June : 2026

CHEMISTRY

Paper: CHM-C-201

Chemistry C2: Inorganic + Physical + Organic

Time: 2 Hours **Total Mark: 45**

(The figures in the right margin indicate full marks of the questions)

Section A : Inorganic Chemistry

Q. 1. Choose the correct answer from the following options: 1×2=2

(a) Which of the following molecules has a bond order of 3?

(i) O_2 (ii) N_2

(iii) NO (iv) CO_2

(b) Which metal is refined by Zone Refining?

(i) Nickel (ii) Tungsten

(iii) Copper (iv) Silicon

2. Answer the following questions *(any two)*: 2×2=4

(a) Explain the following modern method of refining metals *(any one)*: 2

i) Zone refining ii) Vacuum arc process

(b) Define roasting and calcination with one example each. 2

(c) Draw the structure of the following compounds: 1+1=2

(i) Potassium dichromate (ii) DMG with Ni^{2} ion

3. Answer the following questions *(any three)* 3×3 = 9

(a) Discuss the preparation, use and structure of the following reagents in inorganic analysis *(any one)*: 3

i) Potassium Permanganate

ii) Sodium cobaltinitrite

(b) Explain the role of carbon as a reducing agent in metallurgy. Why is it not suitable for reducing highly reactive metal oxides? 2+1=3

(c) Explain the principle of the Goldschmidt thermite process with suitable chemical equations. 3

(d) Explain the changes that occur during roasting of sulphide ores. Why is this step important before reduction? 2+1=3

SECTION B (Physical Chemistry)

4. (a) For tetragonal crystal system has the dimensions of their unit cell 1×2=2

i) $a = b = c$ and $\alpha = \beta = \gamma = 90°$

ii) $a = b \neq c$ and $\alpha \neq \beta \neq \gamma \neq 90°$

iii) $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90°$

iv) $a = b \neq c$ and $\alpha = \beta = \gamma = 90°$

(d) For an ideal gas the change in enthalpy under isothermal expansion is

(i) Positive (ii) Negative

(iii) Zero (iv) None of the above

5. Answer the following questions (any two) 2×2=4

(a) Calculate the Miller indices of crystal planes which cut through the crystal axes at- 2

i) (2a, –3b, –3c) ii) (2a, b, ∞)

(b) What are Schottky and Frenkel defect? 1+1=2

(c) Thermodynamically prove that for one mole of an ideal gas $C_p - C_v = R$ 2

(d) Derive a relation between pressure and volume for an adiabatic expansion of an ideal gas. 2

6. Answer the following questions (any three): 3×3 = 9

(a) Discuss conductors, insulators and semiconductors in the light

of band theory of solids. 1+1+1=3

(b) Derive the Bragg's Equation. 3

(c) Write the statement of Hess's Law. The enthalpy of combustion of carbon, hydrogen and methane are 393.5 kJmole $^{-1}$, 571.8 kJmole $^{-1}$, and 890.3 kJmole $^{-1}$ respectively. Calculate the enthalpy of formation of methane. 1+2=3

(d) Derive the relation $\mu = -\frac{1}{cp}\left(\frac{\partial H}{\partial P}\right)_T$ (μ =Joule Thomson Cofficient)

SECTION C (Organic Chemistry)

7. (a) A *meso* compound is: 1×2=2

(i) Optically active

(ii) Optically inactive due to internal symmetry

(iii) Always chiral

(iv) Only found in alkenes

(b) The number of possible enantiomeric pairs that can be produced during monochlorination of 2-methylbutane is

i) 2 ii) 3

iii) 4 iv) 1

8. Answer the following questions *(any two)*: 2×2=4

(a) Distinguish between enantiomers and diastereomers. 2

(b) What is restricted rotation about a C=C bond? 2

(c) Write short notes on *(any one)*: 1×2=2

(i) Epimers

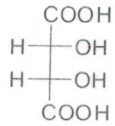
(ii) Optical activity and its measurement

(d) Find the total number of geometrical isomers of the following and name them. 2

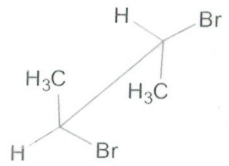
9. Answer the following questions *(any three)*: $3\times3=9$

(a) Define proper axis of symmetry. What are the different proper axes present in benzene and mention the principal axis in it. 1+2=3

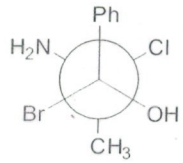
(b) Interconvert the following projection formula as directed (any two): $1\frac{1}{2}\times2=3$

i) 

To Sawhorse projection

ii) 

To Fischer projection

iii) 

To Sawhorse projection

(b) A given Newman projection of butane is in gauche form. Convert it into wedge-dash representation and comment on stability. 1+2=3

(c) Explain erythro and threo isomerism using Fischer projections of a compound with two chiral centers with an example. $1^1/_2+1^1/_2=3$

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