1. Which of the following has highest melting point?
2. Which of the following is present in fire extinguisher?
   (1) Backing Soda  (2) Washing Soda  (3) Caustic Soda  (4) Soda ash

   Ans. (1)

   Sol. Fire extinguisher contain sodium bicarbonate (Backing soda)

3. Correct increasing order of stability of $\text{C}_2\text{O}_4^{2-}$, $\text{O}_2\text{C}^-\text{O}_2\text{C}^-$, $\text{N}_2\text{O}_5^-$ is

   (1) $\text{C}_2\text{O}_4^{2-}$, $\text{O}_2\text{C}^-\text{O}_2\text{C}^-$, $\text{N}_2\text{O}_5^-$
   (2) $\text{O}_2\text{C}^-\text{O}_2\text{C}^-$, $\text{C}_2\text{O}_4^{2-}$, $\text{N}_2\text{O}_5^-$
   (3) $\text{N}_2\text{O}_5^-$, $\text{C}_2\text{O}_4^{2-}$, $\text{O}_2\text{C}^-\text{O}_2\text{C}^-$
   (4) $\text{C}_2\text{O}_4^{2-}$, $\text{O}_2\text{C}^-\text{O}_2\text{C}^-$, $\text{N}_2\text{O}_5^-$

   Ans. (4)

   Sol. Ion Bond order
   (i) $\text{C}_2\text{O}_4^{2-}$ 3
   (ii) $\text{O}_2\text{C}^-\text{O}_2\text{C}^-$ 2
   (iii) $\text{N}_2\text{O}_5^-$ 1

4. Among the following how many are sulphide ores?
   (a) Galena  (b) Copper pyrite  (c) Zinc blende  (d) Bauxite

   Ans. (03 00)

   Sol. (a) PbS - Galena  (b) CuFeS$_2$ - Copper pyrite
   (c) ZnS - Zinc blende  (d) AlO$_2$(OH)$_{2x}$ (0 < x < 1) - Bauxite

5. Determine total energy of 1 mol of photons in J/mol having $\lambda = 600$ nm

   Given $h = 6.62 \times 10^{-34}$ J.s, $c = 3 \times 10^8$ m/s

   (1) $6.64 \times 10^4$ J/mol  (2) $6.64 \times 10^8$ J/mol  (3) $1.24 \times 10^4$ J/mol

   Ans. (1)

   Sol. $E_T = \frac{N_A h c}{\lambda}$

   or $E_T = \frac{6.02 \times 10^{23} \times 6.62 \times 10^{-34} \times 3 \times 10^8}{600 \times 10^{-9}}$

   $= 6.64 \times 10^4$ J/mol

6. $\text{H}_2$ is formed as by product during the formation of
   (1) $\text{Na}_2\text{CrO}_4$  (2) $\text{NaOH}$  (3) Na metal  (4) $\text{NaCl}$

   Ans. (2)

   Sol. In diaphragm cell: formation process of $\text{NaOH}$

   Anode (oxidation) $2\text{H}_2\text{(aq)} \rightarrow \text{Cl}_2\text{(g)} + 2e^-$
7. PCls is formed NCls is not formed why?
(1) Phosphorous has vacant d-orbitals while nitrogen do not have vacant d-orbitals
(2) PCls is stable while NCls is unstable
(3) Phosphorous is more reactive while nitrogen is inert
(4) Phosphorous has large size while nitrogen has small size.

Ans. (1)

Sol. Nitrogen do not have vacant d-orbitals so it do not expands it's octet, while phosphorous have vacant 3d orbitals so it can expands it is octet.

8. Reaction involved in the Hall-Herault process.
(1) Ag + O₂ + H₂O + NaCN → Na[Ag(CN)₂] + NaOH
(2) SnO + C → Sn + CO
(3) Al₂O₃ + C → Al + CO
(4) CuO + Cu₂S → Cu + SO₂

Ans. (3)

Sol. Anode: 2O²⁻ → O₂ + 4e⁻
2C + O₂ → 2CO
Cathode: Al³⁺ + 3e⁻ → Al

9. Which of the following complex have maximum ΔQ value [ΔQ = octahedral splitting energy]
(1) [Cr(H₂O)⁶]⁺³
(2) [Fe(H₂O)₆]⁺³
(3) [Mo(H₂O)₆]⁺³
(4) [Os(H₂O)₆]⁺³

Sol. 5d series member have more value of ΔQ in comparison to 3d & 4d complexes.

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10. In acidic solution Mn(Ⅵ) become unstable and convert into it's two product ions. The difference in oxidation state of it's product ions is 'X', then value of 'X' is

Ans. (3)

Sol. In acidic solution Mn(Ⅵ) become unstable relative to Mn(Ⅶ) and Mn(Ⅳ)

\[3\text{MnO}_4^2-(aq) + 4H^+(aq) \rightarrow 2\text{MnO}_4^- + \text{MnO}_2 + 2H_2O\]

So difference in oxidation state of product ions of Mn is 3

11. Which of the following metal ion gives flame as Green with Blue centre
(1) Cu (2) Ba (3) K (4) Li

Ans. (1)

Sol. Colour of flame Metal
(i) Green with Blue center Cu
(ii) Apple green Ba
(iii) Pink violet K
(iv) Crimson Red Li

12. An electron shows transition from lower Bohr's atomic orbit to higher orbit, then comment on potential energy (P.E.), kinetic energy (K.E.) and total energy (T.E.) of electron.
(1) All three are increase
13. In a 1st order reaction time taken in 90% completion is $X$ times half life, then value of $X$ is ______

[Report your answer to nearest integer]

Ans. 3

Sol. 

$$T_{90\%} = \frac{2.303}{K} \log \left( \frac{100}{10} \right) = \frac{2.303}{K} \log 10$$

$$T_{90\%} = \frac{2.303}{K} \log \left( \frac{100}{50} \right) = \frac{2.303}{K} \log 2$$

$$\frac{T_{90\%}}{T_{50\%}} = \frac{\log 10}{\log 2} = \frac{1}{0.3010} = 3.32$$

14. Find value of $\Delta H_f$ of C$_2$H$_6$ (in kJ/mole)

Using following enthalpy of combustion

$\Delta H_{\text{comb}}, (C_2H_6, g) = -1560$ kJ/mole

$\Delta H_{\text{comb}}, (C, S) = -394$ kJ/mole

$\Delta H_{\text{comb}}, (H_2, g) = -249$ kJ/mole

Ans. (25)

Sol. Given

(i) $C_2H_6(g) + \frac{7}{2} O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l) \quad \Delta H_{\text{comb}} = -1560$ kJ/mole

(ii) $C(s) + O_2(g) \rightarrow CO_2(g) \quad \Delta H_{\text{comb}} = -394$ kJ/mole

(iii) $H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(g) \quad \Delta H_{\text{comb}} = -249$ kJ/mole

Target $2C(s) + 3H_2(g) \rightarrow C_2H_6(g) \quad \Delta H_{f}^\circ = \Delta H_{f}^\circ(C_2H_6, g)$

$\Delta H_{f}^\circ = \Delta H_{f}^\circ(\text{reactant}) - \Delta H_{f}^\circ(\text{Product})$

$= 2\times(-394) + 3\times(-249) - (-1560)$

$= -788 - 747 + 1560$

$= 32$
15. 3 gram of a gas at 300K have same pressure & volume equal to 0.2 gram hydrogen gas at 200 K, then molar mass of gas is:

Ans. (45)

\[ (P\bar{V})_{\text{gas}} = \left( \frac{M_{\text{gas}}}{M_{\text{H}_2}} \right) \bar{V} \]

\[ (P\bar{V})_{\text{H}_2} = \left( \frac{M_{\text{H}_2}}{M_{\text{gas}}} \right) \bar{V} \]

According to question: 
\[ \left( \frac{3}{M_{\text{gas}}} \right) 300 = \left( \frac{0.2}{4} \right) 200 \]

\[ M_{\text{gas}} = \left( \frac{3 \times 3}{0.2} \right) = 45 \]

16. 120 gram of an organic compound on combustion analysis gives 330 gram of carbon dioxide and 270 gram of water. % by mass of C and H in organic compound is:

(1) 50% C and 50% H  
(2) 60% C and 40% H  
(3) 80% C and 20% H  
(4) 75% C and 25% H

Ans. (3)

Sol. Weight of CO₂ = 330 gram  
Mole of CO₂ = \frac{330}{44} gram  
Mole of C = \frac{330}{44} gram  
Weight of C = \frac{330}{44} x 12 gram  
% of C = \frac{330\times 12}{44\times 120} = 75%

Weight of H₂O = 270 gram  
Mole of H₂O = \frac{270}{18} gram  
Mole of H = \frac{270}{18} x 1 gram  
Weight of H = \frac{270\times 100}{18\times 120} = 25%

17. For the equilibrium A(g) ⇌ B(g) \( \Delta H = -42 \text{ kJ/mole} \)

If the ratio of activation energy of forward and backward reaction is \( \frac{2}{3} \) then value of \( E_a \) and \( E_b \) is respectively:

(1) 94 kJ/mole, 126 kJ/mole  
(2) 24 kJ/mole, 36 kJ/mole  
(3) 48 kJ/mole, 72 kJ/mole  
(4) 80 kJ/mole, 135 kJ/mole

Sol. \( E_a = \frac{2}{3} \Rightarrow E_a = \frac{2}{3} E_b \)

\( \Delta H = E_a - E_b = -42 \)
18. Find the value of cell constant for a given cell in which 0.1 molar solution have resistance 20Ω and molar conductivity 0.154 × 10⁻³ S cm² mol⁻¹

\( \frac{2}{3}E_{ab} = E_{af} = -42 \)

\( E_{ab} = 42 \times 3 = 126 \text{ kJ/mole} \)

\( E_{af} = 84 \text{ kJ/mole} \)

\( K = 0.154 \times 10^{-3} \text{ S cm}^{-1} \)

\( K = \frac{1}{R} \) (1)

\( \lambda_m = k \times 1000 \)

\( 0.154 \times 10^{-3} = \frac{k \times 1000}{0.1} \)

\( \text{Cell constant} \left( \frac{1}{a} \right) = K \times R \)

\( = 0.154 \times 10^{-3} \times 20 \)

\( = 3.08 \times 10^{-4} \text{ cm}^{-1} \)

19. Which of the following gas is not involved in heating of atmosphere (Green House Effect).

(1) \( N_2 \)  (2) \( O_2 \)  (3) \( H_2O \)  (4) \( CO_2 \)

**Ans.** (1)

**Sol.** Green house gases are \( CO_2, CH_4, Chlorofluoro carbon, O_3, \) \( N_2O, \) \( H_2O \)

**Note:** Gas which is not a green house gas is nitrogen.

20. Which of the following is not a condensation polymer.

(1) Nylon-66  (2) Buna-N  (3) Dacron  (4) Silicones

**Ans.** (2)

**Sol.** Buna-N is a addition polymer of Buta-di-en and styrene.

21. How many peptide linkage is present in given segment of proteins?

\( \text{Alanyglycine} \text{leucine} \text{alanlyvaline} \)

**Ans.** (4)

**Sol.** Ala-Gly-Leu-Ala-Val

The amino acids are connected to each other by peptide linkage.
22. Suitable reagent for above reaction is

(1) BH₃/THF, H₂O₂/CH₂O then PCC
(2) H₂O₂, then PCC
(3) PCC Oxidation
(4) BH₃/THF, HIO₄

Ans. (1)

Sol.

23. Statement-1: Alkene has weak σ bond, therefore less stable than alkane.

Statement-2: Weak σ bond is less stronger than carbon-carbon sigma bond.

(1) statement-1 is only correct
(2) statement-2 is only correct
(3) Both statement-1 and statement 2 are correct
(4) Both statement-1 and statement 2 are wrong

Ans. (3)

Sol. σ bond is weaker then σ bond

24. Identify the name of given compound

(1) Cimetidine
(2) Ranitidine
(3) Histamine
(4) Novestrol

Ans. (1)

Sol. It is fact

25. Identify the major product ‘C’ in given reaction sequence.

Hex-4-en-2-ol $\xrightarrow{\text{PCC}}$ $\xrightarrow{\text{NaOH, CH₂CO}}$ C

(1) But-2-ene
(2) But-1-ene
(3) Pent-2-ene
(4) Isobutene

Ans. (1)
26. Order of stability of given carbocation is
   
   \[ \begin{align*}
   (A) & \quad \begin{array}{c}
   \hline \\
   \end{array} \\
   (B) & \quad \begin{array}{c}
   \hline \\
   \end{array} \\
   (C) & \quad \begin{array}{c}
   \hline \\
   \end{array}
   \end{align*} \]

   (1) A > B > C  \quad (2) C > B > A  \quad (3) B > A > C  \quad (4) B > C > A

   \textbf{Ans.} (3)

   \textbf{Sol.} B is most stable due to resonance.

27. In Duma's method of estimation of nitrogen, 0.2 gram of an organic compound gives 22.4 ml of nitrogen gas at STP. % of nitrogen in the organic compound is:

   \textbf{Ans.} (14)

   \textbf{Sol.} Vol of N\(_2\) gas = 22.4 ml at STP

   \[
   \text{Mole of N}_2 \text{ gas} = \frac{224}{22400} = \frac{1}{1000} \text{ mole}
   \]

   Weight of N\(_2\) gas = \(\frac{1}{1000} \times 28\) g

   % of N in organic compound is \(\frac{28}{1000} \times \frac{100}{0.2} = 14\%\)

28. Which of the following sequence of reagents can perform the following conversion?

   \[
   \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH} \xrightarrow{\text{2.}} \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{Cl} \\
   (1) \text{SOCl}_2, \text{KCN}, \text{H}_2\text{Pd} \quad (2) \text{SOCl}_2, \text{AgCN}, \text{H}_2\text{Pd} \\
   (3) \text{PCl}_3, \text{AgCN}, \text{H}_2\text{Pd} \quad (4) \text{Red P/HI}
   \]

   \textbf{Ans.} (1)

   \textbf{Sol.} \[
   \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH} \xrightarrow{\text{1.}} \text{SOCl}_2 \xrightarrow{\text{3.}} \text{CH}_3 - \text{CH}_2 - \text{CN} \xrightarrow{\text{4.}} \text{CH}_3 - \text{CH}_2 - \text{CN}
   \]

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