obtained by the reduction of nitrobenzene in neutral medium?
23.  $\text{C}_6\text{H}_5\text{NH}_2 \xrightarrow{\text{NaNO}_2 / \text{HCL}}$  A  $\xrightarrow{\text{KI}}$  B (Identify A and B)
24. Arrange benzene, naphthalene and anthracene in the order of their aromatic nature.
25. In between pyrrole and pyridine, which is more basic in nature?
26. Which position of 5-membered heterocyclic compounds is most reactive towards electrophilic substitution?
27. What are alkaloids?
28. Write any medicinal importance of nicotine.
29. Define isoprene rule.
30. Write any two sources of terpenes, Haemoglobin and chlorophyll?
31. What happens when nitrobenzene is heated with Sn and conc HCl?
32. Which one is most basic out of aniline and p- Nitro aniline?
33. How will you convert benzenediazonium chloride to phenol?
34. What is carbylamine reaction?
35. What happens when primary amine react with nitrous acid?

36. What are polynuclear hydrocarbon? Give two examples.
37. How will you convert furan into furoic acid.
38. Write the structure of Nicotine and Hygrine.
39. Write two importance of morphine .
40. Give commercial method of isolation of alkaloids
41. Why is aniline less basic than ethyl amine>
42. How can you convert benzene diazonium chloride to benzene?
43. How can you convert benzene diazonium bromide to bromo benzene?
44. How can you convert benzene diazonium fluroborate to flurobenzene?
45. How can you convert benzene diazonium chloride to benzonitrile?
46. What happens when benzene diazonium chloride reacts with phenol in basic medium?
47. What is coupling reaction ? Give one example.
48. What is Balz- Schiemann reaction?
49. How can you convert benzene diazonium chloride to benzoic acid?
50. What is Hinsberg reagent?

### **Group-B**

**Each question carries 8 mark.**

1. (a) Write notes on Mannich Reaction  
(b) How do Primary, secondary and tertiary amine react with  $\text{HNO}_2$ .
2. (a) What happens when nitrobenzene is reduced in different media?  
  
(b) How can you convert benzene to 1,3,5- trinitrobenzene.
3. (a) Starting from benzene diazonium chloride, How can you synthesize the following  
compounds.  
(i) Flurobenzene (ii) Benzene (iii) Benzoic acid (iv) P-hydroxy azobenzene
4. (a) Elucidate the structure of Anthracene with synthetic evidence.  
(b) How can you convert Napthalene to  $\beta$ - Naphthol .
5. (a) Elucidate the structure of Quinoline and give its synthetic evidence.

- (b) Discuss the amphoteric nature of pyrrole.
6. (a) Why does pyridine undergo nucleophilic substitution? And which position of pyridine is more reactive for this and Why?
- (b) Give a chemical test to distinguish between quinoline and isoquinoline
7. Write notes on alkaloids as regard to their occurrence. Structural features, isolation and physiological action.
8. Write Notes on :-
- (i) Emde's modification
  - (ii) Medicinal importance of Nicotine and Hygrine.
9. Elucidate the structure of  $\alpha$ -terpinol and write its synthetic evidence.
10. Write Notes on :-
- (i) Isoprene rule
  - (ii) Citral
11. (a) Define the following terms. In what units are these expressed?
- (i) Conductance
  - (ii) Specific resistance
  - (iii) Cell constant
- (b) How is the conductance of a solution of an electrolyte is determined? Establish a relation between specific conductance, Equivalent conductance and molar conductance.
12. (a) The molar conductance of a solution of Aluminium Chloride is found to be  $130 \text{ S cm}^2 \text{ mol}^{-1}$  at 298K. What would be its equivalent conductance at the same temperature?
- (b) Give an account of the Debye-Huckel theory of strong electrolyte.
13. (a) Write a note on Debye-Falkenhagen effect.
- (b) The electrolyte conductivity of a 0.1 N acetic acid solution at 291K is  $0.000471 \text{ S cm}^{-1}$  and that of a 0.001 N Sodium acetate solution is  $0.000781 \text{ S cm}^{-1}$ . What are the equivalent conductivities of acetic acid and sodium acetate?

14. (a) What is meant by the term ionic mobility? Describe an experiment to show that different ions have different ionic mobility.

(b) Write notes on :

(i) Transport number of ions.

(ii) Application of conductance to hydrolysis of salts.

15. (a) What do you mean by the term migration of ions? Write a detailed note on the discharge of ions on electrolysis.

(b) Discuss various applications of conductance measurement with special reference to weak electrolyte.

(c) The ratio of ionic mobility of  $\text{Ag}^+$  and  $\text{NO}_3^-$  being 0.9. The transport number of  $\text{Ag}^+$  will be less than 0.5. Justify your answer.

16. (a) Discuss the applications of emf measurement in chemistry.

(b) Describe quinone-hydroquinone electrode. How does its potential vary with pH

(c) Write the electrode relations for the following electrodes:

(i)  $\text{Pt}, \text{H}_2 (1 \text{ atm}) \mid \text{HCl}$

(ii)  $\text{Cd} \mid \text{Cd}^{2+} (a = 1)$

(iii)  $\text{Zn} \mid \text{ZnCl}_2 (a = 0.5)$

17. (a) What is meant by standard electrode and standard electrode potential? How will you determine  $\text{H}^+$  ion concentration of a solution using normal hydrogen electrode.

(b) What is a reference electrode? Give their significance. Describe the working of an  $\text{Ag} \mid \text{Ag}^+$  electrode. What are its merits relative to NHE?

18. (a) Explain the working principles of concentration cells with and without transference.

(b) Why are potassium or ammonium nitrate or potassium chloride preferred to make salt bridges.

(c) How are emf of a cell and entropy of the cell reaction related?

19. (a) Explain the principles involved in the redox and precipitation titrations by potentiometric method.

(b) Explain any three applications of the concentration cells.

(c) Calculate the emf of the cell



(The standard potential of Zn and Cd electrodes at 298K are -0.76 v and -0.4v respectively)

20. (a) Give two methods of preparation of nitro benzene.

(b) Give reduction of nitrobenzene in acidic medium with mechanism.

21. (a) How is amine prepared from :

(i) Gabriel phthalimide synthesis.

(ii) Hoffmann's bromamide reaction.

(b) Write Notes on :-

(i) Mannich reaction.

(ii) Hoffmann's exhaustive methylation.

22. (a) Elucidate the structure of anthracene with one synthetic evidence.

(b) How is benzene prepared from benzene diazonium chloride? Give the reaction.

23. (a) Elucidate the structure of phenanthrene with one synthesis.

(b) How is Iodobenzene prepared from benzene diazonium chloride? Give the mechanism of the reaction.

24. (a) How is pyrrole prepared from :-

(i) Paal-Knorr synthesis.

(ii) Hantzsch synthesis.



33. (a) Write notes on Fischer-Indole synthesis.  
(b) Why does furan undergo electrophilic substitution at C<sub>2</sub> position.
34. (a) Elucidate the structure of hygrine with its synthetic evidence.  
(b) Give a general method of extraction of alkaloids.
35. (a) Elucidate the structure of Nicotine.  
(b) Elucidate the structure of Citral with its synthetic evidence.
36. Write Notes on :-  
(i) Neral  
(ii) α- terpineol

## Physical Chemistry

Core – X

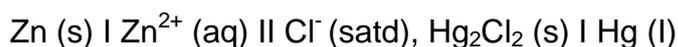
### Group-A

**Each question carries 1 mark.**

1. What is effect of dilution on conductance and equivalent conductance?
2. Define equivalent conductance with unit.
3. Define Kohlrausch law.
4. What is transport number? Give the relation.
5. What is ionic product of water? What is its value at 25°C?
6. Define solubility product.
7. What do you mean by conductometric titration?
8. Give Nernst equation for electrode potential.
9. What is liquid junction potential? What is its value?

10. What is the condition of a substance to be paramagnetic in character?
11. Define law of independent mobility.
12. Write the unit of equivalent conductance.
13. What is the effect of dilution on molar conductance.
14. Define ionic product of water.
15. What is the standard electrode potential of hydrogen electrode?
16. Represent glass electrode with definition.
17. What are reversible cells? Give one examples.
18. What is magnetic susceptibility?
19. What is liquid junction potential?
20. Define transference number?
21. What are strong electrolytes?
22. Write one application of electrolytes?
23. Define molar conductance.
24. Explain the term ionic mobility.
25. Define Faraday's 1<sup>st</sup> law of electrolysis.
26. What do you mean by redox reaction?
27. Define pH.
28. Represent quinone-hydroquinone electrode.
29. Define solubility.
30. What do you mean by diamagnetism?
31. How are equivalent conductivity and molar conductivity of an electrolyte related?
32. Write the expression for the Debye-Huckel-Onsager conductance equation and define the terms involved therein.
33. What are transference numbers and how they are related to the ionic mobilities?
34. Ionic conductance's of Na<sup>+</sup> and Cl<sup>-</sup> ions at infinite dilution are 50.11 and 76.32 Scm<sup>2</sup> equiv.<sup>-1</sup>, respectively. Find out the transport numbers of Na<sup>+</sup> and Cl<sup>-</sup> ions.
35. Write the Nernst equation for the following reduction reaction:  

$$M^{n+} (aq) + ne^{-} \rightleftharpoons M (s)$$
36. The potential of a hydrogen electrode in a solution of unknown concentration is 0.29V at 291 K, as measured against normal hydrogen electrode, calculate the pH of the solution.
37. Give one example each of concentration cells with and without transference.
38. Write the overall cell reaction for the following:



39. Write the Lorenz-Lorentz equation and define each term involved therein.
40. Discuss the nature of the potentiometric precipitation titration curve.
41. What is conductance?
42. Define specific resistance and write its unit.
43. Define cell constant how it is related to specific conductance.
44. How specific conductance is related to equivalent conductance?
45. How specific conductance is related to molar conductance?
46. What is reference of electrode?
47. What is standard electrode potential?
48. How are the emf of a cell related entropy.
  
49. What standard electrode potential of hydrogen electrode ?
50. What is the unit of specific conductance/ molar conductance in SI unit?

### **Group-B**

**Each question carries 8 marks.**

1. (a) Write Notes on:-
  - (i) Molar conductance & effect of dilution
  - (ii) Walden's rule
2. (a) Write Notes on :-
  - (i) Kohlrausch law
  - (ii) Wien effect
3. (a) What is ionic mobilities? How can you determine ionic mobilities?
  - (b) How can you determine -
    - (i) Degree of dissociation of weak electrolyte and
    - (ii) Solubility product of sparingly soluble salts by conductance measurements.
4. (a) State and explain Faraday's laws of electrolysis. What are its applications.
  - (b) What is conductometric? How can you determine the end points of
    - (i) titration of strong acids and weak bases.
    - (ii) strong acids, weak acids and strong bases.
5. (a) What are reversible and irreversible cells? Give examples. Derive Nernst equation for a half cell.

- (b) Determine -
- (i) equilibrium constants
  - (ii) pH value of Hydrogen electrode by e.m.f measurements.
6. (a) Determine emf of concentration cell without transference.
- (b) What is potentiometric titration? How can it use to-
- (i) titration of acid and base.
  - (ii) precipitation reaction of  $\text{AgNO}_3$  and  $\text{NaCl}$ .
7. (a) Define specific and equivalent conductance. How are they related? How do they vary with dilution of electrolyte? .
- (b) Discuss Debye-Huckel-Onsagar theory of strong electrolytes.
8. (a) What is conductometric titration? Explain the conductometric titration curves of -
- (i) strong acid versus weak base and
  - (ii) mixture of strong and weak acids with a strong base.
9. How does conductance measurement help to determine-
- (a) Ionic product of water and
  - (b) Solubility of sparingly soluble salt?
10. (a) State and Explain Faraday's laws of electrolysis. Find out the mass of Aluminum deposited by passing 10amp. Of current for 0.5hrs. through fused alumina.
- (b) Discuss the application of electrolysis in
- (i) Metal extraction
  - (ii) Electroplating soluble salt?
11. (a) What is electro-chemical cell? Give the construction, function and application of Galvanic cell.
- (b) Explain the determination of pH -
- (i) by using hydrogen electrode.
  - (ii) quinone hydroquinone electrode.

12. (a) Explain how will you determine activity coefficient and Transport number from EMF

measurement?

(b) What is magnetic susceptibility? Explain how is it measured by Gouy's method.

13. (a) Discuss Arrhenius theory of electrolyte dissociation.

(c) Define equivalent conductance. How it vary with dilution for strong electrolytes?

14. (a) State and explain Kohlrausch's law.

(b) Calculate equivalent conductance of  $\text{NH}_4\text{OH}$  at infinite dilution from following data.

Equivalent conductance of  $\text{NH}_4\text{Cl}$ ,  $\text{NaOH}$  and  $\text{NaCl}$  at infinite dilution are 149, 247

and  $126 \text{ ohm}^{-1} \text{ cm}^2 \text{ gm. Eq}^{-1}$  respectively.

15. (a) Derive Debye-Huckel-Onsagars equation. Suggest the conditions for the validity of the equation.

(b) Define transport number. Describe one method for its determination.

16. (a) Define EMF of a Cell. How can it be measured experimentally?

(b) Derive Nernst's equation.

17. (a) What are reversible and irreversible cells? Explain them with suitable examples.

(b) Derive relationship between emf  $\Delta H$ ,  $\Delta G$  and  $\Delta S$  of a cell reaction.

18. (a) What are concentration cells? Derive the expression for the emf of a concentration cell without transference.

(b) What is liquid junction potential? Derive the expression for liquid junction potential.

19. (a) Define electrode potential. Determine the e.m.f. of the cell  $\text{Zn}/\text{Zn}^{++} \parallel \text{Cu}^{++} \parallel \text{Cu}$  from the following data:

$$E^0_{\text{Zn}^{++} \mid \text{Zn}} = -0.76 \text{ V} \quad E^0_{\text{Cu}^{++} \mid \text{Cu}} = +0.34 \text{ V}.$$

(b) What do you mean by potentiometric titration? Discuss it involving an acid base reaction.

20. (a) Write notes on Debye-Falkenhagen effect and Wien effect.

(b) Why do you mean by conductance titration? Explain it involving weak acid and strong base.

21. (a) What are the evidences which favour the Arrhenius theory of electrolytic dissociation?

(b) The electrolytic conductivity of water at 298K is  $0.58 \times 10^{-7} \text{ Scm}^{-1}$ . Calculate the degree of Dissociation of water at 298K is  $548.6 \text{ Scm}^2 \text{ eq.}^{-1}$  and density of water =  $0.997 \text{ gm}^{-3}$

22. Derive Debye-Huckel-Onsager equation as applicable to strong electrolytes. Discuss its significance.

23. Describe Hittorff's method for determining the transport number of an ion.

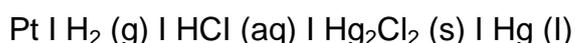
(i) Hoffman bromamide reaction.

24. (a) Derive the following reaction relation for a salt of weak acid and strong base,  $\text{pH} = -\log (K_w c / K_a)^{1/2}$  Debye-Huckel-Onsager equation as applicable to strong electrolytes.

(b) Calculate the pH value of a solution obtained by mixing 0.083 moles of acetic acid and 0.091 moles of sodium acetate and making the volume 500mL,  $K_a$  for acetic acid is  $1.7 \times 10^{-5}$

25. (a) Describe the principles for the determination of pH of a solution using quinhydrone electrode and indicate the limitations (if any) of using this electrode.

(b) Give the cell reaction for the following cell:



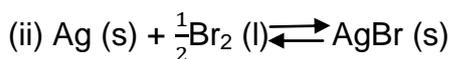
The emf of the above cell is 0.2669 V at 303K and 0.2699 V at 293 K.  $\Delta$  Calculate  $\Delta G$ ,  $\Delta H$  and  $\Delta S$  of the cell reaction at 293 K.

26. Write notes on the following:

(a) Application of electrolysis in industry and metallurgy.

(b) Reversible and irreversible chemical cells.

27. (a) Construct the galvanic cell for each of the following reactions and write the corresponding equations for the cell potential.



(b) How will you determine pH of a solution using glass electrode?

28. (a) What is induced polarization?

(b) What are polar molecules? Illustrate with examples.

(c) Dipole moment for HCl molecule is 1.03D and the internuclear separation is  $1.275\text{\AA}$ .

Calculate the % ionic character of HCl.

29. Write notes on the following:

(a) Kohlrausch's law of independent migration of ions.

(b) Rules of oxidation / reduction of ions based on half-cell potential.

30. Explain molecular polarizabilities. Describe the method of measurement of molecular polarizabilities.

