JEE Main Chemistry Sample Paper-2

Duration: 1 Hour **Maximum Marks: 100**

Instructions

- This paper contains TWO sections: **Section A** (MCQs) and **Section B** (Numerical).
- Section A contains 20 Multiple Choice Questions.
- Section B contains 5 Numerical Value Questions.
- Each correct answer carries **+4 marks**.
- Each incorrect answer carries **-1 mark**.
- No negative marking for unattempted questions.

Section A — Multiple Choice Questions

Q1. Most stable conformation of 2,3-dimethylbutane C2-C3 rotation: [JEE Main 2024]

(A) 0°

(B) 60°

(C) 120°

(D) 180°

Q2. Final product (Z) in reaction sequence: [JEE Main 2023]

(A) Benzaldehyde

(B) Benzoic acid

(C) Benzyl alcohol

(D) Toluene

Q3. Radial probability curve for 3p orbital: [JEE Main 2022]

(A) 0 nodes

(B) 1 node

(C) 2 nodes

(D) 3 nodes

Q4. Correct graph for isothermal expansion of ideal gas: [JEE Main 2025]

(A) P vs V straight line through origin

(B) PV vs P horizontal straight line

(C) V vs T hyperbola

(D) P vs $1/V$ hyperbola

Q5. Major product P in hydroboration-oxidation: [JEE Main 2024]

(A) 1-methylcyclohexanol

(B) trans-2-methylcyclohexanol

(C) cis-2-methylcyclohexanol

(D) Cyclohexylmethanol

Q6. Frost diagram slope between M^{2+} and M^{3+} positive & steeper than $M \rightarrow M^{2+}$: [JEE Main 2021]

(A) M^{2+} prone to disproportionation

(B) M^{3+} strong reducing agent

(C) M^{2+} most stable

(D) M is a noble metal

Q7. Ellingham diagram trend for CO and CO_2 formation: [JEE Main 2023]

(A) $C \rightarrow CO_2$ large positive slope

(B) $C \rightarrow CO$ negative slope

(C) $CO \rightarrow CO_2$ horizontal line

(D) All metal oxide lines negative slopes

Q8. Number of tetrahedral voids per small cube in CCP: [JEE Main 2022]

(A) 1

(B) 2

(C) 4

(D) 8

Q9. Red precipitate with Fehling's solution: [JEE Main 2025]

(A) CuO

(B) Cu_2O

(C) $Cu(OH)_2$

(D) Cu

Q10. HOMO of CO molecule: [JEE Main 2024]

(A) σ_{2p_z}

(B) π_{2p_x}

(C) σ^*_{2s}

(D) σ_{2s}

Q11. Arrhenius plot slope -4000 K, E_a: [JEE Main 2021]

(A) 33.26 kJ/mol

(B) 4000 J/mol

(C) 8.314 kJ/mol

(D) 1.0 kJ/mol

Q12. Δ_o for $[CoCl_6]^{4-} = 18000\ \text{cm}^{-1}$, find Δ_t for $[CoCl_4]^{2-}$: [JEE Main 2023]

(A) 18000 cm^{-1}

(B) 8000 cm^{-1}

(C) 16000 cm^{-1}

(D) 20000 cm^{-1}

Q13. d-orbitals pointing directly towards ligands in octahedral: [JEE Main 2022]

(A) d_{xy}, d_{yz}

(B) $d_{x^2-y^2}, d_{z^2}$

(C) d_{xz}, d_{z^2}

(D) All d-orbitals

Q14. Hydrogen bonds between Cytosine and Guanine: [JEE Main 2025]

(A) 2

(B) 3

(C) 1

(D) 0

Q15. Half-equivalence point in weak acid-strong base titration: [JEE Main 2024]

(A) $pH = 7$

(B) $pH = pK_a$

Salt $= 2 \times$ [Acid]

(C) $pOH = pK_b$

Q16. Structure of Inorganic Benzene: [JEE Main 2021]

(A) $B_3N_3H_3$

(B) $B_3N_3H_6$

(C) B_2H_6

(D) $C_3N_3H_3$

Q17. Ion with largest ionic radius: [JEE Main 2023]

(A) O^{2-}

(B) F^-

(C) Na^+

(D) Mg^{2+}

Q18. Major product of Reimer-Tiemann reaction: [JEE Main 2022]

(A) Salicylic acid

(B) Salicylaldehyde

(C) Phthalic acid

(D) Aspirin

Q19. Reaction of HBr with propene in presence of H_2O_2: [JEE Main 2025]

(A) Markonikov's rule

(B) Anti-Markonikov's rule

(C) Saytzeff's rule

(D) Hofmann's rule

Q20. Boiling point elevation constant (K_b) depends on: [JEE Main 2024]

(A) Nature of solute

(B) Nature of solvent

(C) Concentration of solution

(D) Pressure of system

Section B — Numerical Questions

Q21. Cubic crystal, distance between adjacent (111) planes with lattice edge 300 pm is $X\sqrt{3}$ pm. Find X: [JEE Main 2024]

Q22. First-order reaction, 50% complete in 20 min. Time to reduce to 1/8th: [JEE Main 2023]

Q23. Chiral carbons in open-chain D-glucose: [JEE Main 2025]

Q24. Standard reduction potential for $Cu^{2+}/Cu = +0.34$ V. Potential in 0.01 M solution at 25°C = 0.x V. Find x: [JEE Main 2022]

Q25. Total lone pairs in I_3^- ion: [JEE Main 2024]

Q1.

Solution

Concept: Stability of conformations in alkanes depends on steric hindrance.

Solution:
Most stable conformation occurs when bulky groups are farthest apart.
In 2,3-dimethylbutane, staggered conformation at 180° minimizes repulsion.

Final Answer: (D)

Answer: (D)

Q2.

Solution

Concept: Typical oxidation of alkyl benzene leads to benzoic acid.

Solution:
Strong oxidizing agents convert side chain to COOH group.
Thus final product is benzoic acid.

Final Answer: (B)

Answer: (B)

Q3.

Solution

Concept: Radial nodes $= n - l - 1$.

Solution:
For 3p orbital: $n = 3$, $l = 1$

$$\text{Radial nodes} = 3 - 1 - 1 = 1$$

Final Answer: (B)

Answer: (B)

Q4.

Solution

Concept: Isothermal process: $PV =$ constant.

Solution:
Thus graph of P vs V is rectangular hyperbola.
Equivalent form: PV vs P is constant (horizontal).

Final Answer: (B)

Answer: (B)

Q5.

Solution

Concept: Hydroboration gives anti-Markovnikov and syn addition.

Solution:
OH attaches at less substituted carbon $\rightarrow$ cis product.

Final Answer: (C)

Answer: (C)

Q6.

Solution

Concept: Frost diagram stability interpretation.

Solution:
Higher slope indicates less stability.
Thus M^{2+} tends to disproportionate.

Final Answer: (A)

Answer: (A)

Q7.

Solution

Concept: Ellingham diagram slopes depend on entropy.

Solution:
$C \rightarrow CO$ has negative slope due to increase in entropy.

Final Answer: (B)

Answer: (B)

Q8.

Solution

Concept: In CCP, tetrahedral voids = 2 per atom.

Solution:
Per unit cube = 8 tetrahedral voids $\rightarrow$ per small cube = 2.

Final Answer: (B)

Answer: (B)

Q9.

Solution

Concept: Fehling's solution gives red precipitate of Cu_2O.

Final Answer: (B)

Answer: (B)

Q10.

Solution

Concept: HOMO of CO is σ_{2p_z}.

Final Answer: (A)

Answer: (A)

Q11.

Solution

Concept: Arrhenius equation slope $= -\frac{E_a}{R}$.

Solution:

$$E_a = 4000 \times 8.314 = 33.26 \text{ kJ/mol}$$

Final Answer: (A)

Answer: (A)

Q12.

Solution

Concept: $\Delta_t = \frac{4}{9}\Delta_o$.

$$\Delta_t = \frac{4}{9} \times 18000 = 8000$$

Final Answer: (B)

Answer: (B)

Q13.

Solution

Concept: Orbitals pointing directly $\rightarrow e_g$ orbitals.

Final Answer: (B)

Answer: (B)

Q14.

Solution

Concept: G-C pair has 3 hydrogen bonds.

Final Answer: (B)

Answer: (B)

Q15.

Solution

Concept: Half equivalence $\rightarrow pH = pK_a$.

Final Answer: (B)

Answer: (B)

Q16.

Solution

Concept: Inorganic benzene is borazine.

Final Answer: (B)

Answer: (B)

Q17.

Solution

Concept: Ionic radius increases with negative charge.

Final Answer: (A)

Answer: (A)

Q18.

Solution

Concept: Reimer-Tiemann gives salicylaldehyde.

Final Answer: (B)

Answer: (B)

Q19.

Solution

Concept: Peroxide effect $\rightarrow$ anti-Markovnikov.

Final Answer: (B)

Answer: (B)

Q20.

Solution

Concept: K_b depends on solvent only.

Final Answer: (B)

Answer: (B)

Q21.

Solution

$$d_{111} = \frac{a}{\sqrt{3}} = \frac{300}{\sqrt{3}} = 100\sqrt{3}$$

Final Answer: $X = 100$

Answer: (100)

Q22.

Solution

Half-life = 20 min
1/8 = 3 half-lives $\rightarrow$ time = $3 \times 20 = 60$ min

Final Answer: 60

Answer: (60)

Q23.

Solution

D-glucose has 4 chiral carbons.

Final Answer: 4

Answer: (4)

Q24.

Solution

Using Nernst equation:

$$E = 0.34 - \frac{0.059}{2}\log(100) = 0.34 - 0.059 = 0.28$$

Final Answer: $x = 28$

Answer: (28)

Q25.

Solution

I_3^- has total lone pairs = 9.

Final Answer: 9

Answer: (9)

Answer Key — Section A

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	D	2	B	3	B	4	B	5	C
6	A	7	B	8	B	9	B	10	A
11	A	12	B	13	B	14	B	15	B
16	B	17	A	18	B	19	B	20	B

Answer Key — Section B

Q	Ans	Q	Ans
21	100	22	60
23	4	24	28
25	9		