1. Find the total number of diatomic species from the following:
\[
\text{Ans. (2)}
\]

\[
\begin{array}{|c|c|c|c|c|c|c|c|}
\hline
\text{Species} & \text{N}_2 & \text{N}_3 & \text{N}_5^+ & \text{O}_2 & \text{O}_3^- & \text{O}_5^+ \\
\hline
\text{Bond order} & 3 & 2.5 & 2 & 2 & 2.5 & 1.5 & 1 \\
\hline
\text{No of unpaired electrons} & 0 & 1 & 1 & 2 & 2 & 1 & 1 & 0 \\
\hline
\end{array}
\]

\[
\begin{align*}
\text{N}_2 : & \ (\sigma^1s)^2 \ (\sigma^1s)^2 \ (\sigma^2s)^2 \ (\sigma^2s)^2 \ (\pi^2p_x)^2 \ (\pi^2p_y)^2 \\
\text{N}_3 : & \ (\sigma^1s)^2 \ (\sigma^1s)^2 \ (\sigma^2s)^2 \ (\sigma^2s)^2 \ (\pi^2p_x)^2 \ (\pi^2p_y)^2 \\
\text{N}_5^+ : & \ (\sigma^1s)^2 \ (\sigma^1s)^2 \ (\sigma^2s)^2 \ (\sigma^2s)^2 \ (\pi^2p_x)^2 \ (\pi^2p_y)^2 \\
\text{O}_2 : & \ (\sigma^1s)^2 \ (\sigma^1s)^2 \ (\sigma^2s)^2 \ (\sigma^2s)^2 \ (\pi^2p_x)^2 \ (\pi^2p_y)^2 \\
\text{O}_3^- : & \ (\sigma^1s)^2 \ (\sigma^1s)^2 \ (\sigma^2s)^2 \ (\sigma^2s)^2 \ (\pi^2p_x)^2 \ (\pi^2p_y)^2 \\
\text{O}_5^+ : & \ (\sigma^1s)^2 \ (\sigma^1s)^2 \ (\sigma^2s)^2 \ (\sigma^2s)^2 \ (\pi^2p_x)^2 \ (\pi^2p_y)^2 \\
\end{align*}
\]

2. \text{H}_2\text{O}_2 \text{ on reaction with KMnO}_4 \text{ in acidic medium gives}

\[
\begin{align*}
\text{(1)} & \text{ Mn}^{3+} \\
\text{(2)} & \text{ Mn}^{2+} \\
\text{(3)} & \text{ Mn}^{4+} \\
\text{(4)} & \text{ Mn}^{6+} \\
\end{align*}
\]

\[
\text{Ans. (1)}
\]

\[
2\text{MnO}_4^- + 6\text{H}^+ + 5\text{H}_2\text{O}_2 \rightarrow 2\text{Mn}^{3+} + 8\text{H}_2\text{O} + 5\text{O}_2
\]

\[
\text{Sol.}
\]

3. \text{For cell reaction Zn (s) | Zn}^{2+} \text{ (aq) || Sn}^{2+} \text{ (aq) | Sn (s)}

\[
\text{E}_{\text{cell}} = 0.801 \text{ V}.
\]

Then how many electrons are involved in this cell reaction if reaction quotient is 10^{-2}.

\[
\text{Given } E^{\circ}_{\text{Zn}^{2+}/\text{Zn}} = 0.763 \text{ V}, \quad E^{\circ}_{\text{Sn}^{2+}/\text{Sn}} = 0.008 \text{ V}
\]

\[
\text{Ans. (4)}
\]

\[
\text{Sol. Anode : \left[ \text{Zn (s)} \rightarrow \text{Zn}^{2+} \text{ (aq)} + 2e^- \right] X}
\]

\[
\text{Cathode : \left[ \text{Sn}^{2+} + \text{x}e^- \rightarrow \text{Sn (s)} \right] 2}
\]

\[
\text{x Zn (s) + 2Sn}^{2+} \rightarrow x \text{Zn}^{2+} \text{ (aq)} + \text{Sn (s)}
\]

\[
E^{\circ}_{\text{Cell}} = 0.008 \text{ V} - (-0.763) = 0.771 \text{ V}
\]

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4. \text{Identify correct density order of alkali metals}

\[
(1) \text{ Li < K < Na < Rb < Cs}
\]

\[
(2) \text{ Li < Na < K < Rb < Cs}
\]

\[
0.03 = \frac{0.059}{x} \\
\]

\[
x = 2
\]

Total number of electrons involved = 2x = 4
(4) Li > Na > K > Rb > Cs
(3) Li > Na > K > Rb > Cs
AnS. (1)

Sol. 

<table>
<thead>
<tr>
<th>Property</th>
<th>Lithium (Li)</th>
<th>Sodium (Na)</th>
<th>Potassium (K)</th>
<th>Rubidium (Rb)</th>
<th>Caesium (Cs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density / g cm⁻³</td>
<td>0.53</td>
<td>0.97</td>
<td>0.86</td>
<td>1.50</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Correct density order is; Li < K < Na < Rb < Cs

5. In the following reaction sequence
   
   BF₃ + NaH → A + NaF
   A + N (Me₅) → B
   
   The structure of product B, with respect to Born is
   (1) Trigonal planer (2) Tetrahedral (3) Square planer (4) Pyramidal
   AnS. (2)
Sol.

   2BF₃ + 6NaH → B₂H₆ + 6NaF
   B₂H₆ + 2 NMe₅ → 2BH₃·NMe₅

6. Which set of quantum numbers are not possible?

   (1) n = 3, l = 1, m = 0, s = + 1/2
   (2) n = 3, l = 2, m = 2, s = - 1/2
   (3) n = 3, l = 3, m = 1, s = + 1/2
   (4) n = 3, l = 0, m = 0, s = - 1/2
   AnS. (3)
Sol. The value of n & l can not be equal.
For any value of n, possible values of l are 0 to n−1

7. For a reaction at 500 torr half life is 240 sec while at 250 torr half life is 4 min.
   Then the order of reaction is:
   AnS. (1)
Sol. 

   \[ \frac{[T_{1/2}]}{[T_{1/2}]} = \left( \frac{P_1}{P_2} \right)^{1-n} \]
   \[ \Rightarrow \left( \frac{240}{450} \right) = \left( \frac{500}{250} \right)^{1-n} \]
   \[ \Rightarrow 1 = (2)^{-n} \]
   \[ \Rightarrow (2)^n = 2 \]
   \[ n = 1 \]
8. Which set of oxide does not used in slag formation during extraction of Copper.
(a) FeO  (b) Al₂O₃  (c) ZnO  (d) NiO
(e) CaO
(1) a, b  (2) b, c, d  (3) a, e  (4) a, c
Ans.  (2)
Sol. During extraction of Cu following slag formation reaction takes place.
FeO + SiO₂ → Fe₃O₄ + Si
Flux  Slag
9. SO₂Cl₂ hydrolyse as
SO₂Cl₂ + H₂O → H₂SO₄ + 2HCl
For complete neutralization of product 16 mole of NaOH are required then how many mole of SO₂Cl₂ are taken initially
(1) 16  (2) 8  (3) 4  (4) 2
Ans.  (3)

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| JEE MAIN-2022 | DATE : 25-07-2022 (SHIFT-1) | PAPER-1 | MEMORY BASED | CHEMISTRY |
Sol. SO₂Cl₂ + H₂O → H₂SO₄ + 2HCl
a mole  a mole  2a mole:
(i) H₂SO₄ + 2NaOH → Na₂SO₄ + 2H₂O
a mole  2a mole
(ii) HCl + NaOH → NaCl + H₂O
2a mole  2a mole
Total mole of NaOH required = 4a = 16
a = 4

10. 40 ml, 0.05 M HCl titrated with 20 ml, 0.1M NH₃·OH then closest pH of final solution is :
[Given Kₐ (NH₃·OH) = 10⁻⁶]
(1) 3.2  (2) 4.2  (3) 5.2  (4) 5.2
Ans.  (3)
Sol. HCl + NH₃·OH → NH₄Cl + H₂O
Millimole  2  2  –  –
0  0  2
[NH₄Cl] = \frac{2}{60} = \frac{1}{30} \text{ M}
\text{pH} = 7 - \frac{1}{2} \log C = 7 - \frac{5}{2} \log \left( \frac{1}{30} \right)
= 7 - 2.5 + \frac{1}{2} \log (30)
= 7 - 2.5 + \frac{1}{2} [1 + 0.48]
= 7 - 2.5 + 0.74
= 5.24

11. Find the enthalpy of formation of propane (kJ / mole) using enthalpy of combustion of propane, graphite and diamond.

2926kJ / mole  585.6kJ / 1Mole  585.6kJ / Mole
12. Concentration of HCOOH aqueous solution is 0.5 ml / L. Density of HCOOH solution is 1.05 g / ml. If depression in freezing point is 0.0405°C then van't Hoff factor is -

(1) 1.2  (2) 1.9  (3) 2.2  (4) 0.7

**Ans.**  (2)

**Sol.** Let us take 1 lit solution, so it contain 0.5 ml HCOOH

Density = \( \frac{\text{Mass}}{\text{Volume}} \)

Mass of Solution = \( d \times V \)

\[ = 1.05 \times 0.5 \]

\[ = 0.525 \text{ gram} \]

Mass of solution = 1 kg

Mass of solvent = 1000 - 0.525

\[ = 999.475 \text{ gram} \]

\( \Delta T_f = i k f x m \)

\[ = 0.0405 = i \times 0.02124 \]

\[ i = 1.9 \]

13. In the following reaction Br₂ + F₂ (excess) \( \rightarrow \) 'A'

On hydrolysis of 'A' obtained anion is

(1) Hypohalite  (2) Halite  (3) Halate  (4) Per halate

**Ans.**  (3)

**Sol.** \( \text{Br}_2 + 5F_2 \text{(excess)} \rightarrow 2\text{BrF}_5 \)

\[ 6 \text{BrF}_5 + 3\text{H}_2\text{O} \rightarrow \text{HBrO}_2 + 5\text{HF} \]

Bromic acid

14. List I  (Reaction)  List II  (catalyst used)

| (I) \( \text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3 \) | (a) \( \text{Ni} \) |
| (II) \( \text{CO} + 3\text{H}_2 \rightarrow \text{CH}_4 + \text{H}_2\text{O} \) | (b) \( \text{Cu} / \text{ZnO} - \text{Cr}_2\text{O}_3 \) |
| (III) \( \text{CO} + 2\text{H}_2 \rightarrow \text{CH}_3\text{OH} \) | (c) \( \text{K}_2\text{O} / \text{Al}_2\text{O}_3 - \text{Fe} \) |
| (IV) \( \text{CO} + \text{H}_2 \rightarrow \text{HCHO} \) | (d) \( \text{Cu} \) |

Correct match is

(1) c a b d
(2) a b c d
(3) c b a d
(4) c d a b

**Ans.**  (1)
Sol. (i) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron in Haber’s process:

\[ \text{N}_2(g) + 3\text{H}_2(g) \xrightarrow{\text{Fe}^{\text{III}}} 2\text{NH}_3(g) \]

(ii) The selectivity of a catalyst is its ability to direct a reaction to yield a particular product. For example, starting with \( \text{H}_2 \) and \( \text{CO} \), and using different catalysts, we get different products:

\[ \text{CO}(g) + 3\text{H}_2(g) \xrightarrow{\text{Ni}} \text{CH}_3\text{OH}(g) + \text{H}_2\text{O}(g) \]

(iii) \[ \text{CO}(g) + 2\text{H}_2(g) \xrightarrow{\text{Cu} \text{Zn}, \text{Cd}} \text{CH}_3\text{OH}(g) \]

(iv) \[ \text{CO}(g) + \text{H}_2(g) \xrightarrow{\text{Cu}} \text{HCHO}(g) \]

15. One of the following complex absorb minimum wave length of light.

(a) \([\text{Co(NH}_3)_6]^{3+}\)  (b) \([\text{Co(NH}_3)_6(\text{H}_2\text{O})]^{2+}\)

(c) \([\text{Co(CN})_6]^{3-}\)  (d) \([\text{CoF}_3]^3\)

The magnetic moment (spin only) of that complex is ______ BM.

Ans. (0)

Sol. As complex absorb minimum wave length of light so complex has maximum splitting.

Order of splitting of complex: \([\text{CoF}_3]^3 < [\text{Co(NH}_3)_6(\text{H}_2\text{O})]^{2+} < [\text{Co(NH}_3)_6]^3+ < [\text{Co(CN})_6]^{3-}\)

So complex is \([\text{Co(CN})_6]^{3-}\)

\[ 3d_{3}^{0.6} \rightarrow t_{2g}^{2.2}, e_{g}^{0.0} \]

Number of unpaired electrons = 0

So \( \mu = 0 \)

16. Compound X on heating with \( \text{NH}_3 \) gives B and on strong heating gives \( \text{C}_4\text{H}_4\text{NO}_2 \). 

\( \text{C}_4\text{H}_4\text{NO}_2 \) reacts with ethanolic \( \text{KOH} \) / Alkyl halide and then followed by alkaline hydroxide to give primary amine.

Find X.

\[ \text{(1) } \begin{array}{c} \text{CHO} \\ \text{CHO} \end{array} \quad \text{(2) } \begin{array}{c} \text{COOH} \\ \text{COOH} \end{array} \quad \text{(3) } \begin{array}{c} \text{COOH} \\ \text{COOH} \end{array} \quad \text{(4) } \begin{array}{c} \text{OH} \\ \text{OH} \end{array} \]

Ans. (3)

Sol. ...
17. Polymers melamine resin is formed by

\[
\begin{align*}
(1) & \quad \text{H} & \quad \text{N} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
\end{align*}
\]

\[+ \quad \text{CH}_2 = \text{O} \rightarrow \]

\[
\begin{align*}
(2) & \quad \text{H} & \quad \text{N} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
\end{align*}
\]

\[+ \quad \text{CH}_2 = \text{O} \rightarrow \]

\[
\begin{align*}
(3) & \quad \text{H} & \quad \text{N} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
\end{align*}
\]

\[+ \quad \text{CH}_2 = \text{O} \rightarrow \]

\[
\begin{align*}
(4) & \quad \text{H} & \quad \text{N} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
& \quad \text{N} & \quad \text{H} & \quad \text{H} \\
\end{align*}
\]

\[+ \quad \text{CH}_2 = \text{O} \rightarrow \]

\[\text{Melamine formaldehyde Resin :} \]

\[\text{Melamine} + \text{Formaldehyde} \rightarrow \text{Melamine Formaldehyde polymer (Methyl)} \]

Melamine formaldehyde resin is used in the manufacture of unbreakable crockery.

18. Denaturation does not affect which structure of protein?

(1) Primary (2) Secondary (3) Tertiary (4) Quaternary

Ans. (1)

Sol. Denaturation of proteins:
When a protein in native form is subjected to a physical change like temperature or pH, the H-bonds are disturbed. As a result, globules get unfolded and helices get uncoiled, therefore proteins lose its activity.
During denaturation 2nd and 3rd structures get destroyed but 1st structure remain the same.

Ex: Coagulation of egg white on boiling and curdling of milk caused by bacteria present in milk.

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19. Which is absent in photochemical smog?

(1) NO (2) NO₂ (3) SO₂ (4) HCHO

Ans. (3)

Sol. Like NO₂, O₃ is a toxic gas and both NO₂ and O₃ are strong oxidising agents. They can react with the unburnt hydrocarbons in the polluted air to produce compounds like formaldehyde, acrolein and peroxoacetyl nitrate (PAN).
3CH₄ + 2O₃ → 3CH₃=O + 3H₂O
CH₃COOH = O (acrolein)
CH₃COONO₃ (peroxoacetyl nitrate, PAN)

Classical Smog: It is also known as sulphurous smog or London smog (as first occurred in London). It occurs in cool and humid climate. It is a mixture of smoke, fog and sulphur dioxide. Chemically because of the presence of SO₂ and carbon (soot) particles it is a reducing mixture and so it is also called as reducing smog.

20. Most probable product is

(1) (2) (3) (4)

Ans. (1)

21. Which drug binds to the receptor site and inhibit its natural function and block messages when required?
(1) Antagonist (2) Agonist (3) Anti histamine (4) Antacid

Ans. (1)

22. Wrong Reaction is:

(1) (2) (3) (4)

Ans. (1)

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24. How many sp³ carbon are present in C₆H₄N for acyclic structure?

Ans. (1)

25. Statement I: KHSO₄ dehydrates Glycerol to form acrolein
Statement II: Acrolein has fruity smell and reaction is used for test of Glycerol

Choose the most appropriate option:
(1) Both Statement I and Statement II are correct.
(2) Both Statement I and Statement II are incorrect.
(3) Statement I is correct but Statement II is incorrect.
(4) Statement I is incorrect but Statement II is correct.

Ans. (3)

26. CH₃
    O
    CH₂
    CH₃

O→C≡CH

Chiral carbon in product

Ans. (2)

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