

JEE Main Chemistry Sample Paper-18

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.** The number of stereoisomers possible for the compound 2,3-dichlorobutane is: [JEE Main 2021]
- (A) 2
(B) 3
(C) 4
(D) 0
- Q2.** The correct order of basic strength for the following compounds in aqueous solution is:
(I) NH_3
(II) CH_3NH_2
(III) $(CH_3)_2NH$
(IV) $(CH_3)_3N$ [JEE Main 2022]
- (A) III > II > IV > I
(B) IV > III > II > I
(C) II > III > IV > I
(D) III > IV > II > I
- Q3.** An alkene 'A' on reaction with O_3 followed by Zn/H_2O gives propan-2-one and glyoxal. The IUPAC name of 'A' is: [JEE Main 2023]



- (A) 2-methylbuta-1,3-diene
- (B) 2-methylpenta-1,3-diene
- (C) 3-methylpenta-1,4-diene
- (D) 4-methylpenta-1,3-diene

Q4. The major product of the reaction between propene and Cl_2 at $500^\circ C$ is:

[JEE Main 2019]

- (A) 1,2-dichloropropane
- (B) 2,2-dichloropropane
- (C) 3-chloropropene
- (D) 1-chloropropene

Q5. Among the following, the one that gives a positive Libermann's nitroso test is:

[JEE Main 2020]

- (A) Aniline
- (B) N-Methylaniline
- (C) N,N-Dimethylaniline
- (D) Ethylamine

Q6. The major product of the acid-catalyzed dehydration of 2-methylcyclohexanol is:

[JEE Main 2021]

- (A) 1-methylcyclohexene
- (B) 3-methylcyclohexene
- (C) Methylene cyclohexane
- (D) 1,2-dimethylcyclopentene

Q7. Which of the following will not undergo Cannizzaro reaction? [JEE Main 2024]

- (A) Trimethylacetaldehyde
- (B) Benzaldehyde
- (C) Trichloroacetaldehyde
- (D) Formaldehyde

Q8. In DNA, the complementary bases are held together by:

[JEE Main 2022]



- (A) Covalent bonds
- (B) Hydrogen bonds
- (C) Ionic bonds
- (D) Van der Waals forces

Q9. The reagent used to distinguish between Glucose and Fructose is: [JEE Main 2021]

- (A) Tollen's reagent
- (B) Fehling's solution
- (C) Bromine water
- (D) Benedict's solution

Q10. Which of the following species has a square pyramidal geometry? [JEE Main 2023]

- (A) XeF_4
- (B) SF_4
- (C) BrF_5
- (D) $[Ni(CN)_4]^{2-}$

Q11. The correct order of bond angles in NH_3 , PH_3 , AsH_3 and SbH_3 is: [JEE Main 2020]

- (A) $NH_3 > PH_3 > AsH_3 > SbH_3$
- (B) $SbH_3 > AsH_3 > PH_3 > NH_3$
- (C) $NH_3 = PH_3 = AsH_3 = SbH_3$
- (D) $PH_3 > NH_3 > AsH_3 > SbH_3$

Q12. The hybridization of the central atom in I_3^- is: [JEE Main 2021]

- (A) sp^3
- (B) sp^3d
- (C) sp^3d^2
- (D) sp^2



Q13. The coordination number and oxidation state of 'Cr' in $K_3[Cr(C_2O_4)_3]$ are respectively:

[JEE Main 2022]

- (A) 3, +3
- (B) 6, +3
- (C) 6, +6
- (D) 3, +6

Q14. The correct order of the wavelength of absorption in the visible region for the following is:

- (I) $[Ni(NO_2)_6]^{4-}$
- (II) $[Ni(NH_3)_6]^{2+}$
- (III) $[Ni(H_2O)_6]^{2+}$

[JEE Main 2024]

- (A) I > II > III
- (B) III > II > I
- (C) II > I > III
- (D) III > I > II

Q15. The element with the highest electron gain enthalpy (magnitude) is:

[JEE Main 2019]

- (A) F
- (B) Cl
- (C) Br
- (D) I

Q16. The correct order of the density of alkali metals is:

[JEE Main 2021]

- (A) $Li < Na < K < Rb < Cs$
- (B) $Li < K < Na < Rb < Cs$
- (C) $Cs < Rb < K < Na < Li$
- (D) $Li < Na < K < Cs < Rb$

Q17. Which of the following statements about the interstitial compounds is incorrect?

[JEE Main 2022]

- (A) They are chemically reactive



- (B) They are very hard
- (C) They have high melting points
- (D) They retain metallic conductivity

Q18. A 0.01 M solution of a metal salt has a resistance of 100 ohms in a cell with cell constant 0.5 cm^{-1} . The molar conductivity is: [JEE Main 2023]

- (A) $500 \text{ S cm}^2 \text{ mol}^{-1}$
- (B) $50 \text{ S cm}^2 \text{ mol}^{-1}$
- (C) $5000 \text{ S cm}^2 \text{ mol}^{-1}$
- (D) $5 \text{ S cm}^2 \text{ mol}^{-1}$

Q19. For the reaction $2A + B \rightarrow C$, the rate law is $\text{Rate} = k[A][B]^2$. If the volume of the vessel is reduced to half, the rate of reaction will increase by a factor of: [JEE Main 2021]

- (A) 4
- (B) 8
- (C) 2
- (D) 16

Q20. The de Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 m/s is approximately: ($h = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}$) [JEE Main 2020]

- (A) 10^{-33} m
- (B) 10^{-31} m
- (C) 10^{-16} m
- (D) 10^{-25} m



Section B — Numerical Questions

- Q21.** A mixture of 2 moles of He and 4 moles of N_2 is present in a 10 L flask at 27°C . The total pressure of the mixture is ____ atm. (Take $R = 0.0821 \text{ L}\cdot\text{atm}/\text{K}\cdot\text{mol}$). [JEE Main 2022]
-
- Q22.** The solubility product (K_{sp}) of Ag_2CrO_4 is 1.1×10^{-12} at 298 K. The solubility of Ag_2CrO_4 in a $0.1 \text{ M } AgNO_3$ solution is $x \times 10^{-10} \text{ mol/L}$. Find x . [JEE Main 2023]
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- Q23.** For the combustion of 1 mole of liquid benzene at 25°C , the difference between ΔH and ΔU ($\Delta H - \Delta U$) in kJ/mol is _____. (Take $R = 8.314 \text{ J/K}\cdot\text{mol}$, ignore volume of liquid). [JEE Main 2024]
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- Q24.** The number of moles of CH_4 required to produce 22 g of CO_2 after complete combustion is _____. [JEE Main 2021]
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- Q25.** A buffer solution is prepared by mixing 10 mL of 0.1 M acetic acid and 20 mL of 0.1 M sodium acetate. The pH of the buffer is _____. (Given pK_a of acetic acid = 4.74, $\log 2 = 0.30$). [JEE Main 2025]
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Detailed Solutions

Q1.

Solution

Concept: Stereoisomers are molecules with the same molecular formula and connectivity but different spatial arrangements. Chiral centers are necessary for stereoisomerism.

Solution: - 2,3-Dichlorobutane has two chiral centers at C2 and C3. - The number of stereoisomers possible for a molecule with two chiral centers is 2^n , where n is the number of chiral centers. - For 2,3-dichlorobutane, $n = 2$, so the number of stereoisomers is $2^2 = 4$.

Conclusion: The number of stereoisomers possible is 4.

Final Answer: (C)

Answer: (C)

Q2.

Solution

Concept: The basic strength of amines in aqueous solution depends on the electron-donating or electron-withdrawing nature of the substituents on the nitrogen atom.

Solution: - (I) NH_3 has no substituents on nitrogen. - (II) CH_3NH_2 has a methyl group, which is an electron-donating group, making it more basic than ammonia. - (III) $(CH_3)_2NH$ has two methyl groups, which donate more electron density to nitrogen, making it more basic than CH_3NH_2 . - (IV) $(CH_3)_3N$ has three methyl groups, making it the most basic.

Conclusion: The correct order of basic strength is $III > II > IV > I$.

Final Answer: (B)

Answer: (B)

Q3.

Solution

Concept: Ozonolysis of alkenes cleaves the double bond to form two carbonyl compounds. The structure of the original alkene can be deduced from the products.

Solution: - The products of ozonolysis are propan-2-one and glyoxal (which is formaldehyde). - The compound 'A' must have a conjugated diene structure, which on ozonolysis forms these products. - The correct structure is 2-methylpenta-1,3-diene.

Conclusion: The IUPAC name of 'A' is 2-methylpenta-1,3-diene.

Final Answer: (B)

Answer: (B)



Q4.

Solution

Concept: The reaction of alkenes with chlorine at high temperature follows a free radical mechanism, which can lead to the formation of various products.

Solution: - In the reaction of propene with chlorine at 500°C, the major product is 2,2-dichloropropane due to the formation of a more stable tertiary radical intermediate.

Conclusion: The major product is 2,2-dichloropropane.

Final Answer: (B)

Answer: (B)

Q5.

Solution

Concept: Libermann's nitroso test is used to detect primary aromatic amines, which form a nitroso derivative upon reaction.

Solution: - Aniline (primary aromatic amine) reacts with nitrous acid to form a nitroso compound, giving a positive Libermann's nitroso test. - N-Methylaniline and N,N-Dimethylaniline are secondary and tertiary amines, respectively, and do not give the test.

Conclusion: The compound that gives a positive Libermann's nitroso test is Aniline.

Final Answer: (A)

Answer: (A)

Q6.

Solution

Concept: Acid-catalyzed dehydration of alcohols follows an E1 mechanism where the carbocation intermediate is formed, leading to the most stable alkene.

Solution: - In the dehydration of 2-methylcyclohexanol, the major product is 1-methylcyclohexene, formed by the elimination of a water molecule.

Conclusion: The major product is 1-methylcyclohexene.

Final Answer: (A)

Answer: (A)



Q7.

Solution

Concept: The Cannizzaro reaction occurs in aldehydes without an alpha-hydrogen, where one molecule is reduced to an alcohol and the other is oxidized to a carboxylate ion.

Solution: - Trimethylacetaldehyde has no alpha-hydrogen, so it does not undergo the Cannizzaro reaction. - Formaldehyde and other aldehydes without alpha-hydrogens can undergo this reaction.

Conclusion: The compound that does not undergo the Cannizzaro reaction is Trimethylacetaldehyde.

Final Answer: (A)

Answer: (A)

Q8.

Solution

Concept: In DNA, complementary bases are held together by hydrogen bonds, which stabilize the double-helix structure.

Solution: - The complementary base pairs in DNA (A-T and G-C) are held together by hydrogen bonds.

Conclusion: The complementary bases in DNA are held together by hydrogen bonds.

Final Answer: (B)

Answer: (B)

Q9.

Solution

Concept: Glucose is a reducing sugar, while fructose is a ketose and can also reduce Tollen's reagent but is distinguishable from glucose using Benedict's solution.

Solution: - Benedict's solution reacts with reducing sugars to form a brick-red precipitate. - The reagent that distinguishes between glucose and fructose is Benedict's solution.

Conclusion: The reagent used to distinguish between glucose and fructose is Benedict's solution.

Final Answer: (D)

Answer: (D)



Q10.

Solution

Concept: Square pyramidal geometry occurs in molecules with five bonding pairs and one lone pair, such as BrF_5 .

Solution: - XeF_4 has a square planar geometry. - SF_4 has a seesaw geometry. - BrF_5 has a square pyramidal geometry, as it has five bonding pairs and one lone pair on the central atom.

Conclusion: The species with a square pyramidal geometry is BrF_5 .

Final Answer: (C)

Answer: (C)

Q11.

Solution

Concept: The bond angles in ammonia, phosphine, arsine, and stibine are affected by the lone pairs on the central atom. As the size of the central atom increases, the bond angles decrease.

Solution: - The bond angle in NH_3 is 107° . - The bond angles in PH_3 , AsH_3 , and SbH_3 are progressively smaller due to the larger atomic size and greater lone pair repulsion.

Conclusion: The correct order of bond angles is $NH_3 > PH_3 > AsH_3 > SbH_3$.

Final Answer: (A)

Answer: (A)

Q12.

Solution

Concept: The hybridization of the central atom in I_3^- is determined by the number of bonding and lone pairs.

Solution: - In I_3^- , the central iodine atom has 3 bonding pairs and 2 lone pairs, leading to an sp^3d^2 hybridization.

Conclusion: The hybridization of the central atom in I_3^- is sp^3d^2 .

Final Answer: (C)

Answer: (C)



Q13.

Solution

Concept: The coordination number and oxidation state can be determined from the complex formula.

Solution: - In $K_3[Cr(C_2O_4)_3]$, the coordination number of Cr is 6, as there are three oxalate ligands, each of which coordinates to Cr through two oxygen atoms. - The oxidation state of Cr is +3, as the oxalate ion is a bidentate ligand and is neutral.

Conclusion: The coordination number and oxidation state of 'Cr' are 6 and +3, respectively.

Final Answer: (B)

Answer: (B)

Q14.

Solution

Concept: The wavelength of absorption in transition metal complexes depends on the ligand field strength. Strong field ligands cause a larger splitting of d-orbitals and lead to absorption at lower wavelengths.

Solution: - The correct order of absorption wavelengths is $[Ni(H_2O)_6]^{2+} > [Ni(NH_3)_6]^{2+} > [Ni(NO_2)_6]^{4-}$.

Conclusion: The correct order of absorption wavelength is $III > II > I$.

Final Answer: (B)

Answer: (B)

Q15.

Solution

Concept: The electron gain enthalpy (magnitude) increases as we move across a period due to increasing electronegativity.

Solution: - Fluorine has the most negative electron gain enthalpy due to its small size and high electronegativity.

Conclusion: The element with the highest electron gain enthalpy (magnitude) is F.

Final Answer: (A)

Answer: (A)



Q16.

Solution

Concept: The density of alkali metals decreases down the group as atomic size increases.

Solution: - The correct order of density is $Li < Na < K < Rb < Cs$.

Conclusion: The correct order of the density of alkali metals is $Li < Na < K < Rb < Cs$.

Final Answer: (A)

Answer: (A)

Q17.

Solution

Concept: Interstitial compounds have small atoms occupying the interstitial spaces of metal lattices, making them hard and retaining metallic conductivity.

Solution: - The statement "They are chemically reactive" is incorrect for interstitial compounds, which are generally chemically stable.

Conclusion: The incorrect statement is "They are chemically reactive."

Final Answer: (A)

Answer: (A)

Q18.

Solution

Concept: Molar conductivity is the ability of ions to conduct electricity and can be calculated using the resistance, concentration, and cell constant.

Solution: - The formula for molar conductivity is:

$$\Lambda_m = \frac{R \cdot \text{cell constant}}{\text{concentration}}$$

- Given: resistance $R = 100 \Omega$, cell constant = 0.5 cm^{-1} , and concentration = 0.01 M ,

$$\Lambda_m = \frac{100 \cdot 0.5}{0.01} = 500 \text{ S cm}^2 \text{ mol}^{-1}$$

Conclusion: The molar conductivity is $500 \text{ S cm}^2 \text{ mol}^{-1}$.

Final Answer: (A)

Answer: (A)



Q19.

Solution

Concept: The rate of reaction depends on the concentration of reactants and is determined using the rate law expression.

Solution: - The rate law is given by $Rate = k[A][B]^2$. - When the volume is reduced to half, the concentration of A and B will double. - The rate will increase by a factor of $(2)^3 = 8$.

Conclusion: The rate of reaction will increase by a factor of 8.

Final Answer: (B)

Answer: (B)

Q20.

Solution

Concept: The de Broglie wavelength of a particle is given by:

$$\lambda = \frac{h}{mv}$$

where h is Planck's constant, m is the mass, and v is the velocity.

Solution: - Given: mass of the tennis ball $m = 60\text{ g} = 0.06\text{ kg}$, velocity $v = 10\text{ m/s}$, and $h = 6.63 \times 10^{-34}\text{ J}\cdot\text{s}$. - The de Broglie wavelength is:

$$\lambda = \frac{6.63 \times 10^{-34}}{0.06 \times 10} = 1.105 \times 10^{-33}\text{ m}$$

Conclusion: The de Broglie wavelength is approximately 10^{-33} m .

Final Answer: (A)

Answer: (A)



Q21.

Solution**Concept:** The ideal gas law is used to calculate the total pressure of a gas mixture:

$$PV = nRT$$

where P is the pressure, V is the volume, n is the number of moles, R is the gas constant, and T is the temperature.

Solution: - Given: - $n_{\text{He}} = 2$ moles, $n_{\text{N}_2} = 4$ moles, volume $V = 10$ L, temperature $T = 27^\circ\text{C} = 300.15$ K, and $R = 0.0821$ L · atm/K · mol. - The total number of moles in the mixture is:

$$n_{\text{total}} = n_{\text{He}} + n_{\text{N}_2} = 2 + 4 = 6 \text{ moles}$$

- Applying the ideal gas law:

$$P = \frac{nRT}{V}$$

$$P = \frac{6 \times 0.0821 \times 300.15}{10} = \frac{147.62}{10} = 14.76 \text{ atm}$$

Conclusion: The total pressure of the mixture is 14.76 atm.

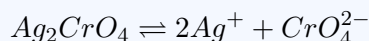
Final Answer: 14.76

Answer: (14.76)

Q22.

Solution

Concept: The solubility product K_{sp} is the equilibrium constant for the dissociation of a sparingly soluble salt. For Ag_2CrO_4 , the dissociation is:



The solubility product is:

$$K_{sp} = [Ag^+]^2[CrO_4^{2-}]$$

Solution: - Given $K_{sp} = 1.1 \times 10^{-12}$, and the concentration of Ag^+ in a 0.1 M $AgNO_3$ solution is 0.1 M, we can set up the equation. - Let the solubility of Ag_2CrO_4 in 0.1 M $AgNO_3$ be x mol/L. The concentration of Ag^+ will be $0.1 + 2x$, and the concentration of CrO_4^{2-} will be x . - The solubility product is:

$$K_{sp} = (0.1 + 2x)^2 \times x$$

- Assuming x is small compared to 0.1, we approximate $0.1 + 2x \approx 0.1$. Thus, the equation becomes:

$$K_{sp} = 0.1^2 \times x = 1.1 \times 10^{-12}$$

$$x = \frac{1.1 \times 10^{-12}}{0.01} = 1.1 \times 10^{-10} \text{ mol/L}$$

Conclusion: The solubility of Ag_2CrO_4 in 0.1 M $AgNO_3$ is 1.1×10^{-10} mol/L.

Final Answer: 1.1

Answer: (1.1)

Q23.

Solution

Concept: The relationship between enthalpy change ΔH and internal energy change ΔU for a combustion reaction is given by:

$$\Delta H = \Delta U + P\Delta V$$

where ΔH is the heat of combustion at constant pressure, ΔU is the heat of combustion at constant volume, and $P\Delta V$ is the work done during expansion.

Solution: - The difference between ΔH and ΔU for combustion is given by:

$$\Delta H - \Delta U = \text{work done by the system}$$

- Since we are ignoring the volume of liquid benzene, ΔV is very small, and the difference $\Delta H - \Delta U$ will be nearly equal to zero.

Conclusion: The difference between ΔH and ΔU is approximately 0 kJ/mol.

Final Answer: 0

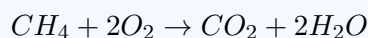
Answer: (0)



Q24.

Solution

Concept: The combustion reaction for methane is:



The stoichiometric relationship between methane and carbon dioxide is 1:1.

Solution: - Given that the mass of CO_2 produced is 22 g, we first calculate the moles of CO_2 :

$$\text{Moles of } CO_2 = \frac{22}{44} = 0.5 \text{ mol}$$

- From the balanced equation, 1 mole of CH_4 produces 1 mole of CO_2 , so the number of moles of CH_4 required is also 0.5 moles.

Conclusion: The number of moles of CH_4 required to produce 22 g of CO_2 is 0.5.

Final Answer: 0.5

Answer: (0.5)

Q25.

Solution

Concept: The pH of a buffer solution can be calculated using the Henderson-Hasselbalch equation:

$$pH = pK_a + \log \left(\frac{[\text{base}]}{[\text{acid}]} \right)$$

where pK_a is the dissociation constant of the weak acid and the ratio of the base to acid is determined from the concentrations.

Solution: - Given: - Concentration of acetic acid = 0.1 M - Concentration of sodium acetate = 0.1 M - pK_a of acetic acid = 4.74 - $\log 2 = 0.30$ - The ratio of the base to acid is:

$$\frac{[\text{base}]}{[\text{acid}]} = \frac{0.1}{0.1} = 1$$

- Applying the Henderson-Hasselbalch equation:

$$pH = 4.74 + \log 1 = 4.74$$

Conclusion: The pH of the buffer solution is 4.74.

Final Answer: 4.74

Answer: (4.74)



Answer Key — Section A

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

Answer Key — Section B

Q	Ans	Q	Ans
21	14.76	22	1.1
23	0	24	0.5
25	4.74		

