JEE (MAIN) 2024
MEMORY BASED QUESTIONS & SOLUTIONS

SHIFT-2

DATE & DAY: 30th January 2024 & Tuesday

PAPER-1
Duration: 3 Hrs.
Time: 03:00 PM - 06:00 PM

SUBJECT: CHEMISTRY

ADMISSIONS OPEN FOR CLASS 12+
ACADEMIC SESSION 2024-25

TARGET: JEE (ADV.) 2024
For Class XII Passed Student
VISHESH COURSE
MODE: OFFLINE/ONLINE
CLASS STARTS 08th APRIL, 2024

TARGET: JEE (MAIN) 2024
For Class XII Passed Student
ABHYAAS COURSE
MODE: OFFLINE/ONLINE
CLASS STARTS 08th APRIL, 2024

SCHOLARSHIP ON THE BASIS OF JEE (MAIN) 2024 %ILE/AIR

REGISTERED & CORPORATE OFFICE (CIN: U80302RJ2007PLC024029):
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PART : CHEMISTRY

1. Geometry of Decacarbonyl dimalanganese (I) is :  
   (1) Octahedral  
   (2) Square planar  
   (3) Trigonal bipyramidal  
   (4) Square pyramidal  
   Ans. (1)

Sol.  

2. Which of the following species has square pyramidal geometry ?  
   (1) PCl₅  
   (2) BrF₅  
   (3) PF₅  
   (4) [Ni(CN)₄]²⁻  
   Ans. (2)

Sol.  

3. **Statement-1**: H₂Te is more acidic than H₂S.
**Statement-2**: H₂Te has less bond strength than H₂S.
   (1) Statement-1 and Statement-2 are correct.
   (2) Statement-1 and Statement-2 are incorrect.
   (3) Statement-1 is correct and Statement-2 is incorrect.
   (4) Statement-1 is incorrect and Statement-2 is correct.
   **Ans.** (1)
   **Sol.** In H₂Te bond length increases and bond energy decreases therefore acid strength increases.

4. Among the following correct statement is :
   (1) Stability of hydrides order: NH₃ < PH₃ < AsH₃ < SbH₃ < BiH₃
   (2) Reducing strength order: NH₃ < PH₃ < AsH₃ < SbH₃ < BiH₃
   (3) NH₃ is strongest reducing agent while BiH₃ is mild reducing agent.
   (4) Basicity of hydrides: NH₃ > PH₃ > AsH₃ > SbH₃ > BiH₃
   **Ans.** (2)
   **Sol.** Due to increase in bond length down the group reducing strength increases.

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5. Given standard electrode potential of Br₂O⁻, IO⁻ and ClO⁻ are 1.85 V, 1.65 V and 1.20 V respectively then select order of their oxidizing power :
   (1) ClO⁻ < Br₂O⁻ < IO⁻
   (2) IO⁻ < Br₂O⁻ < ClO⁻
   (3) ClO⁻ < IO⁻ < Br₂O⁻
   (4) Br₂O⁻ < ClO⁻ < IO⁻
   **Ans.** (3)
   **Sol.** More reduction potential, more is the oxidizing strength.

6. **Statement-1**: Since fluorine is more electronegative than nitrogen, the resultant dipole moment of NH₃ is greater than that of NF₃.
   **Statement-2**: In case of NH₃ the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of N-H bonds, whereas in NF₃ the orbital dipole is in the direction opposite to the resultant dipole moment of three N-F bonds.
   (1) Statement I and Statement II are correct.
   (2) Statement I is correct and Statement II is incorrect.
   (3) Statement I is incorrect and Statement II is correct.
   (4) Statement I and Statement II are incorrect.
   **Ans.** (1)
   **Sol.** The orbital dipole because of lone pair decreases the effect of the resultant N – F bond moments, which results in the low dipole moment of NF₃ as represented below:

![Diagram of dipole moments](image)

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7. In a mixture of B & C, A is added. Given moles of A, B & C are respectively n₁, n₂ & n₃ then determine mole fraction of C.
   **Ans.** n₂ / (n₁ + n₂ + n₃)
8. The colour of KMnO₄ and K₂Cr₂O₇ is due to
   (1) d-d transition  (2) Metal to ligand charge transfer
   (3) Ligand to metal charge transfer  (4) F-Center
   Ans. (3)
   Sol. KMnO₄  K₂Cr₂O₇
      (Purple)     (Orange Red)
   Colour of KMnO₄ & K₂Cr₂O₇ is due to ligand to metal charge transfer phenomenon.

9. MnO₂ + KOH + O₂ → [X]
   [X] → [Y]
   Electrolysis
   Select correct option
   (1) MnO₄⁻  (2) MnO₄²⁻  (3) Mn₂O₇⁴⁻  (4) MnO₃
   Ans. (2)
   Sol. 2 MnO₂ + 4KOH + O₂ → 2K₂MnO₄ + 2H₂O
   MnO₄⁻ → MnO₄²⁻  Electrolysis
   [X] → [Y]

10. Cr₂O₇⁴⁻ + NaOH → [X]
    [X] + HCl + H₂O₂ → [Y]
    Select correct option
    (1) Na₂CrO₄  Cr₂O₇⁴⁻  (2) Na₂Cr₂O₇  Cr₂O₃  (3) Cr₂O₇⁴⁻  Na₂Cr₂O₇
    Ans. (1)
    Sol. Cr₂O₇⁴⁻ + NaOH → Na₂CrO₄ + NaCl + H₂O
    Cr₂O₇⁴⁻ + H⁺ → CrO₄²⁻ + H₂O₂ → CrO₅
11. Which of the following solution have maximum depression in freezing point?

(1) 180 g of glucose in water  
(2) 180 g of Benzoic acid in Benzene  
(3) 180 g of Acetic acid in Benzene  
(4) 180 g of Acetic acid in water

**Sol.**

\[ \Delta T_f = \frac{1}{K_f} \]

\[ \Delta T_f \propto \text{m} \]

For Glucose, \( i = 1 \) in Water

Benzoic acid \( i < 1 \) in Benzene

Acetic acid \( i < 1 \) in Benzene

Acetic acid \( i > 1 \) in Water

More the number of mole of solute greater is depression in freezing point.

12. Among the following how many are optical active?

(i) cis \([\text{Co}(en)_{2}Cl_{2}]\)
(ii) trans \([\text{Co}(en)_{2}Cl_{2}]\)
(iii) cis \([\text{Pt}(en)_{2}Cl_{2}]^{2-}\)
(iv) trans \([\text{Pt}(en)_{2}Cl_{2}]^{2-}\)
(v) \([\text{Pt}(en)]^{2+}\)
(vi) \([\text{Pt}(en)]^{4+}\)

**Ans.** (3)

**Sol.**

Complex | Optical Nature
--- | ---
(i) cis \([\text{Co}(en)_{2}Cl_{2}]\) | Optical active
(ii) trans \([\text{Co}(en)_{2}Cl_{2}]\) | Optical inactive
(iii) cis \([\text{Pt}(en)_{2}Cl_{2}]^{2+}\) | Optical active
(iv) trans \([\text{Pt}(en)_{2}Cl_{2}]^{2-}\) | Optical inactive
(v) \([\text{Pt}(en)]^{2+}\) | Optical active
(vi) \([\text{Pt}(en)]^{4+}\) | Optical inactive

13. In \( \text{He}^+ \) ion an electron Jumps from 5th excited state to 1st excited state, then total number of spectral lines formed are _____.

**Ans.** (10)

**Sol.**

5th excited state \( n_2 = 6 \)

1st excited state \( n_1 = 2 \)

Total spectral line

upto 5th state = 1

4th state = 2

3rd state = 3

2nd state = 4

Total line = 10

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15. How many of the following species can show redox disproportion reaction.
\[ \text{H}_2\text{O}_2, \text{P}_2, \text{NO}_2, \text{Cu}^+, \text{ClO}_2^-, \text{ClO}_3^-, \text{F}_2, \text{Cl}_2 \]
Ans. (6)
Sol. To show disproportion reaction element must show at least 3 oxidation state and element must present in intermediate oxidation state.
\[ \text{H}_2\text{O}_2, \text{P}_2, \text{NO}_2, \text{Cu}^+, \text{ClO}_2^-, \text{ClO}_3^-, \text{F}_2, \text{Cl}_2 \]
can show disproportion reaction.

16. How many of the following can show flame colour test?
\[ \text{Be}, \text{Mg}, \text{Sr}, \text{Ba}, \text{Li}, \text{Cu} \]
Ans. (4)
Sol. Be & Mg do not show flame colour test.

17. In buffer solution of benzoic acid and sodium benzoate pH of solution is 4.5. then ratio of moles of salt to moles of acid is \[ \text{Nearest integer} \]
\[ \text{[Give pKa (Benzoic acid) = 4.5 and log2 = 0.3]} \]
Ans. (2)
Sol. Benzoic acid + sodium benzoate.
\[ \text{Acid Buffer solution} \]
\[ \text{pH} = \text{pKa} + \log \frac{[\text{Salt}]}{[\text{Acid}]} \]
4.5 = 4.2 + log \[ \frac{[\text{Salt}]}{[\text{Acid}]} \]
0.3 = log \[ \frac{[\text{Salt}]}{[\text{Acid}]} \]
\[ \frac{[\text{Salt}]}{[\text{Acid}]} = 2 = \frac{n_{\text{salt}}}{n_{\text{acid}}} = 2 \]

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18. IUPAC name of \( \text{CH}_3\text{-CH-C} = \text{CH-CN} \) is:
\[ \text{NH}_2 \]
(1) 3-Aminobutanitrile (2) 3-Aminobutane cyanitride
(3) 2-Amino-1-cyanopropane (4) 3-Aminebutanitrile
Ans. (3)
Sol. \( \text{CH}_3\text{-CH-C} = \text{CH-CN} \)
\[ \text{NH}_2 \]

19. Which reagent on reaction with phenol give salicyldeyde:
(1) \( \text{CO}_2, \text{NaOH} \) (2) \( \text{CHCl}_3, \text{NaOH} \)
(3) \( \text{Cl}_2\text{O}, \text{NaOH} \) (4) \( \text{H}_2\text{O}, \text{H}^+ \)
Ans. (2)
Sol. This reaction is known as Reimer-Tieman reaction.

20. The correct order of stability for given carboxations is:
(1) \( \text{CH}_3\text{C}^+_+, \text{II} \) \( \text{CH}_3\text{C}^+_+ \), (III) \( \text{CH}_3\text{CH}_2^+, \text{IV} \) \( \text{CH}_3^+ \)
(1) \( \text{I} > \text{II} > \text{III} > \text{IV} \) (2) \( \text{I} > \text{II} > \text{IV} > \text{III} \)
(3) \( \text{IV} > \text{III} > \text{II} > \text{I} \) (4) \( \text{I} > \text{II} > \text{IV} > \text{III} \)
Ans. (2)
Sol. Greater the number of \( \alpha \)-hydrogen, greater the hyperconjugation and stability of carboxation.
21. A & B are respectively

(A) \[\text{H}_2\text{O}_2/\text{OH}\] \[\text{H}_2\text{O}_2/\text{OH}\]
(B) \[\text{H}_2\text{O}/\text{OH}\]

(a) \[\text{H}_2\text{O}_2/\text{OH}\] \[\text{H}_2\text{O}/\text{OH}\]
(b) \[\text{H}_2\text{O}_2/\text{OH}\] \[\text{H}_2\text{O}/\text{OH}\]
(c) \[\text{H}_2\text{O}_2/\text{OH}\] \[\text{H}_2\text{O}/\text{OH}\]

Ans. (1)

Sol. (anti-Marconiak addition of water) (Marociak addition of water)

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22. What is A and B

(1) \[\text{A} = \text{NH}_2\] \[\text{B} = \text{HO}-\text{N=N-}\]
(2) \[\text{A} = \text{Cl}\] \[\text{B} = \text{HO}-\text{N=N-}\]
(3) \[\text{A} = \text{NH}_2\] \[\text{B} = \text{O}-\text{N=N-}\]
(4) \[\text{A} = \text{NH}_2\] \[\text{B} = \text{O}-\text{N=N-}\]

Ans. (1)

Sol. (1) conc. H_2SO_4 + conc. HNO_3 \[\text{A} = \text{NO}_2\] \[\text{B} = \text{N-NO}_3\]
(2) Sn/HCl \[\text{A} = \text{NH}_2\] \[\text{B} = \text{OH} - \text{OH}\]
23.  
\[ \text{CHO} \xrightarrow{50\% \text{KOH}} A + B \]
A & B are respectively

(1) A =  
\[ \text{COO}^- \]
B =  
\[ \text{CH}_2\text{OH} \]

(2) A =  
\[ \text{COO}^- \]
B =  
\[ \text{CH}_2\text{OH} \]

(3) A =  
\[ \text{CH}_2\text{OH} \]
B =  
\[ \text{CH}_2\text{OH} \]

(4) A =  
\[ \text{COO}^- \]
B =  
\[ \text{CH}_2\text{OH} \]

Ans. (1)

Sol.
This is a Cannizaro reaction.

24. Total number of optical isomers formed is Chlorobutane + Cl₂ → dichlorobutane

Ans. (7)

Sol.
\[ \text{R+S} \]
\[ \text{Cl} \]
\[ \text{Cl} \]
\[ \text{R} \]
\[ \text{R} \]
\[ \text{R} \]
\[ \text{S} \]
\[ \text{Cl} \]

25. Total number of geometrical isomers possible for given compound is?

Ans. (4)