JEE (MAIN) 2024
MEMORY BASED QUESTIONS & SOLUTIONS
SHIFT-1

DATE & DAY: 31st January 2024 & Wednesday
PAPER-1
Duration: 3 Hrs.
Time: 09:00 - 12:00 IST

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

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PERCENTILE BOOSTER
JEE (Main) 2024 April Attempt में अधिकतम %ILE प्राप्त करने के लिए आज ही जोड़ करें।

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

PART: CHEMISTRY

1. Which of the following metals used in battery industry?
   (I) Fe  (II) Mn  (III) Ni  (IV) Cd  (V) Cr
   (1) (I) and (II)  (2) (II) and (IV)  (3) (I) and (IV)  (4) (III) and (IV)

   Ans.  (4)
   Sol.

   A rechargeable nickel-cadmium cell in a jelly roll arrangement and separated by a layer soaked in moist sodium or potassium hydroxide.
   Another important secondary cell is the nickel-cadmium cell which has longer life than the lead storage cell but more expensive to manufacture. We shall not go into details of working of the cell and the electrode reactions during charging and discharging. The overall reaction during discharge is:
2. Select the correct option for isobaric process:

\[
\text{Cd (s) + 2Ni(OH)\textsubscript{2} (s) } \rightarrow \text{CdO (s) + 2Ni(OH)\textsubscript{2} (s) + H\textsubscript{2}O (l)}
\]

(1) \( P_1 = P_2 \)  
(2) \( P_1 > P_2 \)  
(3) \( P_2 > P_1 \)  
(4) \( P_2 > P_1 \)

**Ans.** (3)

**Sol.**

\[
P \times V = nRT
\]

\[
P \times T
\]

\[
\text{order of pressure : } P_2 > P_1
\]

3. Among the following solution showing positive deviation:

(1) Acetone + CHCl\textsubscript{3}  
(2) Acetone + Cs\textsubscript{2}  
(3) HNO\textsubscript{3} + H\textsubscript{2}O  
(4) HCOOH + H\textsubscript{2}O

**Ans.** (2)

**Sol.** Remaining shows negative derivation.

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4. **Statement-I**: Noble gases have very high boiling point.

**Statement-II**: Noble gases molecules have strong dispersion forces.

(1) Both statements are correct.
(2) Statement I is correct and statement II is incorrect.
(3) Statement I is incorrect and statement II is correct.
(4) Both statements are incorrect.

**Ans.** (4)

5. Among the following white precipitate is:

(1) Pb\textsubscript{2}  
(2) (NH\textsubscript{4})\textsubscript{2}S  
(3) (NH\textsubscript{4})\textsubscript{2}AsO\textsubscript{4} \cdot 12MoO\textsubscript{3}  
(4) PbSO\textsubscript{4}

**Ans.** (4)

**Sol.**

(1) Pb\textsubscript{2} \rightarrow yellow ppt
(2) (NH\textsubscript{4})\textsubscript{2}S \rightarrow soluble
(3) (NH\textsubscript{4})\textsubscript{2}AsO\textsubscript{4} \cdot 12MoO\textsubscript{3} \rightarrow yellow ppt

6. What is the correct order of electron gain enthalpy of following?

(1) S > Ar > F > Br  
(2) F > Br > S > Ar  
(3) Ar > S > Br > F  
(4) Ar > F > Br > S

**Ans.** (3)

**Sol.** We have to take with sign, if magnitude wise electron gain enthalpy is not asked

<table>
<thead>
<tr>
<th>Element</th>
<th>Electron gain enthalpy (KJ/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>-333</td>
</tr>
<tr>
<td>S</td>
<td>-200</td>
</tr>
<tr>
<td>Br</td>
<td>-325</td>
</tr>
<tr>
<td>Ar</td>
<td>+96</td>
</tr>
</tbody>
</table>

7. \[ \text{Fe}^{2+}(aq) + \text{SCN}^{-}(aq) \rightleftharpoons \text{Fe(SCN)}^{2-}(aq) \]

Value of \( K_c \) is:

(1) \[ \frac{[\text{Fe(SCN)}^{2-}]}{[\text{Fe}^{2+}][\text{SCN}^{-}]} \]  
(2) \[ \frac{[\text{Fe}^{2+}][\text{SCN}^{-}]}{[\text{Fe(SCN)}^{2-}]} \]  
(3) \[ \frac{[\text{Fe}^{2+}]}{[\text{Fe(SCN)}^{2-}]} \]  
(4) \[ \frac{[\text{SCN}^{-}]}{[\text{Fe}^{2+}][\text{Fe(SCN)}^{2-}]} \]

**Ans.** (1)

**Sol.**

\[ K_c = \frac{[\text{Fe(SCN)}^{2-}]}{[\text{Fe}^{2+}][\text{SCN}^{-}]} \]

8. Two combining atomic orbitals:

(A) Must have same energy
(B) Must have same symmetry about the molecular axis
(C) Must overlap to less extent

**Ans.** (B)
9. For first order gaseous reaction

\[ \text{A(g)} \rightarrow \text{B(g)} + \text{C(g)} \]

Initial pressure is \( P_i \), and total pressure after time \( t \) is \( P_t \). Then the rate constant of reaction is _______.

(1) \( \frac{2.303}{t} \log \left( \frac{P_t}{2P_i - P_t} \right) \)

(2) \( \frac{2.303}{t} \log \left( \frac{P_i}{P_t - P_i} \right) \)

(3) \( \frac{2.303}{t} \log \left( \frac{2P_i}{P_t} \right) \)

(4) None of these

**Ans.** (1)

**Sol.**

\( \frac{A(g)}{B(g) + C(g)} \)

\[ t = 0 \quad \begin{array}{ccc} \text{P}_i & 0 & 0 \\ \text{P}_i & 0 & 0 \end{array} \]

\[ t = t \quad \begin{array}{ccc} \text{P}_i - x & x & x \end{array} \]

\[ t = \infty \quad 0 \quad \text{P}_i \quad \text{P}_i \]

\[ K = \frac{2.303}{t} \log \left( \frac{P_i - P_t}{P_t} \right) = 2.303 \log \left( \frac{2P_i - P_t}{P_t} \right) \]

\[ K = \frac{2.303}{t} \log \left( \frac{P_i}{2P_t - P_i} \right) \]

10. Calculate the Gibbs free energy (\( \Delta G^\circ \)) in KJ for the reaction given below if

\[ \begin{array}{c} \text{K}_w = 70.95 \text{ at 300 K} \\ \log 70.95 = 1.8509 \end{array} \]

\[ \begin{array}{c} \text{CO}_2(g) + 2\text{H}_2(g) \rightleftharpoons \text{CO}_2(g) + \text{H}_2\text{O}(g) \\ \Delta G^\circ = -2.303 \text{ RT} \log \text{K}_w \\ \Delta G^\circ = -2.303 \times 8.314 \times 300 \log (70.95) \\ = -10632.4 \text{ J} \\ = -10.632 \text{ KJ} \end{array} \]

**Ans.** (1)

**Sol.**

Given \( \text{K}_w = 70.95 \) at 300K

The reaction is

\[ \text{CO}_2(g) + 2\text{H}_2(g) \rightleftharpoons \text{CO}_2(g) + \text{H}_2\text{O}(g) \]

We know the relation

\[ \Delta G^\circ = -2.303 \text{ RT} \log \text{K}_w \]

\[ \Delta G^\circ = -2.303 \times 8.314 \times 300 \log (70.95) \]

\[ = -10632.4 \text{ J} \]

\[ = -10.632 \text{ KJ} \]

11. Electrolytic conductance does not depend on

(1) Nature of electrolyte

(2) Nature of electrode

(3) Nature of solvent added

(4) Concentration of electrolyte

**Ans.** (2)

**Sol.**

As per NCERT.

The conductance of electricity by ions present in the solutions is called electrolytic or ionic conductance. The conductivity of electrolytic (ionic) solutions depends on:

(i) the nature of the electrolyte added

(ii) size of the ions produced and their solvation

(iii) the nature of the solvent and its viscosity

(iv) concentration of the electrolyte

(v) temperature (it increases with the increase of temperature).
12. **Statement-I**: CFT can explain the strength of anionic ligands.  
**Statement-II**: VBT does not explain the colour exhibited by co-ordination compounds.  
(1) Both statements are correct.  
(2) Both Statements are incorrect.  
(3) Statement I is correct and statement II is incorrect.  
(4) Statement I is incorrect and statement II is correct.  
**Ans.** (4)  
**Sol.** Theory based.

13. **Assertion**: $K_2MnO_4$ changes into $KMnO_4$ in neutral or acidic solution  
**Reason**: $KMnO_4$ under goes disproportionation in neutral or acidic medium.  
(1) Both A and R are true and R is the correct explanation of A.  
(2) Both A and R are true but R is NOT the correct explanation of A.  
(3) A is true but R is false.  
(4) A is false but R is true.  
**Ans.** (4)  
**Sol.** Potassium permanganate is prepared by fusion of MnO$_2$ with an alkali metal hydroxide and an oxidising agent like KNO$_3$. This produces the dark green $K_2MnO_4$ which disproportionates in a neutral or acidic solution to give permanganate.

$$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$$
$$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^{-} + MnO_2 + 2H_2O$$

14. **Statement-I**: The structure of CrO$_4^{2-}$ ion is square planar  
**Statement-II**: Chromate ion charges to dichromate ion in acidic medium.  
(1) Both statements are correct.  
(2) Both Statements are incorrect.  
(3) Statement I is correct and statement II is incorrect.  
(4) Statement I is incorrect and statement II is correct.  
**Ans.** (1)  
**Sol.**

$$\begin{array}{c}
\text{Chromate ion} \\
\text{Tetrahedral}\
\end{array}$$

$$\Rightarrow 2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$$

15. (I) Shape of $[\text{Ni(CN)}_4]^{2-}$ is square planar  
(II) VBT cannot explain ligand field strength  
(III) For cis-$(\text{P} \equiv \text{P})\text{Cu}^{2+}$ isomerism is not exhibited  
(IV) $[\text{NiCl}_6]^{2-}$ is square planar  
select correct statements  
(1) I, II  
(2) III, IV  
(3) I, III  
(4) II, IV  
**Ans.** (1)  

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**JEE(Main) 2024 | DATE : 31-01-2024 (SHIFT-1) | PAPER-1 | MEMORY BASED | CHEMISTRY**

**Sol.**  
(I) dsp$^2$, sq. planar  
(II) True  
(III) It is optically active (d- & l-forms)  
(IV) sp$^3$, tetrahedral

16. **Match the column:**

<table>
<thead>
<tr>
<th>Column-I</th>
<th>Column-II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Glucose + red P/HI</td>
<td>(1) No reaction</td>
</tr>
</tbody>
</table>
17. Find out the final product (C)

\[
\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{Br} \xrightarrow{\text{alk KOH}} \text{Br} \xrightarrow{\text{aq KOH}} \text{OH}
\]

(1) Propane  (2) Propan-1-ol  (3) Propan-2-ol  (4) Propene

Ans. (3)

18. Adsorption method is used in

(1) Chromatography  (2) Extraction  (3) Distillation  (4) Sublimation

Ans. (1)

19. Correct IUPAC name of

\[
\text{HO-} \xrightarrow{\text{C}} \text{O}
\]

(1) 7-Hydroxyheptan-2-one  (2) 6-Hydroxyheptan-2-one  (3) 2-Oxooctan-7-one  (4) Hydrogen-6-oxoheptane

Ans. (1)

Sol. 7-Hydroxyheptan-2-one

20. Statement-I: pKa of phenol = 10 and pKa of ethyl alcohol = 15.6

Statement-II: Ethyl alcohol is more acidic than phenol.

(1) Both Statement-I & Statement-II are correct.
(2) Both Statement-I & Statement-II are incorrect.
(3) Statement-I is correct whereas Statement-II is incorrect.
(4) Both Statement-I and Statement-II are incorrect.

Ans. (3)

Sol. Statement-I is correct whereas Statement-II is incorrect.

21. The sextet carbon species eligible as electrophile is

(1) Carbocation  (2) Carbanion  (3) Pentavalent carbon  (4) Free radial carbon

Ans. (1)

Sol. Carbocation is every charge electrophile with six electron in valence shell.

22. Statement-I: Alcohol act as both nucleophile and electrophile.

Statement-II: Alcohol reacts with active metals like Na, K to product H₂ gas.

(1) Both Statement-I & Statement-II are correct.
(2) Both Statement-I & Statement-II are incorrect.
(3) Statement-I is incorrect whereas Statement-II is correct.
(4) Both Statement-I and Statement-II are incorrect.

Ans. (3)

Sol. (3) Statement-I is incorrect whereas Statement-II is correct.

23. In the reaction of combustion of CH₄, it gives 22g of CO₂. Find the moles of CH₄ in terms of \( x \times 10^{-2} \) mol.
24. If one faraday of electricity is used in the discharging of Cu\(^{2+}\). Then find the mass in (g) of Cu deposited (Nearest integer) \(\text{(Cu} = \text{63.5)}\)

**Ans. (32)**

**Sol.**

\[ \text{Cu}^{2+} + 2e^- \rightarrow \text{Cu} \]

1 F \(\rightarrow\) Eq. wt

n-factor = 2

\[ E_u = \frac{M}{2} \]

\[ E_u = \frac{63.5}{2} = 32g \]

---

25. For \([\text{Ni(NH}_3\text{)}_6]^{2+}\) spin only magnetic moment is \(x \times 10^{-1}\) BM. Value of \(x\) is \(\ldots\) (Nearest integer)

**Ans. (28)**

**Sol.** 

\[ \text{sp}^{3d} \]

\[ n = 2, \sqrt{2(2 + 2)} = \sqrt{8} \text{ BM} = 2.8 \text{ BM} = 28 \times 10^{-1} \text{ BM} \]

26. What is molar mass (in g/mol) of salt, which will not produce colored gas in the following

NaBr \(\rightarrow\) Core: H\(_2\)SO\(_4\)

NaNO\(_3\) \(\rightarrow\) Core: H\(_2\)SO\(_4\)

CaF\(_2\) \(\rightarrow\) Core: H\(_2\)SO\(_4\)

NaI \(\rightarrow\) Core: H\(_2\)SO\(_4\)

**Ans. (78)**

**Sol.**

NaBr \(\rightarrow\) Core: H\(_2\)SO\(_4\) \(\rightarrow\) Na\(_2\)SO\(_4\) + Br\(_2\) \(\uparrow\) + SO\(_2\)

(Neutral Brown)

NaI \(\rightarrow\) Core: H\(_2\)SO\(_4\) \(\rightarrow\) Na\(_2\)SO\(_4\) + I\(_2\) \(\uparrow\) + SO\(_2\)

(Violet)

CaF\(_2\) \(\rightarrow\) Core: H\(_2\)SO\(_4\) \(\rightarrow\) CaSO\(_4\) + HF \(\uparrow\)

(Colorless)

NaNO\(_3\) \(\rightarrow\) Core: H\(_2\)SO\(_4\) \(\rightarrow\) Na\(_2\)SO\(_4\) + H\(_2\)O + NO\(_2\) \(\uparrow\) + O\(_2\)

(Brown)

CaF\(_2\) = 76 g/mol

27. How many of the following have sp\(^3\) hybridisation?

SO\(_2\), H\(_2\)O, NH\(_3\), BCl\(_3\), SiO\(_2\), CO\(_2\), BeCl\(_2\)

**Ans. (3)**

**Sol.**

sp\(^3\): SO\(_2\), BCl\(_3\)

sp\(^1\): H\(_2\)O, NH\(_3\), SiO\(_2\)

sp: BeCl\(_2\), CO\(_2\)

28. The total number of different alkanes formed when the following mixture is subjected to electrolysis (does not consider dis proportional product).

C\(_2\)H\(_4\)COONa + C\(_2\)H\(_5\)COONa →

**Ans. (3)**
29. 

(i) PhMgBr 

(ii) NH₄Cl 

Find the number of OH group in (P) 

Ans. (2)

Sol. 

(i) PhMgBr 

(ii) NH₄Cl