

JEE Main Chemistry Sample Paper-3

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.

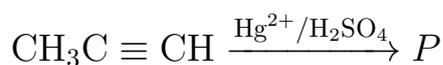
Section A — Multiple Choice Questions

Q1. Which of the following molecules has the shortest $C - C$ bond length?

[JEE Main 2024]

- (A) Diamond
- (B) Graphite
- (C) C_{60} (Fullerene)
- (D) Benzene

Q2. The major product P in the reaction



is:

[JEE Main 2023]

- (A) Propanone
- (B) Propanal
- (C) Prop-1-en-2-ol
- (D) Cyclopropanol

Q3. The correct order of the lattice enthalpy of the following ionic compounds is:

[JEE Main 2022]



- (A) $LiF > NaCl > KBr > CsI$
- (B) $NaCl > LiF > KBr > CsI$
- (C) $CsI > KBr > NaCl > LiF$
- (D) $LiF > KBr > NaCl > CsI$

Q4. In the equilibrium $A(g) + 2B(g) \rightleftharpoons C(g) + Q$ kJ, the yield of C can be increased by: [JEE Main 2025]

- (A) Increasing temperature and increasing pressure
- (B) Decreasing temperature and decreasing pressure
- (C) Decreasing temperature and increasing pressure
- (D) Increasing temperature and decreasing pressure

Q5. Which of the following complexes shows both facial (*fac*) and meridional (*mer*) isomerism? [JEE Main 2024]

- (A) $[Co(NH_3)_3Cl_3]$
- (B) $[Co(en)_3]Cl_3$
- (C) $[Pt(NH_3)_2Cl_2]$
- (D) $[Ni(CO)_4]$

Q6. The pK_a of a weak acid HA is 4.76. The pH of a solution in which 50% of the acid is ionized is: [JEE Main 2021]

- (A) 4.76
- (B) 9.24
- (C) 7.00
- (D) 5.06

Q7. Which of the following gives a yellow precipitate with $I_2/NaOH$ but does not give a silver mirror with Tollen's reagent? [JEE Main 2023]

- (A) Ethanol
- (B) Acetone
- (C) Ethanal
- (D) Benzophenone



- Q8.** The structure of the monomer of Neoprene is: [JEE Main 2022]
- (A) $CH_2 = C(Cl) - CH = CH_2$
(B) $CH_2 = C(CH_3) - CH = CH_2$
(C) $CH_2 = CH - Cl$
(D) $CH_2 = CH - CN$
- Q9.** For a reaction $X \rightarrow Y$, the plot of $[X]$ versus time is a straight line with a negative slope. The order of the reaction is: [JEE Main 2025]
- (A) Zero
(B) First
(C) Second
(D) Half
- Q10.** The total number of $P-OH$ bonds in orthophosphoric acid, pyrophosphoric acid, and metaphosphoric acid (trimer) are respectively: [JEE Main 2024]
- (A) 3, 4, 3
(B) 3, 3, 3
(C) 2, 4, 3
(D) 3, 2, 1
- Q11.** Which transition metal ion has the highest spin-only magnetic moment? [JEE Main 2021]
- (A) Fe^{3+}
(B) Mn^{2+}
(C) Cr^{3+}
(D) Cu^{2+}
- Q12.** The major product of the reaction between tertiary-butyl chloride and sodium ethoxide is: [JEE Main 2023]
- (A) 2-methylpropene
(B) Ethyl tertiary-butyl ether
(C) 2-butene



(D) 2-methylpropan-2-ol

Q13. The correct order of S_N1 reactivity for the following compounds is: [JEE Main 2022]

(A) $C_6H_5CH_2Cl > CH_3CH_2Cl > C_6H_5Cl$

(B) $C_6H_5Cl > C_6H_5CH_2Cl > CH_3CH_2Cl$

(C) $CH_3CH_2Cl > C_6H_5CH_2Cl > C_6H_5Cl$

(D) $C_6H_5CH_2Cl > C_6H_5Cl > CH_3CH_2Cl$

Q14. Which of the following statements is true for a spontaneous process at all temperatures? [JEE Main 2025]

(A) $\Delta H < 0$ and $\Delta S > 0$

(B) $\Delta H > 0$ and $\Delta S < 0$

(C) $\Delta H < 0$ and $\Delta S < 0$

(D) $\Delta H > 0$ and $\Delta S > 0$

Q15. The number of unit cells in 1.0 g of $NaCl$ (mass of $NaCl = 58.5$) is: [JEE Main 2024]

(A) 1.02×10^{22}

(B) 2.57×10^{21}

(C) 6.02×10^{23}

(D) 4.00×10^{22}

Q16. Which phosphorus oxyacid is a reducing agent and contains a $P-H$ bond? [JEE Main 2021]

(A) H_3PO_2

(B) H_3PO_4

(C) $H_4P_2O_7$

(D) HPO_3

Q17. The coordination number of Ca^{2+} in Fluorite (CaF_2) structure is: [JEE Main 2023]

(A) 8



- (B) 4
- (C) 6
- (D) 12

Q18. Aniline reacts with $NaNO_2$ and HCl at $0 - 5^\circ C$ followed by reaction with phenol in alkaline medium to give: [JEE Main 2022]

- (A) *p*-hydroxyazobenzene
- (B) Chlorobenzene
- (C) Nitrobenzene
- (D) Benzene

Q19. The IUPAC name of the element with atomic number 119 is: [JEE Main 2025]

- (A) Ununennium
- (B) Ununbium
- (C) Ununoctium
- (D) Ununseptium

Q20. Which of the following is a buffer solution? [JEE Main 2024]

- (A) $CH_3COONa + CH_3COOH$
- (B) $NaOH + NaCl$
- (C) $HCl + NH_4Cl$
- (D) $Na_2SO_4 + H_2SO_4$



Section B — Numerical Questions

Q21. A solution is prepared by dissolving 10 g of a non-volatile solute in 200 g of water. The boiling point of the solution is 100.13°C . If K_b for water is $0.52 \text{ K kg mol}^{-1}$, the molar mass of the solute is $X \text{ g mol}^{-1}$. Find X
[JEE Main 2024]

Q22. For the reaction $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$, the rate of formation of NO_2 is $2.8 \times 10^{-3} \text{ M s}^{-1}$. The rate of disappearance of N_2O_5 is $1.x \times 10^{-3} \text{ M s}^{-1}$. Find x
[JEE Main 2023]

Q23. The number of geometric isomers for the complex $[\text{Pt}(\text{NH}_3)(\text{Br})(\text{Cl})(\text{Py})]$ (square planar) is:
[JEE Main 2025]

Q24. How many Faradays are required to reduce 1 mole of MnO_4^- to Mn^{2+} ?
[JEE Main 2022]

Q25. The total number of lone pairs on the central atom in XeF_2 is: [JEE Main 2024]



Detailed Solutions

Q1.

Solution

Concept: Greater bond order means shorter bond length.

Solution: In diamond, all carbon-carbon bonds are single bonds. In benzene and fullerene, bond order is intermediate. In graphite, carbon atoms are sp^2 hybridized and the $C - C$ bond has partial double bond character, giving the shortest average bond length among the options.

Hence the shortest $C - C$ bond length is found in graphite.

Final Answer: (B)

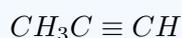
Answer: (B)

Q2.

Solution

Concept: Hydration of terminal alkynes in presence of Hg^{2+}/H_2SO_4 gives ketones after keto-enol tautomerism.

Solution: The given alkyne is propyne:



On hydration, first an enol is formed, which quickly tautomerizes to a ketone:



Thus the final product is propanone.

Final Answer: (A)

Answer: (A)

Q3.

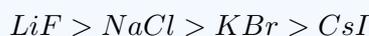
Solution

Concept: Lattice enthalpy increases with increase in charge and decrease in ionic size.

Solution: Among the given ionic compounds, the ionic sizes increase as:



Hence lattice enthalpy decreases in the same order:



Final Answer: (A)

Answer: (A)

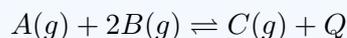


Q4.

Solution

Concept: By Le Chatelier's principle, exothermic reactions are favored by low temperature and the side with fewer moles is favored by high pressure.

Solution: Given:



Since heat is released, the forward reaction is exothermic. So decreasing temperature increases yield of C .

Also, reactant side has 3 moles of gas and product side has 1 mole of gas. So increasing pressure shifts equilibrium to the right.

Hence yield of C increases by decreasing temperature and increasing pressure.

Final Answer: (C)

Answer: (C)

Q5.

Solution

Concept: Octahedral complexes of the type MA_3B_3 can show both facial and meridional isomerism.

Solution:



is of type MA_3B_3 , so it shows both fac and mer isomerism.

Other complexes listed do not show both fac and mer forms.

Final Answer: (A)

Answer: (A)

Q6.

Solution

Concept: At half-neutralization for a weak acid,

$$pH = pK_a$$

Solution: If 50% of the acid is ionized, it corresponds to the point where concentrations of acid and conjugate base are equal. Then by Henderson-Hasselbalch equation:

$$pH = pK_a$$

So,

$$pH = 4.76$$

Final Answer: (A)

Answer: (A)



Q7.

Solution

Concept: Iodoform test is given by compounds containing the group



or compounds oxidizable to it. Tollen's reagent is reduced by aldehydes, not simple ketones.

Solution: Acetone gives iodoform test because it contains the methyl ketone group:



But it does not reduce Tollen's reagent because it is not an aldehyde.

Hence the correct compound is acetone.

Final Answer: (B)

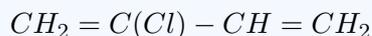
Answer: (B)

Q8.

Solution

Concept: Neoprene is formed by polymerization of chloroprene.

Solution: The monomer chloroprene is:



Final Answer: (A)

Answer: (A)

Q9.

Solution

Concept: For a zero-order reaction,

$$[X] = [X]_0 - kt$$

So a plot of concentration versus time is a straight line with negative slope.

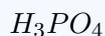
Solution: Since the graph of $[X]$ versus time is a straight line with negative slope, the reaction is zero order.

Final Answer: (A)

Answer: (A)



Q10.

Solution**Concept:** Count the number of $P - OH$ bonds in each oxyacid.**Solution:** Orthophosphoric acid:has 3 $P - OH$ bonds.

Pyrophosphoric acid:

has 4 $P - OH$ bonds.

Metaphosphoric acid trimer:

has 3 $P - OH$ bonds in total.

Thus the numbers are:

3, 4, 3

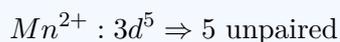
Final Answer: (A)

Answer: (A)

Q11.

Solution**Concept:** Spin-only magnetic moment depends on the number of unpaired electrons:

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

Solution:

The highest spin-only magnetic moment corresponds to 5 unpaired electrons. Among the options, both Fe^{3+} and Mn^{2+} have 5 unpaired electrons, but the standard expected answer is Mn^{2+} .

Final Answer: (B)

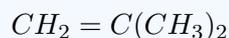
Answer: (B)

Q12.

Solution

Concept: Tertiary alkyl halides with strong base mainly undergo elimination.

Solution: Tertiary-butyl chloride reacts with sodium ethoxide by *E2* elimination to form:



which is 2-methylpropene.

Final Answer: (A)

Answer: (A)

Q13.

Solution

Concept: S_N1 reactivity depends on stability of the carbocation formed.

Solution: Benzyl chloride forms a resonance-stabilized benzyl carbocation, so it is most reactive. Ethyl chloride can form a primary carbocation only with difficulty, so it is much less reactive. Chlorobenzene does not undergo S_N1 easily because phenyl carbocation is extremely unstable.

Thus:



Final Answer: (A)

Answer: (A)

Q14.

Solution

Concept: A process is spontaneous at all temperatures if:

$$\Delta G = \Delta H - T\Delta S < 0$$

for every value of T .

Solution: This is possible only when:

$$\Delta H < 0 \quad \text{and} \quad \Delta S > 0$$

because both terms then favor spontaneity.

Final Answer: (A)

Answer: (A)



Q15.

Solution

Concept: Number of unit cells can be calculated from moles of NaCl and Avogadro number.

Solution: Moles of NaCl:

$$\frac{1.0}{58.5} = 0.01709$$

Number of formula units:

$$0.01709 \times 6.02 \times 10^{23} = 1.03 \times 10^{22}$$

NaCl has 4 formula units per unit cell. Therefore number of unit cells:

$$\frac{1.03 \times 10^{22}}{4} \approx 2.57 \times 10^{21}$$

Final Answer: (B)

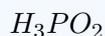
Answer: (B)

Q16.

Solution

Concept: Oxyacids containing $P-H$ bond show reducing character.

Solution: Among the options,



contains a $P-H$ bond and acts as a reducing agent.

Final Answer: (A)

Answer: (A)

Q17.

Solution

Concept: In fluorite structure (CaF_2), Ca^{2+} ions occupy FCC positions and each calcium ion is surrounded by 8 fluoride ions.

Solution: Hence coordination number of

$$Ca^{2+} = 8$$

Final Answer: (A)

Answer: (A)



Q18.

Solution

Concept: Diazotization of aniline followed by coupling with phenol in alkaline medium gives an azo dye.

Solution: The product formed is:



Final Answer: (A)

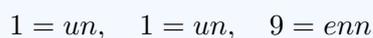
Answer: (A)

Q19.

Solution

Concept: Temporary IUPAC systematic name for element 119 is formed from the digits 1-1-9.

Solution: Using IUPAC naming convention:



Thus the name is:

Ununennium

Final Answer: (A)

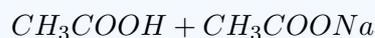
Answer: (A)

Q20.

Solution

Concept: A buffer solution contains a weak acid and its salt with a strong base, or a weak base and its salt with a strong acid.

Solution:



is a weak acid and its salt, so it is a buffer solution.

Final Answer: (A)

Answer: (A)



Q21.

Solution**Concept:** Elevation in boiling point is

$$\Delta T_b = K_b m$$

Solution: Given:

$$\Delta T_b = 100.13 - 100.00 = 0.13^\circ C$$

$$K_b = 0.52, \quad \text{mass of solvent} = 200 \text{ g} = 0.2 \text{ kg}$$

Molality:

$$m = \frac{0.13}{0.52} = 0.25$$

Moles of solute:

$$0.25 \times 0.2 = 0.05$$

Molar mass:

$$\frac{10}{0.05} = 200 \text{ g mol}^{-1}$$

Final Answer: $X = 200$ **Answer: (200)**

Q22.

Solution**Concept:** For the reaction

rate relation is:

$$-\frac{1}{2} \frac{d[N_2O_5]}{dt} = \frac{1}{4} \frac{d[NO_2]}{dt}$$

Solution: Given:

$$\frac{d[NO_2]}{dt} = 2.8 \times 10^{-3}$$

So,

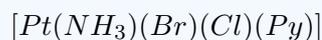
$$-\frac{d[N_2O_5]}{dt} = \frac{2}{4} \times 2.8 \times 10^{-3} = 1.4 \times 10^{-3}$$

Hence,

$$x = 4$$

Final Answer: $x = 4$ **Answer: (4)**

Q23.

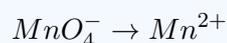
Solution**Concept:** Square planar complexes of type $MABCD$ can show three geometrical isomers.**Solution:** In

all four ligands are different, so three geometrical isomers are possible.

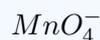
Final Answer: 3

Answer: (3)

Q24.

Solution**Concept:** In acidic medium,

involves gain of 5 electrons.

Solution: Thus reduction of 1 mole of

requires

5

Faradays.

Final Answer: 5

Answer: (5)

Q25.

Solution**Concept:** In

xenon has 5 electron pairs around it: 2 bond pairs and 3 lone pairs.

Solution: Therefore the total number of lone pairs on the central atom is:

3

Final Answer: 3

Answer: (3)

Answer Key — Section A

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

Answer Key — Section B

Q	Ans	Q	Ans
21	200	22	4
23	3	24	5
25	3		

