# Preparatory Exam – January 2025

## Chemistry (34) - I PUC

Time: 2:45 Hrs. Max. Marks: 70

Instructions:

1. Question paper has FIVE parts. All parts are compulsory
2. In part – A questions, first attempted answer will be considered for awarding marks.
3. Write balanced chemical equations and draw neat labelled diagrams and graphs wherever necessary.
4. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
5. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed)

### Part A

**I Select the correct option from the given choices** 1x 15 = 15

1. The number of significant figures in 0.2500
   (a)2 (b) 3 (c) 4 (d) 1
2. If two volume of gas give one volume of $A_2(g)$ and one volume of $B_2(g)$, then molecular formula of the gas will be
   (a) $A_4B_4$ (b) AB (c) $A_2B_2$ (d) $A_3B_3$
3. An atom of an element contains 20 neutrons and 19 electrons. Its mass number is
   (a) 29 (b) 28 (c) 01 (d) 39
4. The number of radial nodes for 3p orbital is
   (a) 3 (b) 4 (c) 2 (d) 1
5. Which one of the following is smallest in size?
   (a) $N^{3-}$ (b) $O^{2-}$ (c) $F^-$ (d) $Na^+$
6. The most electronegative element in the periodic table is
   (a) Cl (b) F (c) Br (d) I
7. The molecule having non zero dipole moment is
   (a) $CO_2$ (b) $NH_3$ (c) $CH_4$ (d) $BF_3$
8. The example for extensive property is
   (a) Pressure (b) temperature (c) Density (d) Mass
9. The change in internal energy ($\Delta U$) for an isolated system when there is no transfer of energy as heat or as work will be equal to
   (a) q (b) W (c) 0 (d) 1
10. Statement I: A chemical reaction is feasible if $\Delta G < 0$
    Statement II: For all feasible chemical reaction $\Delta S = 0$
    Identify the correct statement
    a) Both statement I and II are correct.
    b) Both statement I and II are incorrect
    c) Statement I is correct and statement II is incorrect
    d) Statement I is incorrect and statement II is correct



P.T.O.

11. Match the following elements in compounds with their oxidation state:

| Element | Oxidation State |
|---|---|
| A) Oxygen in $H_2O_2$ | (i) +1 |
| B) Hydrogen in $H_2$ | (ii) +5 |
| C) Nitrogen in $HNO_3$ | (iii) O |
| D) Sodium in NaCl | (iv) -1 |

a) A→ iv; B→iii; C→ ii; D→i

b) A→ iii; B→iv; C→ i; D→ ii

c) A→ ii; B→ i; C→ iv; D→ iii

d) A→i; B→ii ; C→iii; D→ iv

12. The heterocyclic compound among the following is

(a) cyclopropane (b) Benzene (c) Furan (d) Propane

13. Which of the following is an electrophilic reagent?

(a) $H_2O$ (b) $NH_3$ (c) $OH^-$ (d) $\overset{+}{N}O_2$

14. Separation of two substances by crystallization depends upon their difference in

(a) Density (b) Solubility (c) Melting point (d) Boiling point

15. General formula of alkene is

(a) $C_nH_{2n-2}$ (b) $CnH_{2n}$ (c) $CnH_{2n+2}$ (d) none of these

**II Fill in the blanks by choosing the appropriate word from those given in the brackets** **1 x 5 = 5**

**(~~ethyne~~, benzene, ~~increases~~, ~~decreases~~, chalcogens, ~~halogens~~)**

16. $SP^2$ hybridisation of carbon atom is in _____

17. Calcium carbide reacts with water to form _____

18. When the $p^H$ of a solution decreases its hydrogen ion concentration _____

19. Covalent radius of atom _____ along a period

20. $16^{th}$ column elements are called as _____

## Part B

**III Answer any FIVE of the following. Each question carries two marks** **2 x 5 = 10**

21. What are isobars? Give an example.

22. Define hydrogen bond. Mention the types of hydrogen bond present in water

23. Write lewis dot structure for (i) $O_2$ (ii) $CO_3^{2-}$

24. Define specific heat capacity. Write the relation between Cp and Cv.

25. State first law of thermodynamics. Write its mathematical expression.

26. Derive $p^{H} + p^{OH} = 14$ at 298K

27. Explain the effect of concentration on the equilibrium

$$Fe^{3+}(aq) + SCN^{-}(aq) \rightleftharpoons [Fe(SCN)]^{2+}(aq)$$

28. Write any two differences between inductive effect and electromeric effect.

29. Give IUPAC name of the following compound

(i) $H_3CCH_2CH_2\underset{\underset{CH_3}{|}}{CH}CH_3$

(ii) $H_3C-\overset{H}{\overset{|}{C}}=\overset{H}{\overset{|}{C}}-CH_3$

30. What is a functional group? Give an example.

## Part C

**IV Answer any THREE of the following. Each question carries three marks** **3 x 3 = 9**

31. Define ionization enthalpy. How does it vary along a period and down a group?

32. Explain sp hybridization by taking $BeCl_2$ as an example. Mention its shape.

33. For $O_2$ molecule 

(i) Write the electronic configuration

(ii) Calculate its bond order

(iii) Mention its magnetic property.

34. Write three postulates of VSEPR theory.

35. Balance the following redox reaction by oxidation number method

$MnO_2 + Br^- \longrightarrow Mn^{2+} + Br_2$ (in acidic medium)

**V Answer any THREE of the following. Each question carries three marks.** **3 x 3 = 9**

36. Write significance of any three quantum numbers.

37. (a) State Heisenberg's uncertainty principle. Write its mathematical form

(b) What is the atomic number of the element whose outermost electrons are represented by $3p^5$ ?

38. (a) Define acid and base by Bronsted – Lowry concept.

(b) Write the conjugate base of $CH_3COOH$

39. (a) What are buffer solutions? Give one example for acidic buffer.

(b) What happens to pH of water when $NH_4Cl$ solid is dissolved in it?

40. (a) Write Born-Haber cycle for the formation of sodium chloride crystal.

(b) Define isolated system.



P.T.O.

## Part D

**VI Answer any TWO of the following. Each question carries five marks** **5 x 2 = 10**

41. (a) Describe the estimation of carbon and hydrogen by Liebig's method.

(b) Write the bondline formula for $H_3C\ \underset{\displaystyle CH_3}{\underset{|}{CH}}\ CH_2CH_2OH$ **(4+1)**

42. (a) Complete the following reactions

(i) $C_2H_5Cl + KOH(alc.) \xrightarrow{\Delta}$

(ii) $CH_3COONa + NaOH \xrightarrow{\Delta CaO}$

(iii) $H_2C = CH_2 + Br_2 \longrightarrow$

(b) Explain Wurtz reaction with an example **(3+2)**

43. (a) Write the mechanism for Chlorination of benzene.

(b) Identify the number of sigma and pi bonds in $H_3C - \underset{\displaystyle H}{\underset{|}{C}} = \underset{\displaystyle H}{\underset{|}{C}} - CH_3$

**(3+2)**

## Part E

## (Numerical Problems)

**VII Answer any THREE of the following. Each question carries four marks** **3 x 4 = 12**

44. A compound contains 4.07% H, 24.27% of C and 71.65% of Cl. Its molecular mass is 98.96g. Calculate the empirical formula and molecular formula of the compound.

45. Calculate the energy of one mole of photon of radiation whose frequency is $5 \times 10^{14}$ Hz.

46. The enthalpy of combustion of carbon, hydrogen and methane at 298K are -393.5kJ, -285.8kJ and -890.3kJ respectively. Calculate the enthalpy of formation of methane.

47. (a) At equilibrium for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3, [N_2] = 1.5X10^{-2}M$, $[H_2] = 3X10^{-2}M$ and $[NH_3] = 1.2X10^{-2}M$ Calculate the equilibrium constant.

(b) Calculate the pH of 0.001M HCl solution **(2+2)**

48. In carius method of estimation of halogen, 0.15g of an organic compound gave 0.12g of AgBr. Find the percentage of bromine in the compound.

(Atomic mass of Ag = 108g and Br=80g)

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