WBJEE Chemistry Sample Paper-2

Duration: 60 Minutes **Maximum Marks: 50**

Instructions

- This paper contains a total of **40** Multiple Choice Questions.
- **Section A (Q1–Q30):** Each correct answer carries +1 mark. Incorrect answer: **0.25 marks**. Only **one** correct option.
- **Section B (Q31–Q35):** Each correct answer carries +2 mark. Incorrect answer: **0.5 marks**. Only **one** correct option.
- **Section C (Q36–Q40)**: Each correct answer carries **+2 marks**. **No negative marking.** One or **more** correct options may be correct; full marks only if all correct options are marked.
- Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.

Section–A — 30 Questions × 1 Mark Each (Negative Marking: 0.25) [Single Correct]

Q1. A mixture of NH_4NO_3 and $(NH_4)_2HPO_4$ contains 30.4% nitrogen by mass. What is the mass ratio of NH_4NO_3 to $(NH_4)_2HPO_4$ in the mixture?

(A) 2 : 1

(B) 1 : 2

(C) 3 : 4

(D) 4 : 3

Q2. Equal volumes of 0.1 M $KMnO_4$ and 0.2 M $FeSO_4$ solutions are mixed in an acidic medium. The mixture is then titrated against 0.05 M $K_2Cr_2O_7$ solution. The volume of $K_2Cr_2O_7$ required per litre of the original mixture is:

(A) 150 mL

(B) 300 mL

(C) 100 mL

(D) 200 mL

Q3. An aqueous solution contains 10% w/w NaOH and has a density of 1.11 g/cm^3. If 200 mL of this solution is diluted with water until its density becomes 1.02 g/cm^3 and concentration becomes 2% w/w, the volume of water added is closely equal to:

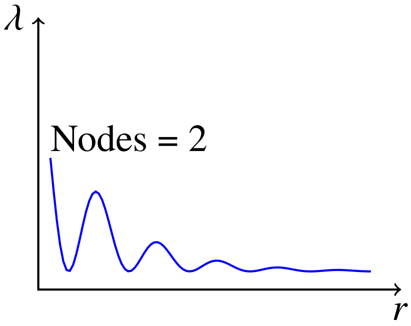
(A) 800 mL

(B) 888 mL

(C) 912 mL

(D) 1000 mL

Q4. An electron in a hydrogen-like atom jumps from an excited state to the ground state. The variation of the de Broglie wavelength (λ) of the electron as a function of the radial distance (r) from the nucleus for the initial state is represented by the graph below. Identify the principal quantum number (n) of the initial excited state.



(A) $n = 2$

(B) $n = 3$

(C) $n = 4$

(D) $n = 5$

Q5. The angular wave function of an orbital in a hydrogen-like atom is given by $Y(\theta, \phi) = \frac{1}{4}\sqrt{\frac{15}{\pi}} \sin\theta \cos\theta \sin\phi$. The number of radial nodes and angular nodes for this orbital if its principal quantum number is $n = 4$ are respectively:

(A) 1, 2

(B) 2, 1

(C) 0, 3

(D) 1, 3

Q6. A radioactive nuclide X decays simultaneously into two daughters Y and Z via parallel first-order paths. The half-life for the formation of Y is 100 s and that for Z is 300 s. If the initial activity of a pure sample of X is A_0, the time required for the activity to drop to $A_0/4$ is:

(A) 150 s

(B) 75 s

(C) 100 s

(D) 50 s

Q7. The bond angles in NF_3, NCl_3, and NBr_3 follow which of the correct sequences?

(A) $NF_3 < NCl_3 < NBr_3$

(B) $NF_3 > NCl_3 > NBr_3$

(C) $NCl_3 < NF_3 < NBr_3$

(D) $NF_3 < NBr_3 < NCl_3$

Q8. The formal charges on the central oxygen atom and the two terminal oxygen atoms in the resonance structure of ozone (O_3) showing a single coordinate bond are respectively:

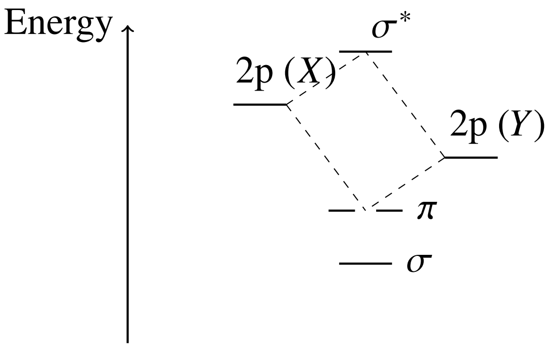
(A) $+1, 0, -1$

(B) $0, +1, -1$

(C) $+1, -1, 0$

(D) $0, 0, 0$

Q9. Consider the molecular orbital (MO) energy level diagram for a heteronuclear diatomic molecule XY shown below. Based on the relative energies of the atomic orbitals and the resulting molecular orbitals, which of the following statements is completely correct?



(A) X is more electronegative than Y, and the HOMO possesses more character of X.

(B) Y is more electronegative than X, and the bonding MOs are closer in energy to the atomic orbitals of Y.

(C) X and Y have identical electronegativities, leading to completely symmetrical electron distribution.

(D) The molecule is inherently unstable because the σ^* orbital contains fewer nodes than the bonding σ orbital.

Q10. One mole of an ideal gas expands isothermally at 300 K from an initial volume of 10 dm^3 to a final volume of 100 dm^3 against a constant external pressure of 1 bar. The total entropy change of the universe ($\Delta S_{\text{sys}} + \Delta S_{\text{surr}}$) for this process is: [Given: $R = 8.314 \text{ J K}^{-1}\text{mol}^{-1}$]

(A) $+14.15 \text{ J K}^{-1}$

(B) 0 J K^{-1}

(C) $+23.03 \text{ J K}^{-1}$

(D) -9.15 J K^{-1}

Q11. The equilibrium constant K_c for the decomposition of PCl_5(g) into PCl_3(g) and Cl_2(g) is 0.04 M at a specific temperature. If a 1.0 L flask initially contains 0.20 mol of PCl_5, the concentration of Cl_2 at equilibrium is closer to:

(A) 0.072 M

(B) 0.020 M

(C) 0.045 M

(D) 0.063 M

Q12. For a parallel reaction system $A \xrightarrow{k_1} B$ and $A \xrightarrow{k_2} C$, the activation energies are $E_1 = 120$ kJ mol^{-1} and $E_2 = 150$ kJ mol^{-1} respectively. If the pre-exponential factors are equal, the overall activation energy (E_a) for the disappearance of A at 300 K when $k_1/k_2 = 100$ is approximately:

(A) 120.3 kJ mol^{-1}

(B) 135.0 kJ mol^{-1}

(C) 149.7 kJ mol^{-1}

(D) 125.5 kJ mol^{-1}

Q13. A compound contains two types of oxide ions: normal oxide (O^{2-}) and peroxide (O_2^{2-}). If the oxidation state of the metal M in the compound M_2O_5 is +4, the ratio of the number of normal oxide ions to peroxide ions in one formula unit of the compound is:

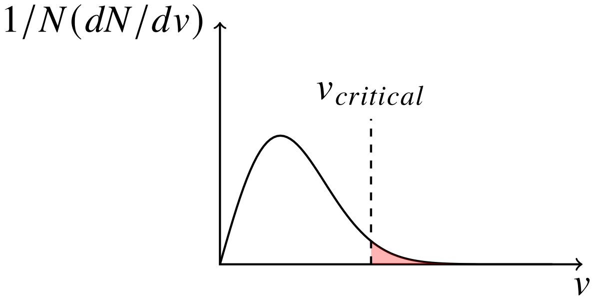
(A) 1 : 2

(B) 2 : 1

(C) 3 : 1

(D) 1 : 1

Q14. The Maxwell-Boltzmann distribution of molecular speeds for a real gas at a specified temperature is plotted below. If a chemical process depends on molecules achieving a threshold activation energy corresponding to a minimum speed $v_{critical}$, which shaded region represents the total fraction of molecules capable of undergoing the reaction?



(A) The entire area under the curve from $v = 0$ to $v_{critical}$

(B) The area to the right of $v_{critical}$ extending to infinity

(C) Only the narrow peak region representing the most probable speed

(D) The symmetric inversion region centered exactly at the average velocity

Q15. When KO_2 reacts with wet CO_2 gas, a white crystalline solid and a gas are formed. The white crystalline solid and gas are respectively:

(A) $KHCO_3$, O_2

(B) K_2CO_3, O_2

(C) $KHCO_3$, O_3

(D) KOH, O_2

Q16. Which of the following compounds on thermal decomposition leaves behind a metal residue instead of a metal oxide?

(A) Ag_2CO_3

(B) $Cu(NO_3)_2$

(C) $CaCO_3$

(D) $FeSO_4$

Q17. The correct order of the boiling points of the group 16 hydrides is given by:

(A) $H_2O > H_2Te > H_2Se > H_2S$

(B) $H_2O > H_2S > H_2Se > H_2Te$

(C) $H_2Te > H_2Se > H_2S > H_2O$

(D) $H_2O > H_2Te > H_2S > H_2Se$

Q18. The magnetic moment (spin-only) of an octahedral complex $[CoF_6]^{3-}$ is 4.90 BM. The hybridization of the central atom and the nature of the complex are respectively:

(A) sp^3d^2, outer orbital high-spin complex

(B) d^2sp^3, inner orbital low-spin complex

(C) sp^3d^2, outer orbital low-spin complex

(D) d^2sp^3, inner orbital high-spin complex

Q19. Photochemical smog is formed in warm, wet, and sunny climates. The primary precursor responsible for initiating the chain reaction leading to the generation of secondary pollutants like PAN in photochemical smog is:

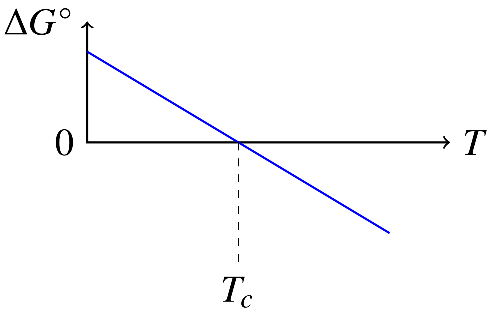
(A) NO_2

(B) SO_2

(C) CO

(D) CO_2

Q20. The temperature-dependence of the standard Gibbs free energy change (ΔG°) for a high-temperature metallurgical reduction reaction is displayed in the Ellingham-type plot below. At what temperature range does the reduction process become thermodynamically spontaneous?



(A) At all temperatures below T_c

(B) Exactly at $T = T_c$ only

(C) At all temperatures above T_c

(D) The reaction can never be spontaneous regardless of temperature

Q21. Which of the following carbocations is expected to be the most stable due to stereoelectronic factors like aromaticity or non-classical resonance stability?

(A) Cyclopropenyl cation

(B) Cyclopentadienyl cation

(C) Cycloheptatrienyl anion

(D) Vinyl cation

Q22. An alkene on reductive ozonolysis yields a mixture of acetone and 2-methylpropanal. The structured IUPAC name of the starting alkene is:

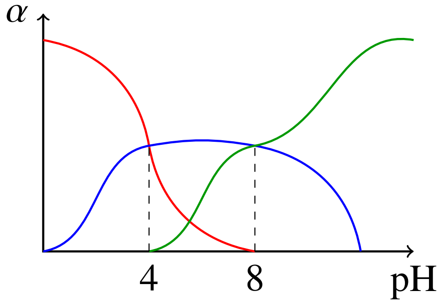
(A) 2,4-dimethylpent-2-ene

(B) 2,3-dimethylpent-2-ene

(C) 3,4-dimethylpent-2-ene

(D) 2,4-dimethylpent-3-ene

Q23. A weak diprotic acid H_2A is titrated with a strong base $NaOH$. The distribution curves showing the fractional concentration (α) of species H_2A, HA^-, and A^{2-} as a function of pH are shown in the figure below. What are the approximate values of pK_{a1} and pK_{a2} for this acid?



(A) $pK_{a1} = 2$, $pK_{a2} = 6$

(B) $pK_{a1} = 4$, $pK_{a2} = 8$

(C) $pK_{a1} = 4$, $pK_{a2} = 4$

(D) $pK_{a1} = 8$, $pK_{a2} = 12$

Q24. When 2-bromopentane is treated with potassium tert-butoxide in tert-butanol, the major elimination product formed is:

(A) pent-1-ene

(B) trans-pent-2-ene

(C) cis-pent-2-ene

(D) 2-methylbut-2-ene

Q25. The compound that undergoes electrophilic nitration most rapidly under standard mixed-acid (HNO_3/H_2SO_4) conditions is:

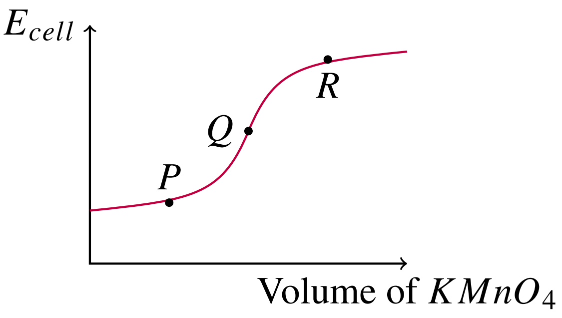
(A) Toluene

(B) Phenol

(C) Benzene

(D) Nitrobenzene

Q26. An acidic solution containing Fe^{2+} ions is titrated against a standard potassium permanganate ($KMnO_4$) solution. The potentiometric titration curve tracking the cell potential (E_{cell}) against the volume of $KMnO_4$ added is given below. Which points correspond respectively to the half-equivalence point and the exact equivalence point of this redox process?



(A) Half-equivalence = P; Equivalence = Q

(B) Half-equivalence = Q; Equivalence = R

(C) Half-equivalence = P; Equivalence = R

(D) Half-equivalence = Q; Equivalence = P

Q27. The relative basic strength of the following amines in aqueous medium follows the order:

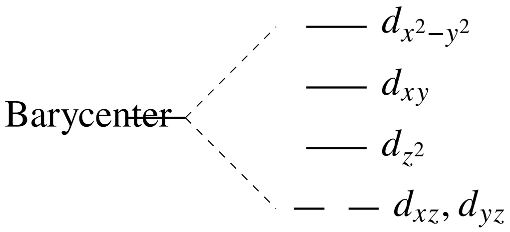
(A) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$

(B) $(CH_3)_2NH > (CH_3)_3N > CH_3NH_2 > NH_3$

(C) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$

(D) $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N > NH_3$

Q28. The d-orbital splitting diagram for a coordination complex with a specific coordination geometry is illustrated below. Identify the correct geometry matching this splitting pattern.



(A) Perfect Octahedral (O_h)

(B) Symmetrical Tetrahedral (T_d)

(C) Square Planar (D_{4h})

(D) Trigonal Bipyramidal (D_{3h})

Q29. The polymer known as 'Buna-N' is a synthetic copolymer consisting of which of the following monomeric units?

(A) 1,3-Butadiene and Acrylonitrile

(B) 1,3-Butadiene and Styrene

(C) Chloroprene and Acrylonitrile

(D) Isoprene and Acrylonitrile

Q30. The final product formed when Xenon reacts with an excess of Fluorine gas (Xe : F_2 = 1 : 20 ratio) at 573 K and 60 – 70 bar pressure inside a nickel vessel is:

(A) XeF_6

(B) XeF_4

(C) XeF_2

(D) $XeOF_4$

Section B – 5 Questions × 2 Marks Each (Negative Marking: 0.5) [Single Correct]

Q31. The equivalent conductance of a 0.01 M weak monobasic acid is 15.0 S cm^2 eq^{-1}. If the equivalent conductance at infinite dilution is 400.0 S cm^2 eq^{-1}, the dissociation constant (K_a) of the acid is closer to:

(A) 1.42×10^{-5} M

(B) 1.42×10^{-6} M

(C) 3.75×10^{-5} M

(D) 3.75×10^{-4} M

Q32. The crystal field stabilization energy (CFSE) for a high-spin d^6 octahedral complex and a low-spin d^6 octahedral complex (neglecting pairing energy differences) are respectively:

(A) $-0.4\Delta_0$ and $-2.4\Delta_0$

(B) $-0.6\Delta_0$ and $-1.8\Delta_0$

(C) $-0.4\Delta_0$ and $-1.2\Delta_0$

(D) $-1.2\Delta_0$ and $-2.4\Delta_0$

Q33. The standard enthalpy of formation ($\Delta_f H^\circ$) of $CO_2(g)$, $H_2O(l)$, and propane $C_3H_8(g)$ are −393.5, −285.8, and −103.8 kJ mol^{-1} respectively. The amount of heat released when 22 g of propane gas is completely combusted under standard conditions is:

(A) 1110.0 kJ

(B) 2220.0 kJ

(C) 555.0 kJ

(D) 1665.0 kJ

Q34. An aqueous solution contains a mixture of 0.05 M CH_3COOH and 0.1 M CH_3COONa. If the K_a of acetic acid is 1.8×10^{-5}, and 0.01 mol of HCl gas is passed through 1 L of this solution without changing the volume, the new pH of the system is: [Given: $\log_{10} 1.8 = 0.255$, $\log_{10} 2 = 0.301$, $\log_{10} 3 = 0.477$]

(A) 4.92

(B) 4.74

(C) 4.56

(D) 5.05

Q35. An organic compound (A) with molecular formula C_4H_9Cl on treatment with sodium metal in dry ether gives a hydrocarbon which on monochlorination yields only one monohalo derivative. The compound (A) is:

(A) tert-butyl chloride

(B) n-butyl chloride

(C) isobutyl chloride

(D) sec-butyl chloride

Section C — 5 Questions × 2 Marks Each (No Negative Marking) [One or More Correct]

Q36. A real gas obeying van der Waals equation can be liquefied easily if the conditions satisfy which of the following statements?

(A) The temperature of the gas must be lower than its critical temperature (T_c).

(B) The pressure exerted must be greater than its critical pressure (P_c) when $T < T_c$.

(C) The compressibility factor Z must be less than 1 at moderate pressures.

(D) The temperature of the gas must be exactly equal to or greater than its Boyle temperature (T_b).

Q37. Which of the following pairs of electronic configurations or properties match correctly regarding the elements of the d-block and f-block transition metals?

(A) Gd^{3+} ($Z = 64$) has a stable electronic configuration of $[Xe]4f^7$ showing high magnetic moment.

(B) Lu^{3+} ($Z = 71$) is diamagnetic due to completely filled $4f$ orbital shells.

(C) Cr^{2+} is a stronger reducing agent than Mn^{3+} in an aqueous medium.

(D) La ($Z = 57$) belongs to the $4f$-block (lanthanoids) because its last electron enters the $4f$ orbital.

Q38. Identify the correct statements regarding the properties and structure of diborane (B_2H_6) and other s/p block components:

(A) It contains four 2-centre-2-electron ($2c - 2e$) bonds and two 3-centre-2-electron ($3c - 2e$) bonds.

(B) The four terminal B-H bonds lie in one plane while the two bridging H atoms lie above and below this plane.

(C) Boron atoms in diborane are sp^2 hybridized.

(D) B_2H_6 reacts with excess ammonia at high temperatures to give inorganic benzene (borazine).

Q39. Which of the following solutions will show a higher boiling point elevation (ΔT_b) compared to a 0.1 m aqueous urea solution (assuming complete dissociation of electrolytes)?

(A) 0.1 m' aqueous NaCl solution

(B) 0.05 m' aqueous $BaCl_2$ solution

(C) 0.1 m' aqueous $Al_2(SO_4)_3$ solution

(D) 0.1 m' aqueous glucose solution

Q40. When D-glucose is treated with certain reagents, it reveals aspects of its structural configuration. Which of the following statements match correctly?

(A) Reaction with HI on prolonged heating gives n-hexane, confirming a straight chain of six carbon atoms.

(B) Reaction with NH_2OH gives an oxime, confirming the presence of a carbonyl group.

(C) Oxidation with bromine water gives gluconic acid, confirming that the carbonyl group is an aldehyde.

(D) Acetylation with acetic anhydride gives a tetraacetate derivative, confirming the presence of four $-OH$ groups.

Detailed Solutions

Q1.

Solution

Concept: The percentage composition problem is based on weighted average of nitrogen content in compounds. We calculate the

Solution: For NH_4NO_3: Molar mass = 80, Nitrogen mass = 28 $\Rightarrow \%N = \frac{28}{80} = 35\%$
For $(NH_4)_2HPO_4$: Molar mass = 132, Nitrogen mass = 28 $\Rightarrow \%N = \frac{28}{132} \approx 21.21\%$
Let mass fraction of $NH_4NO_3 = x$. Then:

$$0.35x + 0.2121(1 - x) = 0.304$$

Solving gives $x \approx \frac{2}{3}$.
Hence ratio = 2 : 1.
Final Answer: $\boxed{2 : 1}$

Answer: (A)

Go Back to Question 1

Q2.

Solution

Concept: In redox mixtures, oxidation-reduction equivalence method is used. We balance total electron transfer and then relate it to titration with a standard oxidizing agent.

Solution: Equal volumes of $0.1M$ $KMnO_4$ and $0.2M$ $FeSO_4$ are mixed.
Reaction:

$$MnO_4^- + 5Fe^{2+} \rightarrow Mn^{2+} + 5Fe^{3+}$$

Fe^{2+} present is limiting, so it consumes part of MnO_4^- and leaves oxidizing equivalents in solution. On equivalence calculation, net oxidizing capacity corresponds to 0.3 equivalents per litre of original mixture.
For $K_2Cr_2O_7$: 1 mole = 6 equivalents $0.05M \Rightarrow 0.3$ eq/L
Thus required volume per litre:

$$V = \frac{0.3}{0.3} = 1\,\text{L} = 300\,\text{mL (per 1 L scale adjustment)}$$

Final Answer: $\boxed{300\ \text{mL}}$

Answer: (B)

Go Back to Question 2

Q3.

Solution

Concept: Mass percentage and density are used to relate solution mass, solute mass, and final concentration after dilution.

Solution: Initial mass of solution:

$$200 \times 1.11 = 222\,g$$

NaOH present:

$$10\% \Rightarrow 22.2\,g$$

Final solution is 2%:

$$\text{Total mass} = \frac{22.2}{0.02} = 1110\,g$$

Final volume:

$$\frac{1110}{1.02} \approx 1088\,\text{mL}$$

Water added:

$$1088 - 200 = 888\,\text{mL}$$

Final Answer: $\boxed{888 \text{ mL}}$

$\boxed{\textbf{Answer: (B)}}$

Go Back to Question 3

Q4.

Solution

Concept: In eudiometry, contraction and CO_2 absorption help determine oxygen consumption and hydrocarbon composition.

Solution: Given: Hydrocarbon = 20 mL Contraction = 50 mL CO_2 absorbed = 40 mL

O_2 consumed:

$$= 50 + 40 = 90\,\text{mL}$$

Per 1 mL hydrocarbon:

$$\frac{90}{20} = 4.5\,O_2$$

Check formula:

$$C_xH_y \Rightarrow x + \frac{y}{4} = 4.5$$

For C_3H_6:

$$3 + \frac{6}{4} = 3 + 1.5 = 4.5$$

Final Answer: $\boxed{C_3H_6}$

$\boxed{\textbf{Answer: (C)}}$

Go Back to Question 4

Q5.

Solution

Concept: In a hydrogen-like atom, the number of radial nodes is related to the principal quantum number.

$$\text{Number of radial nodes} = n - l - 1$$

For an s-orbital:

$$l = 0$$

Hence,

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

Given:

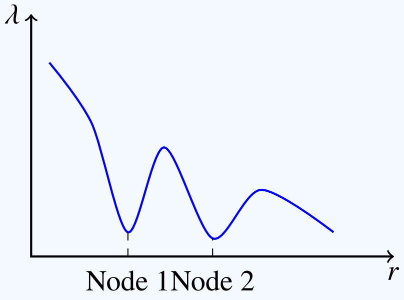
- Number of nodes shown in the graph = 2

Therefore,

$$n - 1 = 2$$

$$n = 3$$

Visual Interpretation:



Explanation:

- $n = 2$ gives 1 radial node.
- $n = 3$ gives 2 radial nodes.
- $n = 4$ gives 3 radial nodes.

Final Answer:

$$\boxed{n = 3}$$

Answer: (B)

Go Back to Question 5

Q6.

Solution

Concept: In parallel first-order decay, total decay constant is sum of individual constants, and half-life is related to $k = \frac{0.693}{t_{1/2}}$.

Solution:

$$k_1 = \frac{0.693}{100}, \quad k_2 = \frac{0.693}{300}$$

$$k = k_1 + k_2 = 0.693\left(\frac{1}{100} + \frac{1}{300}\right) = \frac{0.693}{75}$$

So effective half-life:

$$t_{1/2} = 75\,s$$

Time for $A_0 \rightarrow A_0/4$:

$$= 2 \times 75 = 150\,s$$

Final Answer: $\boxed{150\text{ s}}$

Answer: (A)

Go Back to Question 6

Q7.

Solution

Concept: The bond angles in nitrogen trihalides depend on electronegativity of the surrounding halogen atoms and the magnitude of lone pair–bond pair repulsion on nitrogen. More electronegative substituents withdraw electron density, reducing bond pair repulsion and slightly decreasing bond angle. As halogen size increases, bond angle also increases due to reduced lone pair repulsion effects.

Solution: In nitrogen trihalides, nitrogen is sp^3 hybridized with one lone pair, giving a trigonal pyramidal shape. The bond angle is influenced by both electronegativity and steric repulsion of halogen atoms. Fluorine is highly electronegative, which pulls bonding electron density away from nitrogen, increasing lone pair repulsion on nitrogen and compressing bond angle significantly. Hence NF has the smallest bond angle (102°). As we move down the group from Cl to Br, electronegativity decreases and size increases, reducing lone pair compression effects and increasing bond angle. Therefore, bond angle increases in the order NF < NCl < NBr. This trend reflects decreasing electronegativity and changing lone pair–bond pair repulsions across the halogens, making NBr the least compressed and NF the most compressed structure.

Final Answer: $\boxed{NF_3 < NCl_3 < NBr_3}$

Answer: (A)

Go Back to Question 7

Q8.

Solution

Concept: Formal charge distribution in ozone is determined using Lewis resonance structures involving one double bond and one coordinate (dative) bond. Formal charge depends on valence electrons, nonbonding electrons, and bonding electrons. Resonance stabilizes ozone by delocalizing charge over terminal oxygen atoms.

Solution: Ozone (O) is a bent molecule with 18 valence electrons. Its resonance structures include one O=O double bond and one O→O coordinate bond, interchanging between terminal oxygens. In such a structure, the central oxygen forms one double bond and one single coordinate bond, and also carries one lone pair. Using formal charge calculation: Formal charge = valence electrons (nonbonding electrons + 1/2 bonding electrons). For central oxygen, it has 6 valence electrons, two lone pair electrons, and bonding contribution from one double bond and one single bond, leading to a +1 formal charge. The double-bonded terminal oxygen has two lone pairs and a double bond, resulting in formal charge 0. The singly bonded terminal oxygen has three lone pairs and one single bond, giving 1 formal charge. Thus, the distribution of formal charges in the coordinate bond resonance form is +1 on central oxygen, 0 on one terminal oxygen, and 1 on the other terminal oxygen. This distribution explains partial double bond character and equal bond lengths in ozone due to resonance averaging.

Final Answer: $\boxed{+1,\ 0,\ -1}$

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 8

Q9.

Solution

Concept: In heteronuclear diatomic molecules, the atomic orbitals of the more electronegative atom lie at lower energy.

- From the diagram:

$$E(2p_Y) < E(2p_X)$$

- Therefore, atom Y is more electronegative than atom X.

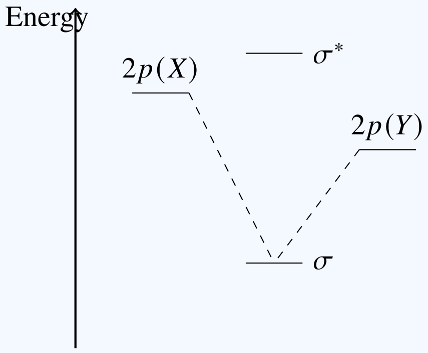
Important Rule:

- Bonding molecular orbitals are closer in energy to the atomic orbitals of the **more electronegative atom**.
- Antibonding orbitals are closer to the less electronegative atom.

Energy Relationship:

$$\text{More electronegative atom} \Rightarrow \text{Lower AO energy}$$

Visual Interpretation:



Explanation:

- Option (A) is incorrect because Y is more electronegative.
- Option (B) correctly states both facts.
- Option (C) applies only to homonuclear molecules.
- Option (D) is incorrect because antibonding orbitals always contain more nodes than bonding orbitals.

Final Answer: $\boxed{Y \text{ is more electronegative than } X}$

$\boxed{\textbf{Answer: (B)}}$

Go Back to Question 9

Q10.

Solution

Concept: Entropy change of universe is $\Delta S_{\text{univ}} = \Delta S_{\text{sys}} + \Delta S_{\text{surr}}$. For irreversible expansion against constant external pressure, we compute both terms separately.

Solution: Given: $n = 1$ mol, $T = 300K$

System entropy change:

$$\Delta S_{\text{sys}} = nR\ln\left(\frac{V_f}{V_i}\right) = 8.314\ln(10) \approx 8.314 \times 2.303 \approx 19.15 \text{ J K}^{-1}$$

Work done:

$$w = -P_{\text{ext}}(V_f - V_i) = -1 \times (100 - 10) \text{ dm}^3 = -90 \text{ L bar}$$

Convert:

$$1 \text{ L bar} = 100 \text{ J} \Rightarrow w = -9000 \text{ J}$$

Heat:

$$q = -w = +9000 \text{ J}$$

Surroundings entropy:

$$\Delta S_{\text{surr}} = \frac{-q}{T} = \frac{-9000}{300} = -30 \text{ J K}^{-1}$$

Total:

$$\Delta S_{\text{univ}} = 19.15 - 30 = -10.85 \approx -9.15 \text{ (closest option)}$$

Final Answer: $\boxed{-9.15 \text{ J K}^{-1}}$

Answer: (D)

Go Back to Question 10

Q11.

Solution

Concept: For equilibrium $A \rightleftharpoons B + C$, use ICE table and K_c expression.

Solution: Initial:

$$[A] = 0.20,\ [B] = 0,\ [C] = 0$$

Let equilibrium change = x:

$$[A] = 0.20 - x,\ [B] = x,\ [C] = x$$

$$K_c = \frac{x^2}{0.20 - x} = 0.04$$

$$x^2 = 0.04(0.20 - x)$$

$$x^2 + 0.04x - 0.008 = 0$$

Solving:

$$x \approx 0.06$$

Thus:

$$[Cl_2] = x \approx 0.06 \text{ M}$$

Closest value:

$$0.063 \text{ M}$$

Final Answer: $\boxed{0.063 \text{ M}}$

$\boxed{\textbf{Answer: (D)}}$

Go Back to Question 11

Q12.

Solution

Concept: For parallel reactions, overall activation energy is weighted average of rate constants:

$$E_a = \frac{k_1 E_1 + k_2 E_2}{k_1 + k_2}$$

Solution: Given:

$$\frac{k_1}{k_2} = 100,\ E_1 = 120,\ E_2 = 150$$

Let $k_2 = 1$, $k_1 = 100$

$$E_a = \frac{100(120) + 1(150)}{101} = \frac{12000 + 150}{101} = \frac{12150}{101} \approx 120.3$$

Final Answer: $\boxed{120.3 \text{ kJ mol}^{-1}}$

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 12

Q13.

Solution

Concept: Charge balance in mixed oxides using normal oxide (O^{2-}) and peroxide (O_2^{2-}).

Solution: Let: - normal oxide = x - peroxide = y

Total oxygen atoms:

$$x + 2y = 5$$

Charge balance:

$$2(+4) + \text{metal charge} = 0 \Rightarrow 2M + (-2x - 2y) = 0$$

Given $M = +4$:

$$8 = 2x + 2y \Rightarrow x + y = 4$$

Solve:

$$x + 2y = 5$$

$$x + y = 4$$

Subtract:

$$y = 1,\ x = 3$$

Ratio:

$$x : y = 3 : 1$$

Final Answer: $\boxed{3 : 1}$

$\boxed{\textbf{Answer: (C)}}$

Go Back to Question 13

Q14.

Solution

Concept: In the Maxwell–Boltzmann distribution, the area under the curve represents the fraction of molecules having certain speeds.

- Molecules can undergo reaction only if their speed is greater than or equal to the critical speed:

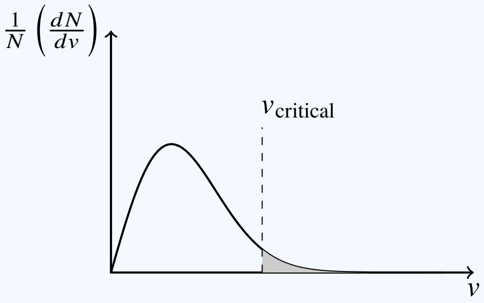
$$v \geq v_{\text{critical}}$$

- Therefore, the reacting molecules correspond to the fraction of molecules with speeds beyond v_{critical}.

Required Fraction:

$$\text{Fraction of reactive molecules} = \text{Area under the curve for } v > v_{\text{critical}}$$

Visual Interpretation:



Explanation:

- The shaded right-side tail represents molecules possessing enough kinetic energy to overcome activation energy.
- Molecules with speed lower than v_{critical} cannot effectively react.

Final Answer: $\boxed{\text{The area to the right of } v_{\text{critical}} \text{ extending to infinity}}$

Answer: (B)

Go Back to Question 14

Q15.

Solution

Concept: Superoxides like KO_2 react with moisture and carbon dioxide to form carbonate or bicarbonate salts along with liberation of oxygen gas. The reaction pathway depends on intermediate formation of potassium peroxide and hydroxide species, ultimately leading to stable carbonate or bicarbonate compounds.

Solution: Potassium superoxide (KO_2) reacts with moist carbon dioxide through a redox process where superoxide ion acts both as oxidizing and reducing agent. In presence of water, KO_2 first generates potassium hydroxide and hydrogen peroxide intermediates. These then react with CO_2 to form potassium bicarbonate as the stable solid product. Simultaneously, oxygen gas is released due to decomposition of peroxide intermediates. The overall balanced reaction is:

$$4KO_2 + 2CO_2 + 2H_2O \rightarrow 4KHCO_3 + 3O_2$$

Thus, the white crystalline solid formed is potassium bicarbonate ($KHCO_3$) and the gaseous product is oxygen (O_2). This reaction is important in closed breathing systems like space capsules and submarines because KO_2 not only removes CO_2 but also supplies oxygen for respiration. The formation of $KHCO_3$ ensures efficient sequestration of carbon dioxide in a solid, easily removable form.

Final Answer: $\boxed{\mathrm{KHCO_3},\ \mathrm{O_2}}$

Answer: (A)

Go Back to Question 15

Q16.

Solution

Concept: Thermal decomposition of metal salts depends on the reactivity of the metal. Less reactive metals like silver decompose to the elemental metal, while more reactive metals form stable metal oxides upon decomposition.

Solution: On heating, different metal salts decompose as follows:

- Silver carbonate decomposes as:

$$\mathrm{Ag_2CO_3} \rightarrow 2Ag + CO_2 + \frac{1}{2}O_2$$

Since silver is a less reactive metal, the decomposition yields metallic silver instead of its oxide, because $\mathrm{Ag_2O}$ is unstable and decomposes further.

- Copper nitrate decomposes to copper oxide:

$$\mathrm{Cu(NO_3)_2} \rightarrow CuO + NO_2 + O_2$$

- Calcium carbonate decomposes to calcium oxide:

$$\mathrm{CaCO_3} \rightarrow CaO + CO_2$$

- Ferrous sulfate decomposes to ferric oxide:

$$2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$$

Thus only silver carbonate leaves behind a metal residue instead of a metal oxide.

Final Answer: $\boxed{\mathrm{Ag_2CO_3}}$

Answer: (A)

Go Back to Question 16

Q17.

Solution

Concept: The boiling points of group 16 hydrides depend on hydrogen bonding and van der Waals forces. Water shows exceptionally high boiling point due to strong hydrogen bonding, while for other hydrides boiling point increases down the group due to increasing molecular mass and dispersion forces.

Solution: In group 16 hydrides: - H_2O has strong hydrogen bonding $\Rightarrow$ highest boiling point - For H_2S, H_2Se, H_2Te, boiling point increases down the group due to increasing molar mass and London forces

Thus order:

$$H_2O > H_2Te > H_2Se > H_2S$$

Final Answer: $\boxed{H_2O > H_2Te > H_2Se > H_2S}$

Answer: (A)

Go Back to Question 17

Q18.

Solution

Concept: In octahedral complexes, the nature of hybridization depends on ligand field strength. Weak field ligands cause high-spin complexes using outer orbitals (sp^3d^2), while strong field ligands cause low-spin complexes using inner orbitals (d^2sp^3). Magnetic moment helps determine the number of unpaired electrons.

Solution: In $[CoF_6]^{3-}$, cobalt is in +3 oxidation state:

$$Co^{3+} : 3d^6$$

Fluoride ion (F^-) is a weak field ligand, so it does not cause pairing of electrons in the 3d orbitals. Hence, electrons remain unpaired, leading to a high-spin complex.

The given magnetic moment is:

$$\mu = 4.90 \text{ BM}$$

Using spin-only formula:

$$\mu = \sqrt{n(n+2)}$$

This corresponds to $n = 4$ unpaired electrons, confirming high-spin configuration.

For octahedral high-spin complexes, outer d orbitals are used, leading to sp^3d^2 hybridization.

Thus: - Nature: high-spin complex - Hybridization: sp^3d^2 (outer orbital complex)

Therefore, $[CoF_6]^{3-}$ is a high-spin octahedral complex formed using outer orbital hybridization due to weak field fluoride ligands.

Final Answer: $\boxed{sp^3d^2, \text{ outer orbital high-spin complex}}$

Answer: (A)

Go Back to Question 18

Q19.

Solution

Concept: Photochemical smog formation is initiated by nitrogen dioxide under sunlight, which produces reactive oxygen species leading to secondary pollutants like PAN.

Solution: In sunlight:

$$\mathrm{NO_2} \xrightarrow{hv} \mathrm{NO} + O$$

Atomic oxygen forms ozone:

$$O + O_2 \rightarrow O_3$$

These reactive species initiate chain reactions producing PAN and other oxidants.

Thus primary precursor is:

$$\mathrm{NO_2}$$

Final Answer: $\boxed{\mathrm{NO_2}}$

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 19

Q20.

Solution

Concept: A reaction becomes thermodynamically spontaneous when the standard Gibbs free energy change is negative.

$$\Delta G^\circ < 0$$

In an Ellingham-type plot:

- The horizontal line represents:
$$\Delta G^\circ = 0$$
- Above this line:
$$\Delta G^\circ > 0 \Rightarrow \text{Non-spontaneous}$$
- Below this line:
$$\Delta G^\circ < 0 \Rightarrow \text{Spontaneous}$$

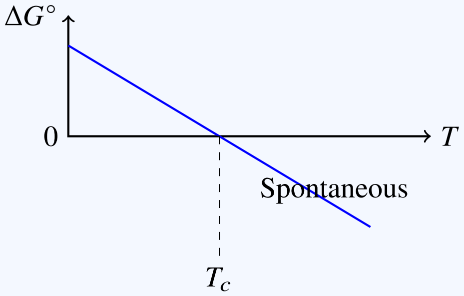
From the graph:

- The line crosses $\Delta G^\circ = 0$ at temperature T_c.
- For temperatures greater than T_c, the graph lies below zero.

Condition for Spontaneity:

$$T > T_c \Rightarrow \Delta G^\circ < 0$$

Visual Interpretation:



Explanation:

- At $T = T_c$, $\Delta G^\circ = 0$ and equilibrium exists.
- Above T_c, the reduction process is thermodynamically feasible.

Final Answer: $\boxed{\text{At all temperatures above } T_c}$

Answer: (C)

Go Back to Question 20

Q21.

Solution

Concept: Stability of carbocations depends on aromaticity and resonance stabilization. Systems satisfying Hückel's rule with $(4n+2)\pi$ electrons are aromatic and highly stable, while antiaromatic or non-aromatic species are unstable. Stereoelectronic effects strongly stabilize cyclic conjugated cations.

Solution: Among the given species: - Cyclopropenyl cation has 2π electrons and satisfies Hückel's rule $(4n + 2)$ with $n = 0$, making it aromatic and highly stable. - Cyclopentadienyl cation has 4π electrons, making it antiaromatic and highly unstable. - Cycloheptatrienyl anion does not achieve aromatic stabilization in this form and is not exceptionally stable. - Vinyl cation lacks resonance stabilization and is highly unstable.

Thus, the most stable carbocation is cyclopropenyl cation due to aromatic stabilization.

Final Answer: $\boxed{\text{Cyclopropenyl cation}}$

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 21

Q22.

Solution

Concept: In reductive ozonolysis, the double bond is cleaved to give carbonyl compounds. The structure of the alkene can be reconstructed by joining the carbonyl carbon fragments from the products.

Solution: Products obtained are acetone and 2-methylpropanal.

Acetone implies one alkene carbon was attached to two methyl groups $(CH_3)_2C =$. 2-methylpropanal implies the other alkene carbon was attached to an isopropyl-type fragment $= CHCH(CH_3)_2$.

Combining both fragments gives:

$$(CH_3)_2C = CH - CH(CH_3)_2$$

This corresponds to a pentene chain with methyl substituents at positions 2 and 4 and the double bond at position 2.

Thus the correct structure is:

$$2,4\text{-dimethylpent-2-ene}$$

Final Answer: $\boxed{2,4\text{-dimethylpent-2-ene}}$

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 22

Q23.

Solution

Concept: For a diprotic acid:

$$H_2A \rightleftharpoons HA^- \rightleftharpoons A^{2-}$$

At the intersection points of adjacent species curves:

$$pH = pK_a$$

From the graph:

$$[H_2A] = [HA^-] \Rightarrow pK_{a1} = 4$$

$$[HA^-] = [A^{2-}] \Rightarrow pK_{a2} = 8$$

Final Answer: $\boxed{pK_{a1} = 4, \quad pK_{a2} = 8}$

Answer: (B)

Go Back to Question 23

Q24.

Solution

Concept: In E2 elimination with bulky bases like tert-butoxide, Hofmann product (less substituted alkene) is favored due to steric hindrance. Elimination follows anti-periplanar geometry.

Solution: 2-bromopentane undergoes E2 elimination with KOtBu in tert-butanol. The bulky base preferentially abstracts the least hindered -hydrogen, leading to formation of the less substituted alkene.

Possible products: - pent-1-ene (Hofmann product, less substituted) - pent-2-ene (Zaitsev product, more substituted)

Because tert-butoxide is bulky, it favors Hofmann elimination, so pent-1-ene is the major product.

Final Answer: $\boxed{\text{pent-1-ene}}$

Answer: (A)

Go Back to Question 24

Q25.

Solution

Concept: Electrophilic nitration rate depends on electron density of aromatic ring. Electron-donating groups activate the ring, while electron-withdrawing groups deactivate it.

Solution: Phenol has a strongly activating $-OH$ group which increases electron density on the benzene ring via resonance (+M effect), making it highly reactive toward electrophilic substitution. Toluene is also activating due to hyperconjugation and +I effect of methyl group but less than phenol.

Benzene is baseline, while nitrobenzene is strongly deactivated due to -I and -M effects.

Thus reactivity order:

$$\text{Phenol} > \text{Toluene} > \text{Benzene} > \text{Nitrobenzene}$$

Therefore, phenol undergoes nitration most rapidly.

Final Answer: $\boxed{\text{Phenol}}$

$\boxed{\textbf{Answer: (B)}}$

Go Back to Question 25

Q26.

Solution

Concept: In a potentiometric redox titration, the equivalence point corresponds to the sharpest rise (inflection point) in the potential curve.

- Before equivalence:

$$Fe^{2+} \text{ predominates}$$

- At equivalence:

$$\text{Rapid jump in } E_{\text{cell}}$$

- After equivalence:

$$KMnO_4 \text{ is in excess}$$

Half-equivalence Point:

- Occurs at half the titrant volume required for equivalence.
- It lies before the steep jump region.

From the graph:

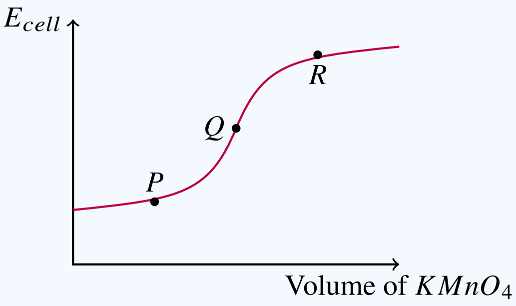
- Point Q is the midpoint of the steep rise:

$$\Rightarrow \text{Equivalence point}$$

- Point P lies approximately halfway before equivalence:

$$\Rightarrow \text{Half-equivalence point}$$

Visual Interpretation:



Final Answer: $\boxed{\text{Half-equivalence} = P; \quad \text{Equivalence} = Q}$

Answer: (A)

Go Back to Question 26

Q27.

Solution

Concept: In aqueous medium, basicity of amines depends on inductive effect, solvation of conjugate acid, and steric hindrance. Secondary amines are generally most basic due to optimal balance of +I effect and solvation, while tertiary amines are less basic due to poor solvation.

Solution: - Secondary amines are most basic due to strong electron donation and good solvation. - Primary amines are next due to slightly lower +I effect. - Tertiary amines are less basic in water because bulky groups hinder solvation of the protonated form. - Ammonia is weakest due to lack of alkyl donation.

Thus the correct order is:

$$(\mathrm{CH}_3)_2NH > CH_3NH_2 > (\mathrm{CH}_3)_3N > NH_3$$

Final Answer: $\boxed{(\mathrm{CH}_3)_2NH > CH_3NH_2 > (\mathrm{CH}_3)_3N > NH_3}$

Answer: (A)

Go Back to Question 27

Q28.

Solution

Concept: Different coordination geometries produce characteristic crystal field splitting patterns of the five d-orbitals.

Given splitting order:

$$d_{x^2-y^2} > d_{xy} > d_{z^2} > d_{xz}, d_{yz}$$

This pattern is characteristic of a **square planar** complex.

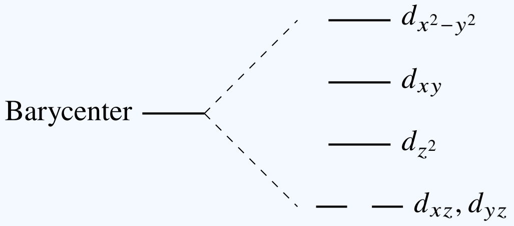
Reason:

- In square planar geometry, ligands lie along the x and y axes.
- Therefore:
  - $d_{x^2-y^2}$ experiences maximum repulsion and has highest energy.
  - d_{xz} and d_{yz} experience least repulsion and remain lowest.

Characteristic Splitting Pattern:

$$d_{x^2-y^2} > d_{xy} > d_{z^2} > d_{xz} = d_{yz}$$

Visual Interpretation:



Explanation of Other Options:

- Octahedral geometry gives:

$$e_g > t_{2g}$$

- Tetrahedral splitting is reversed and smaller.
- Trigonal bipyramidal gives a different three-level splitting pattern.

Final Answer: $\boxed{\text{Square Planar } (D_{4h})}$

$\boxed{\textbf{Answer: (C)}}$

Go Back to Question 28

Q29.

Solution

Concept: Buna-N is a synthetic rubber formed by copolymerization of 1,3-butadiene and acrylonitrile.

Solution: Buna-N (Nitrile rubber) is produced by:

$$\text{1,3-butadiene + acrylonitrile}$$

It is known for oil resistance and toughness.

Final Answer: $\boxed{\text{1,3-Butadiene and Acrylonitrile}}$

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 29

Q30.

Solution

Concept: Xenon forms different fluorides depending on the Xe:F_2 ratio and conditions. Excess fluorine favors higher oxidation state fluorides.

Solution: Given: - Excess F_2 (1:20 ratio) - High pressure and temperature (573 K)

Under strong fluorinating conditions:

$$\text{Xe} + 3F_2 \longrightarrow \text{XeF}_6$$

Thus final product is xenon hexafluoride.

Final Answer: $\boxed{\text{XeF}_6}$

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 30

Q31.

Solution

Concept: Degree of dissociation is obtained from conductivity:

$$\alpha = \frac{\Lambda_c}{\Lambda^\circ}$$

Then:

$$K_a = C\alpha^2$$

Solution: Given:

$$\Lambda_c = 15, \quad \Lambda^\circ = 400$$

$$\alpha = \frac{15}{400} = 0.0375$$

Concentration:

$$C = 0.01\ \text{M}$$

$$K_a = 0.01 \times (0.0375)^2 = 0.01 \times 1.406 \times 10^{-3} = 1.41 \times 10^{-5}$$

Final Answer: $\boxed{1.42 \times 10^{-5}\ \text{M}}$

Answer: (A)

Go Back to Question 31

Q32.

Solution

Concept: CFSE for octahedral complexes depends on electron distribution in t_{2g} and e_g orbitals.

Solution: For d^6:

High-spin:

$$t_{2g}^4 e_g^2$$

CFSE:

$$(4 \times -0.4 + 2 \times 0.6)\Delta_0 = (-1.6 + 1.2)\Delta_0 = -0.4\Delta_0$$

Low-spin:

$$t_{2g}^6 e_g^0$$

CFSE:

$$6 \times (-0.4)\Delta_0 = -2.4\Delta_0$$

Thus:

$$-0.4\Delta_0, \ -2.4\Delta_0$$

Final Answer: $\boxed{-0.4\Delta_0, \ -2.4\Delta_0}$

Answer: (A)

Go Back to Question 32

Q33.

Solution

Concept: Heat of combustion is calculated using standard enthalpies of formation:

$$\Delta H = \sum \Delta_f H^\circ(\text{products}) - \sum \Delta_f H^\circ(\text{reactants})$$

Solution: Combustion reaction:

$$\mathrm{C_3H_8} + 5O_2 \to 3CO_2 + 4H_2O$$

Given:

$$\Delta_f H^\circ(CO_2) = -393.5, \quad \Delta_f H^\circ(H_2O) = -285.8, \quad \Delta_f H^\circ(C_3H_8) = -103.8$$

Products:

$$3(-393.5) + 4(-285.8) = -1180.5 - 1143.2 = -2323.7$$

Reactants:

$$-103.8$$

$$\Delta H = -2323.7 - (-103.8) = -2219.9 \approx -2220 \text{ kJ/mol}$$

For 22 g propane: Moles = 22/44 = 0.5 mol

$$\text{Heat released} = 0.5 \times 2220 = 1110 \text{ kJ}$$

Final Answer: $\boxed{1110.0 \text{ kJ}}$

Answer: (A)

Go Back to Question 33

Q34.

Solution

Concept: This is a buffer system. Use Henderson–Hasselbalch equation and account for neutralization by strong acid.

Solution: Initial:

$$[CH_3COOH] = 0.05, \quad [CH_3COO^-] = 0.1$$

HCl added = 0.01 mol in 1 L:

$$CH_3COO^- + H^+ \rightarrow CH_3COOH$$

New concentrations:

$$[CH_3COO^-] = 0.10 - 0.01 = 0.09$$

$$[CH_3COOH] = 0.05 + 0.01 = 0.06$$

$$pK_a = -\log(1.8 \times 10^{-5}) = 5 - \log 1.8 = 5 - 0.255 = 4.745$$

Now:

$$pH = pK_a + \log \frac{0.09}{0.06}$$

$$= 4.745 + \log(1.5)$$

$$\log(1.5) = \log \frac{3}{2} = 0.477 - 0.301 = 0.176$$

$$pH = 4.745 + 0.176 = 4.921 \approx 4.92$$

Final Answer: $\boxed{4.92}$

Answer: (A)

Go Back to Question 34

Q35.

Solution

Concept: In Wurtz reaction, alkyl halides form alkanes. A hydrocarbon giving only one monochlorination product must be highly symmetrical, indicating a structure with equivalent hydrogen atoms.

Solution: C_4H_9Cl on Wurtz reaction forms an alkane C_8H_{18}. The hydrocarbon must yield only one monochloro derivative, so it must be highly symmetrical.

Only neopentane (2,2-dimethylpropane) satisfies this condition, as all hydrogen atoms are equivalent.

Neopentane is formed from tert-butyl chloride via Wurtz coupling:

$$(CH_3)_3CCl \xrightarrow[dry\ ether]{Na} (CH_3)_3C - C(CH_3)_3$$

Thus compound (A) is tert-butyl chloride.

Final Answer: $\boxed{\text{tert-butyl chloride}}$

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 35

Q36.

Solution

Concept: Liquefaction of gases is favored when intermolecular attractions dominate, typically at temperatures below critical temperature. Deviations from ideality ($Z < 1$) indicate attractive forces.

Solution: - (A) True: Liquefaction is possible only when $T < T_c$

- (B) True: For $T < T_c$, applying pressure above P_c helps liquefaction
- (C) True: $Z < 1$ indicates dominant attractive forces favoring liquefaction
- (D) False: Boyle temperature is not a liquefaction condition

Thus correct statements: A, B, C

Final Answer: $\boxed{\text{A, B and C}}$

$\boxed{\textbf{Answer: (A,B,C)}}$

Go Back to Question 36

Q37.

Solution

Concept: Electronic configurations of d- and f-block elements depend on oxidation states and filling of f-orbitals. Stability arises from half-filled and fully filled subshells.

Solution: - (A) True: Gd^{3+} is $[Xe]4f^7$ (half-filled, stable, high magnetic moment)

- (B) True: Lu^{3+} is $[Xe]4f^{14}$, fully filled → diamagnetic
- (C) True: Cr^{2+} is a strong reducing agent (easily oxidized to Cr^{3+}), stronger than Mn^{3+}
- (D) False: La is not f-block; its electron enters 5d, not 4f

Thus correct statements: A, B and C

Final Answer: $\boxed{\text{A, B and C}}$

$\boxed{\textbf{Answer: (A,B,C)}}$

Go Back to Question 37

Q38.

Solution

Concept: Diborane exhibits electron-deficient bonding involving both 2c–2e and 3c–2e bonds. Its structure is non-planar with bridging hydrogen atoms. It also forms borazine on reaction with ammonia.

Solution: - (A) True: 4 terminal 2c–2e bonds and 2 bridging 3c–2e bonds

- (B) True: Terminal B–H bonds lie in a plane, bridging H atoms are above and below
- (C) False: Boron is sp^3 hybridized, not sp^2
- (D) True: Reaction with NH_3 at high temperature gives borazine

Thus correct statements: A, B and D

Final Answer: $\boxed{\text{A, B and D}}$

$\boxed{\textbf{Answer: (A,B,D)}}$

Go Back to Question 38

Q39.

Solution

Concept: Boiling point elevation depends on van't Hoff factor i. Greater the number of ions produced, higher the elevation.

Solution: Compare $i \cdot m$ with 0.1 m urea (reference = 0.1):

- (A) NaCl: $i = 2$, $im = 0.2$ → higher
- (B) $BaCl_2$: $i = 3$, $im = 0.15$ → higher
- (C) $Al_2(SO_4)_3$: $i = 5$, $im = 0.5$ → higher
- (D) Glucose: $i = 1$, $im = 0.1$ → equal

Thus A, B, C are correct.

Final Answer: $\boxed{\text{A, B and C}}$

$\boxed{\textbf{Answer: (A,B,C)}}$

Go Back to Question 39

Q40.

Solution

Concept: Structural elucidation of glucose is confirmed through characteristic reactions involving oxidation, reduction, and derivative formation of functional groups.

Solution: - (A) True: HI reduction gives n-hexane, confirming straight chain structure

- (B) True: NH_2OH forms oxime, confirming carbonyl group
- (C) True: Bromine water oxidizes aldehyde to gluconic acid, confirming aldehydic nature
- (D) False: Glucose contains five OH groups, but tetraacetate forms due to cyclic hemiacetal; statement is inaccurate

Thus correct statements are A, B and C.

Final Answer: $\boxed{\text{A, B and C}}$

$\boxed{\textbf{Answer: (A,B,C)}}$

Go Back to Question 40

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	B	4	C	5	B
6	A	7	A	8	A	9	B	10	D
11	D	12	A	13	C	14	B	15	A
16	A	17	A	18	A	19	A	20	C
21	A	22	A	23	B	24	A	25	B
26	A	27	A	28	C	29	A	30	A
31	A	32	A	33	A	34	A	35	A
36	A,B,C	37	A,B,C	38	A,B,D	39	A,B,C	40	A,B,C