1. 56 litre of N₂ react with excess of H₂ gives 20 litre of NH₃ then find amount of N₂ unreacted.

Ans. (46)

Sol. \[ \text{N}_2(g) + 3\text{H}_2(g) \rightarrow 2\text{NH}_3(g) \]

<table>
<thead>
<tr>
<th>t</th>
<th>N₂ (g)</th>
<th>3H₂ (g)</th>
<th>NH₃ (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>56 litre</td>
<td>excess</td>
<td>20 litre</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. 1 gram of solute x and y each are added in 1 kg solvent separately, ratio of depression in freezing point is 1:4; find ratio of molecular mass of x and y respectively.

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

**Ans. (3)**

**Sol.**

\[ \Delta T_f = \frac{Km}{m} \]

\[ \Delta T_{f1} = \frac{Km_1}{m_1} \]

\[ \Delta T_{f2} = \frac{Km_2}{m_2} \]

\[ \Delta T_{f1} / \Delta T_{f2} = \frac{m_2}{m_1} \]

\[ \frac{1}{4} = \frac{M_y}{M_x} \]

\[ M_x = 4M_y \]

3. For an acid base titration, methyl orange is used as indicator, then which form of the methyl orange is exist at end point?

(1) Quinonoid  (2) Heterocyclic  (3) Phenolic  (4) Benzonoid

**Ans. (1)**

**Sol.** For an acid base titration, methyl orange exist at end point as Quinonoid form

![Benzonoid form of the azoanion (yellow in colour)](image1)

![Quinonoid form of the azoanion (phenolic red in colour)](image2)

4. In the following complexes (a) \([\text{Co(NH}_3\text{)}_6]^{3+}\), (b) \([\text{Co(en)}_3]^{3+}\), (c) \([\text{Co(H}_2\text{O})_6]^{3+}\)

Identify the correct order of absorption of energy:

(1) \(c < a < b\)  (2) \(a < b < c\)  (3) \(c < b < a\)  (4) \(a < c < b\)

**Ans. (1)**

**Sol.** All are Co\(^{3+}\) complex so stronger the ligand, greater is splitting of d orbital and greater is amount of energy absorbed.

Order of strength of ligands: en > NH\(_3\) > H\(_2\)O

\[ E = \frac{hc}{\lambda} \]

5. **Statement – I:** Pig iron is formed by cast iron and iron scrap.

**Statement – II:** Pig iron contain less carbon than cast iron.

(1) Both statement - I & II are true
(2) Statement - I is true while statement - II is false
(3) Statement - I is false while statement - II is true
(4) Both statement - I & Statement - II are false.

**Ans. (4)**

**Sol.** Cast iron are formed by pig iron & scrap iron

Pig iron \( \Rightarrow \) Carbon 4%
6. Find magnetic movement (spin only) of M⁺⁺ ion which have negative electrode potential for M⁺⁺/M⁺⁺⁺.
Cr⁺⁺/Cr⁺⁺⁺, Mn⁺⁺/Mn⁺⁺⁺, Co⁺⁺/Co⁺⁺⁺, Fe⁺⁺/Fe⁺⁺⁺
report you answer to nearest integer.

Ans. (4)

<table>
<thead>
<tr>
<th>M⁺⁺/M⁺⁺⁺</th>
<th>Cr⁺⁺/Cr⁺⁺⁺</th>
<th>Mn⁺⁺/Mn⁺⁺⁺</th>
<th>Fe⁺⁺/Fe⁺⁺⁺</th>
<th>Co⁺⁺/Co⁺⁺⁺</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔE_{n+1}</td>
<td>-0.41 V</td>
<td>1.57 V</td>
<td>0.77 V</td>
<td>1.97 V</td>
</tr>
</tbody>
</table>

So, negative value of electrode potential for M⁺⁺/M⁺⁺⁺ is for Cr⁺⁺/Cr⁺⁺⁺
So, Cr⁺⁺ = [Ar] 18, 3d⁰
μ = \sqrt{\sqrt{n+2} - \sqrt{3(3+2)}} = \sqrt{15}BM
= 3.97 \approx 4

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7. List – I
   (Compound)
   (i) XeF₂
   (ii) XeF₆
   (iii) XeOF₄
   (iv) XeO₃

List – II
   Hybridisation & Structure
   (a) sp³d⁵, distorted octahedral
   (b) sp³d, Linear
   (c) sp³, pyramidal
   (d) sp³d², square pyramidal

Ⅰ Ⅱ Ⅲ Ⅳ
(1) b a d c
(2) a b c d
(3) b a c d
(4) a b d c

Ans. (1)

Sol. (i) XeF₂ ⇒ sp³d, Linear
(ii) XeF₆ ⇒ sp³d², distorted octahedral
(iii) XeOF₄ ⇒ sp³d², square pyramidal
(iv) XeO₃ ⇒ sp³, pyramidal
8. Identify correct order of density of alkaline earth metal is -
   (1) Ca < Mg < Be < Sr
   (2) Be < Mg < Ca < Sr
   (3) Sr < Ca < Mg < Be
   (4) Be < Ca < Mg < Sr
   Ans. (1)

9. If an excited electron in H atom jumps from n = 5 to ground state, then maximum number of spectral line observed are.
   Ans. (4)
   Sol. In single H atom if electron jumps from n = 5 to ground state
   
   \[ \begin{align*}
   n &= 5 \quad \downarrow \\
   n &= 4 \quad \downarrow \\
   n &= 3 \quad \downarrow \\
   n &= 2 \quad \downarrow \\
   n &= 1 \\
   \end{align*} \]
   So, maximum no. of spectral line = 4

10. Solution – I : 10 mole, 20 ml
    Solution – II : 20 mole, 80 ml
    Conductivity of both solutions are same if both solution are present in such type of cell which have same cell constant, then relation between \( \lambda_{m1} \) and \( \lambda_{m2} \) is
    \( \lambda_{m2} = 2 \lambda_{m1} \)
    \( \lambda_{m2} = \frac{1}{2} \lambda_{m1} \)
    \( \lambda_{m2} = \lambda_{m1} \)
    \( \lambda_{m2} = 4 \lambda_{m1} \)
    Ans. (1)
    Sol.
    \[ \lambda_{m1} = \frac{K \times 1000}{M} \]
    \[ \lambda_{m2} = \frac{M_A}{M} \]
    \[ \lambda_{m2} = \left( \frac{20 \times 1000}{20} \right) = \frac{1}{2} \]
    \[ \lambda_{m2} = 2 \lambda_{m1} \]

11. The sum of number of lone pair present on central atom in following species are XeFa, XeOF4, XeO3
    Ans. (3)
Sol.

\[ \text{XeF}_6 \rightarrow \text{no. of lone pair} = 1 \]
\[ \text{sp}^3\text{d}^3, \text{distorted octahedral} \]

\[ \text{XeOF}_4 \rightarrow \text{no. of lone pair} = 1 \]
\[ \text{sp}^3\text{d}^2, \text{square pyramidal} \]

\[ \text{XeO}_2 \rightarrow \text{no. of lone pair} = 1 \]
\[ \text{sp}^3, \text{pyramidal} \]

12. Find total number of acidic oxides in the following species:

\[ \text{NO, } \text{N}_2\text{O, } \text{CO, } \text{B}_2\text{O}_3, \text{P}_2\text{O}_5, \text{SO}_2, \text{CO}_2 \]

(1) 3 \hspace{1cm} (2) 4 \hspace{1cm} (3) 5 \hspace{1cm} (4) 6

Ans. (2)

Sol. acidic oxide \( \rightarrow \text{B}_2\text{O}_3, \text{P}_2\text{O}_5, \text{SO}_2, \text{CO}_2 \)

Neutral oxide \( \rightarrow \text{NO, } \text{N}_2\text{O}, \text{CO} \)

13. For a 1st order reaction graph between \( \frac{P}{P_0} \) with \( t \) as follows.

\[
\text{Slope} = -3.465 \\
\ln \left( \frac{P}{P_0} \right) = -3.465t
\]

Then \( \frac{1}{3} \) of reaction (in sec) is

Ans. (12)
slope = $-k = -3.465$

$k = 3.465 \text{ mm}^{-1}$

$t_1 = \frac{0.693}{k} = \frac{0.693}{3.465} = \frac{1}{5} \text{ min} = 12 \text{ sec}$

14. Which of the following are correct for micelle formation.

(a) Enthalpy of system decreases  
(b) Enthalpy of system increases  
(c) Entropy of system increases  
(d) Entropy of system decreases

Correct set of statement are

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

Ans. (3)

Sol. Micelle formation is spontaneous therefore $\Delta S > 0$.

Micelle formation decrease stability of colloidal solution so enthalpy should be positive $\Delta H > 0$.

15. Correct order of 1st ionisation energy of $\text{Be, B, N, O}$

(1) $\text{Be < B < N < O}$  
(2) $\text{Be < B < N < O}$  
(3) $\text{Be < B < N < O}$  
(4) $\text{Be < Be < N < O}$

Ans. (1)

Sol. $\text{Be} = 1s^2$, $2s^2$  
$\text{B} = 1s^2$, $2s^2$, $2p^1$  
$\text{N} = 1s^2$, $2s^2$, $2p^3$  
$\text{O} = 1s^2$, $2s^2$, $2p^4$

As IE of $\text{N} > \text{O}$ [due to Half-filled configuration]  
IE of $\text{Be} > \text{B}$ [due to penetration effect]  
So, correct order $\Rightarrow \text{B < Be < O < N}$.

16. $\text{H}_2\text{C}_2\text{O}_4$ is ionised as

$\text{H}_2\text{C}_2\text{O}_4 \leftrightarrow \text{H}^+ + \text{H}_2\text{C}_2\text{O}_4^-$  
$\text{H}_2\text{C}_2\text{O}_4^- \leftrightarrow \text{H}^+ + \text{C}_2\text{O}_4^{2-}$  
$\text{H}_2\text{C}_2\text{O}_4 \leftrightarrow 2\text{H}^+ + \text{C}_2\text{O}_4^{2-}$

Relation between $K_{eq}$, $K_{eq}$ and $K_{eq}$ is

(1) $K_{eq} = K_{eq} \times K_{eq}$  
(2) $K_{eq} = K_{eq} \times K_{eq}$  
(3) $K_{eq} = \frac{K_{eq}}{K_{eq}}$  
(4) $K_{eq} = K_{eq} - K_{eq}$

Ans. (1)

Sol. $K_{eq} = K_{eq} \times K_{eq}$

17. High purity $\text{H}_2$ can be obtained

(1) By electrolysis of warm aqueous barium hydroxide solution using Ni electrodes  
(2) Electrolysis of acidified water using Pt electrode  
(3) by reaction of steam with coke at high temperature  
(4) as by product in the manufacture of $\text{NaOH}$ and $\text{Cl}_2$ by electrolysis of brine solution

Ans. (1)

Sol. High purity (>99.95%) dihydrogen is obtained by electrolysis of warm aqueous barium hydroxide solution between nickel electrodes.

18. The enthalpy of neutralisation of $\text{HCl}$ with $\text{NaOH}$ is 57.3 KJ mole$^{-1}$ and that of $\text{CH}_2\text{COOH}$ with $\text{NaOH}$ is 55.3 KJ mole$^{-1}$ calculate the enthalpy of ionisation of $\text{CH}_2\text{COOH}$ (in KJ mole$^{-1}$)

Ans. (2)

Sol. $\text{HCl + NaOH \rightarrow NaCl + H}_2\text{O}$  
$\Delta H = -57.3 \text{ KJ mole}^{-1}$

$\text{CH}_2\text{COOH} + \text{NaOH} \rightarrow \text{CH}_2\text{COONa} + \text{H}_2\text{O}$  
$\Delta H = -55.3 \text{ KJ mole}^{-1}$

Thus, the enthalpy of ionisation of $\text{CH}_2\text{COOH}$ is $55.3 - 57.3 = -2.0 \text{ KJ mole}^{-1}$.
19. Some drugs do not bind to the enzyme's active site. These bind to a different site of enzyme which is called
   (1) Therapeutic Site  (2) Non Active Site  (3) Allosteric Site  (4) Binding Site

   Ans. (3)

   Sol. Some drugs do not bind to the enzyme's active site. These bind to a different site of enzyme which is called **allosteric site**.

   ![Allosteric Site Diagram]

---

20. The total number of products formed on mono-bromination of \( \text{C}_6\text{H}_5 \) is (excluding stereoisomers)

   Ans. (8)

   Sol.
   \[
   \begin{align*}
   \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 &= 3 \text{ mono-bromination products} \\
   \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 &= 4 \text{ mono-bromination products} \\
   \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 &= 1 \text{ mono-bromination product}
   \end{align*}
   \]

21. Glycosidic linkage between C1 of glucose and C3 of fructose is found in
   (1) Amylose  (2) Sucrose  (3) Maltose  (4) Lactose

   Ans. (2)

   Sol.
   ![Glycosidic Linkage Diagram]

22. Product of the given reaction is

   \[
   \begin{align*}
   \text{CH}_3 - \text{CH} = \text{CH}_2 - \text{C} = \text{CH}_3 \quad \text{OH}^- \quad \Delta \\
   &\Rightarrow \quad \text{1. } \text{CH}_3 - \text{CH} = \text{CH}_2 - \text{C} = \text{CH} - \text{CH}_2 \text{CH}_3 \\
   &\Rightarrow \quad \text{2. } \text{CH}_3 - \text{CH} = \text{CH}_2 - \text{C} = \text{CH} - \text{CH}_2 \text{CH}_3
   \end{align*}
   \]
23. Identify the correct match.
(a) Teflon  (p) Non-stick utensils
(b) Nylon-6,6  (q) Brush bristles
(c) HDPE  (r) Toys
(d) LDPE  (s) Buckets
(1) (a) - (r), (b) - (q), (c) - (p), (d) - (s)
(2) (a) - (p), (b) - (q), (c) - (s), (d) - (r)
(3) (a) - (r), (b) - (q), (c) - (s), (d) - (p)
(4) (a) - (r), (b) - (p), (c) - (q), (d) - (s)

Ans. (2)

Sol. Applications of polymers from NCERT.

24. The correct order of acidity is:

(A)  
(B)  
(C)  
(D)  

(1) A > B > C > D  
(2) B > C > D > A  
(3) C > D > B > A  
(4) A > C > B > D

Ans. (1)

Sol. –NO₂ groups is strong –m and –l group where as –OCH₃ is +m and –l group.

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25. Match the following:
   a. Sodium arsenite   p. Bending bones
   b. Nicotine         q. Pesticides
   c. Fluoride        r. Herbicides
   d. Sulphate        s. Laxative effect

   (1) (a) - (r), (b) - (q), (c) - (p), (d) - (s)  
   (2) (a) - (q), (b) - (r), (c) - (p), (d) - (s)  
   (3) (a) - (r), (b) - (q), (c) - (s), (d) - (p)  
   (4) (a) - (r), (b) - (p), (c) - (q), (d) - (s)

   Ans. (1)  
   Sol. fact

26. CH₃CH₂CeN → CH₃HgBr → H₂O → Zn-Hg/HCl → (P)

   Major Product (P) is:

   (1) CH₂=CH₂CH₂CH₂OH  
   (2) CH₂=CH₂CCH₃  
   (3) CH₃CH₂CH₂CH₂OH  
   (4) CH₂=CH₂CH₂CH₃

   Ans. (4)  
   Sol.

27. CH₂=CH₂CH₂CH₂CH₂CH₂CH₂CH₂CH₂CH₂CH₂

   Major Product of the reaction is:

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

   Ans. (1)
28. If the distance travelled by solvent is 3.25 and distance travelled by A and B respectively is 2.08 and 1.05. Then ratio of Rf-factor of A and B is

Ans. \( 2 \) 

Sol. \[
R_f = \frac{\text{distance travel by the solute}}{\text{distance travel by the solvent}}
\]

\[
R_{fA} = \frac{2.08}{3.25} = 0.64
\]

\[
R_{fB} = \frac{1.05}{3.25} = 0.32
\]

\[
\text{Ratio} = \frac{R_{fA}}{R_{fB}} = \frac{0.64}{0.32} = 2
\]
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