2026

CHEMISTRY

(Major)

Anandaram Dhekial Phookan College Library
Acc. No.
Date
Nagaon, Assam

Paper : CHE4200104MJ

(Chemistry-II)

Full Marks : 45

Time : 2 hour

The figures in the margin indicate the full marks for the question.

1. Answer the following questions : **1×5=5**

(a) The structure of BeF_2 is _____.

(b) Benzoic acid is stronger acid than propanoic acid. (*True / False*)

(c) Define exact differential.

(d) Give one example of chelate ligand.

(e) Arrange the following in increasing order of acid strength :
$ClCH_2COOH$, FCH_2COOH, $BrCH_2COOH$, CH_3COOH

2. Answer *any five* of the following questions : **2×5=10**

(a) State and explain the First law of thermodynamics?

(b) How does the Bent's rule govern the pattern of hybridization?

(c) Calculate the work done when 2 moles of an ideal gas expand reversibly and isothermally from a volume of 500 ml to a volume of 2 L at 25°C and normal pressure.

(d) What is Berry pseudo rotation? Explain with example.

(e) Which is more stable, a benzyl carbanion or a methyl carbanion? Why?

(f) What is enthalpy of combustion? Give example.

(g) What is optical isomerism? Give two examples of coordination compounds showing optical isomerism.

(h) How carbocations are formed? How electronegativity affects the stability of the carbocations?

(i) Define resonance and resonance energy. Explain the concept of resonance structures with suitable examples.

(j) Define intensive and extensive properties with suitable examples.

3. **Answer *any four* of the following questions :** **5×4=20**

(a) Explain the postulates of Werner's coordination theory with suitable example.

(b) What are carbenes? Mention about different classes of carbenes providing suitable example. Propose one method for the generation of carbenes. 1+2+2

(c) Explain Fajan's rule and how they determine the covalent character in ionic compounds. Provide examples to illustrate the consequences of polarization. 1+2+2

(d) Name the following according to IUPAC systems : 5

(i) $[Fe(F)_6]^{3-}$ (ii) $[Co(en)_3]^{3+}$

(iii) $K_3[Fe(CN)_5(NO)]$ (iv) $Li[AlH_4]$

(v) $[Co(NH_2—CH_2—CH_2—NH_2)_3]_2(SO_4)_3$

(e) Give the molecular electronic configuration of N_2 molecule. Draw the MO energy level diagram of the N_2 molecule. Calculate bond order of the molecule and explain its magnetic property. 1+2+2

(f) What is the definition of pK_a and pK_b? How can you express the acid strength of organic acids and basic strength of organic bases? 2+3

(g) What are heat capacities at constant volume and constant pressure? Derive the relationship $C_p - C_v = R$. 2+3

(h) What are ambidentate and hexadentate ligands? Give two examples of each. 2+3

4. **Answer *any one* of the following questions :** **10×1=10**

(a) What are the possible geometries for coordination number '4' and '5'? What type of hybridized orbitals may be used for such geometries? Explain with suitable examples.

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(b) (i) Explain the Heitler-London approach to the valence bond theory and how it describe the formation of a covalent bond. Describe the role of electron spin and overlap of atomic orbitals. 2+3+2

(ii) State three rules for the linear combination of atomic orbitals. 3

(c) (i) What is Joule-Thomson effect? Show that Joule-Thomson expansion of a gas is an isoenthalpic process. 1+4

(ii) What is a Carnot cycle? Derive an expression of the efficiency of a reversible Carnot cycle taking an ideal gas as the working material. Is it possible to have a Carnot cycle of efficiency one? 1+3+1

(d) Explain giving reasons. 2×3

i) Benzyl carbocation is highly stable.

ii) Methylamine is a stronger base than ammonia but aniline is less basic than ammonia.

iii) Methylcarbanion is more stable than ethylcarbanion.

1. What are free radicals? How are they generated? 2

2. Show that at 298 K, $pK_a + pK_b = pKw = 14$. 2

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