CHEMISTRY

SECTION – A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

1. Maximum no. of e^- in n = 4 shell
   (1) 72
   (2) 50
   (3) 16
   (4) 32

Answer (4)

Sol. Maximum number of $e^- = 2n^2$

$$= 2(4)^2$$

$$= 32$$

2. BOD value of a water sample is 3 ppm.
   Select the correct option about the given sample of water.
   (1) It is highly polluted water
   (2) It is clean water
   (3) Concentration of oxygen in the given sample is very less
   (4) None of these

Answer (2)

Sol. The given sample of water is clean water as BOD value of clean water ranges between 3 to 5.

3. Which of the following chloride is more soluble in organic solvent?
   (1) Be
   (2) K
   (3) Ca
   (4) Mg

Answer (1)

Sol. Out of the given elements, the chlorides of K and Ca are largely ionic. So, they will be more soluble in water and less soluble in organic solvents. $BeCl_2$ has higher covalent character than $MgCl_2$. Therefore, $BeCl_2$ is more soluble in organic solvents than $MgCl_2$.

4. The correct order of bond strength
   H_2O, H_2S, H_2Se, H_2Te
   (1) $H_2O > H_2S > H_2Se > H_2Te$
   (2) $H_2S > H_2O > H_2Se > H_2Te$
   (3) $H_2Te > H_2Se > H_2S > H_2O$
   (4) $H_2Te > H_2S > H_2O > H_2Se$

Answer (1)

Sol. The correct order of bond strength is
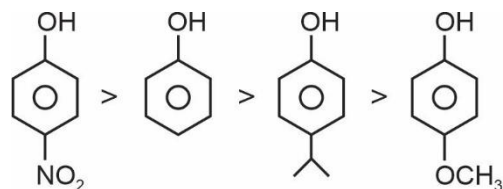 $H_2O > H_2S > H_2Se > H_2Te$

5. The correct order of acidic strength of the following compounds is
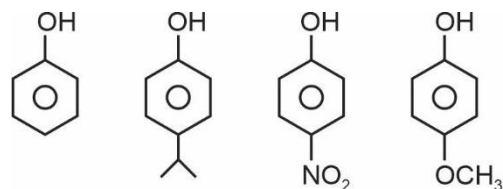
   (1) a > b > c > d   (2) c > a > b > d
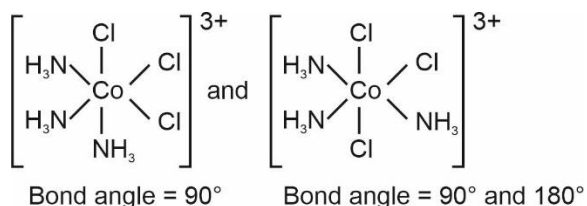   (3) d > c > b > a   (4) c > b > a > d

Answer (2)

Sol. The correct acidic order is
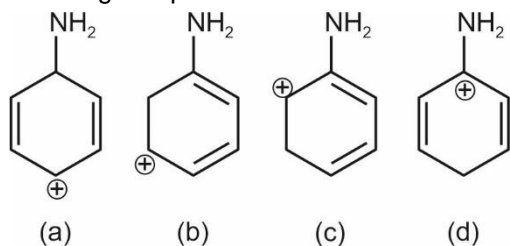

6. What is Cl – Co – Cl bond angle in $[Co(NH_3)_3Cl_3]$?
   (1) 120° and 90°
   (2) 90° and 180°
   (3) 90°
   (4) 180°

Answer (2)
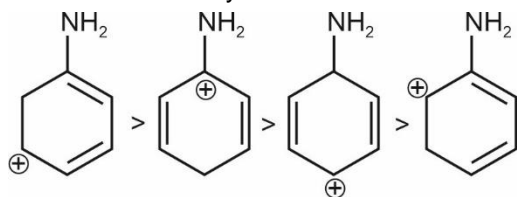
Sol.

Bond angle = 90°   Bond angle = 90° and 180°

7. The correct decreasing order of stability of the following compounds is
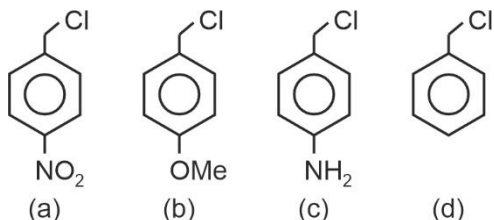

(a)   (b)   (c)   (d)

(1) a > b > c > d

(2) d > b > c > a

(3) b > d > a > c

(4) b > a > d > c

Answer (3)

Sol. The correct stability order is
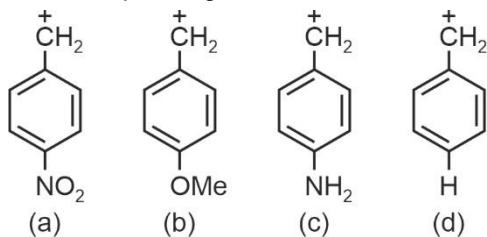

8. Which of the following is correct order of S_N1 reaction?

(a)   (b)   (c)   (d)

(1) a > b > c > d   (2) c > b > d > a

(3) c > a > b > d   (4) d > a > b > c

Answer (2)

Sol. The reactivity order of the given aralkyl halides towards S_N1 reaction will be decided by the stability of their corresponding carbocations.

(a)   (b)   (c)   (d)

The benzyl carbocation is stabilised by resonance. The presence of –NH₂ group at the p-position promotes the resonance stabilisation due to +R effect. The –OMe group also promotes but to a lesser extent due to higher electronegativity of O-atom than N-atom. The –NO₂ group opposes the resonance stabilisation due to its –R effect.

∴ The correct order is c > b > d > a.

9. Lead storage battery have 38% (w/w) H_2SO_4. Find the temperature at which the liquid of battery will freeze

$(i = 2.67)$; k_f of water = $1.86 \dfrac{K \cdot kg}{mole}$

(1) –3.1°C

(2) –31°C

(3) –0.31°C

(4) –0.031°C

Answer (2)

Sol. $\Delta T_f = ik_f \cdot m$

$= (2.67)(1.86)(m)$

$m = \dfrac{38(1000)}{(98)(62)} = 6.25$

$\Delta T_f = (2.67)(1.86)(6.25)$

$ = 31.06°C$

Freezing point = –31.06°C

10. $KMnO_4$ oxidises I^- in acidic & neutral medium in which form – respectively.

(1) IO_3^-, IO^-

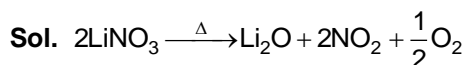(2) IO_3^-, IO_3^-

(3) IO_3^-, I_3^-

(4) I_2, IO_3^-

Answer (4)

Sol. : $I^\ominus$ converts to I_2 in acidic medium and converts to $IO_3^\ominus$ in neutral medium.

11. Which of the following equation is correct?

(1) $LiNO_3 \rightarrow Li + NO_2 + O_2$

(2) $LiNO_3 \rightarrow LiNO_2 + O_2$

(3) $LiNO_3 \rightarrow Li_2O + NO_2 + O_2$

(4) $LiNO_3 \rightarrow Li_2O + N_2O_4 + O_2$

Answer (3)

Sol. $2LiNO_3 \xrightarrow{\Delta} Li_2O + 2NO_2 + \dfrac{1}{2}O_2$

12. The option containing correct match is

   (List-I)   (List-II)

   A. $Ni(CO)_4$ (i) sp^3

   B. $[Ni(CN)_4]^{2-}$ (ii) sp^3d^2

   C. $[Cu(H_2O)_6]^{+2}$ (iii) d^2sp^3

   D. $[Fe(CN)_6]^{4-}$ (iv) dsp^2

   (1) A(i), B(iv), C(ii), D(iii)

   (2) A(iii), B(ii), C(iv), D(i)

   (3) A(ii), B(iii), C(iv), D(i)

   (4) A(iv), B(ii), C(i), D(iii)

Answer (1)

Sol. $Ni(CO)_4 \rightarrow sp^3$

   $[Ni(CN)_4]^{2-} \rightarrow dsp^2$

   $\left[Cu(H_2O)_6\right]^{+2} \rightarrow sp^3d^2$

   $\left[Fe(CN)_6\right]^{4-} \rightarrow d^2sp^3$
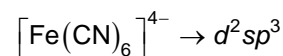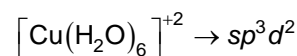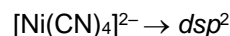
13. Statement 1:– Antihistamine prevents the secretion of acid in stomach

   Statement 2: – Antiallergic and antacid work on same receptors

   (1) 1 is correct, 2 is incorrect

   (2) Both are correct

   (3) 1 is incorrect, 2 is correct

   (4) Both are incorrect

Answer (4)

Sol. Antihistamines do not affect the secretion of acid in stomach. Antiallergic and antacid drugs work on different receptors. Therefore, both the statements are incorrect.

14. **Statement-1:** During hall-heroult process mixing of CaF_2 and Na_3AlF_6 decreases the M.P. of Al_2O_3.

   Statement-2: During electrolytic refining Anode is pure and cathode is impure.

   (1) Both are correct

   (2) Statement-1 is correct, statement-2 is incorrect

   (3) Both are incorrect

   (4) Statement-1 is incorrect, statement-2 is correct

Answer (2)

Sol. Mixture of CaF_2 and Na_3AlF_6 decreases the melting point of Al_2O_3.

15. Nessler's reagent is

   (1) $K_2[HgI_4]$

   (2) $K_3[HgI_4]$

   (3) Hg_2I_2

   (4) HgI_2

Answer (1)

Sol. Nessler's reagent is $K_2[HgI_4]$

16. Boric acid is present in solid state while BF_3 is a gas at room temperature because

   (1) Hydrogen bonding is present in boric acid

   (2) Boric acid has more molar mass as compared to BF_3

   (3) BF_3 is polymeric in nature

   (4) Both (2) and (3)

Answer (1)

Sol. Due to H-bonding, boric acid is solid at room temperature.

SECTION - B

Numerical Value Type Questions: This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, –00.33, –00.30, 30.27, –27.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.

21. For given E_{cell},

$X \mid X^{2+}(0.001\,M) \parallel Y^{2+}(0.01\,M) \mid Y$ at 298 K
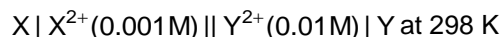
$E^\circ_{X^{2+}/X} = -0.76$

$E^\circ_{Y^{2+}/Y} = +0.34$

$\dfrac{2.303\,RT}{F} = 0.06$

If $E_{cell} = t$, find 5t (closest integer).

Answer (6)

Sol. $E_{cell} = E^\circ_{cell} - \dfrac{0.06}{2}\log\dfrac{10^{-3}}{10^{-2}}$

$= 1.10 - 0.03\,(-1)$

$= 1.10 + 0.03$

$t = 1.13\,V$

$5t = 5.65\,V$

Nearest integer = 6

22. Find the number of formula units of FeO per unit cell (Round off to the nearest integer)

Given that density = $4.0\,gm/cm^3$

$a = 5\text{Å}$

$N_A = 6.0 \times 10^{23}$

Answer (04)

Sol. Density = $\dfrac{ZM}{N_A \times a^3} \Rightarrow Z = \dfrac{density \times N_A \times a^3}{M}$

$= \dfrac{4 \times 6.0 \times 10^{23} \times (5 \times 10^{-8})^3}{(56+16)}$

$= \dfrac{4 \times 6 \times 125 \times 10^{-1}}{72} = 4.16$

23. For 1st order reaction, 540 s is required for 60% completion, then the time for 90% completion is 1.35×10^x. Find x.

$(\log 4 = 0.6)$

Answer (3)

Sol. $\dfrac{t_{90}}{t_{60}} = \dfrac{\log\dfrac{100}{100-90}}{\log\left(\dfrac{100}{100-60}\right)} = \dfrac{1}{\log\dfrac{10}{4}} = \dfrac{1}{1-0.6} = \dfrac{1}{0.4}$

$t_{90} = \dfrac{540}{0.4} = 1350\ sec$

$1350 = 1.35 \times 10^x$

$x = 3$

24. 1 mole of a gas undergoes adiabatic process given that $C_V = 20\ JK^{-1}\ mol^{-1}$, w = 3 kJ, $T_1 = 27°C$, $T_2 = ?\ (°C)$

Answer (177)

Sol. $w = +\ nC_v(T_2 - T_1)$

$3000 = 1 \times 20 \times (T_2 - 300)$

$150 = T_2 - 300$

$T_2 = 450\ K$

$\Rightarrow T_2 = 177°C$

25. Volume strength of H_2O_2 solution is 60 'V', strength of solution is_____ g/L.

(Round off to the nearest integer)

Answer (182)

Sol. Volume strength of H_2O_2 = 60 volume

Molarity of H_2O_2 solution = $\dfrac{60}{11.2}\ M$

Strength of H_2O_2 solution = $\dfrac{60 \times 34}{11.2}$

$= 182.14\ g/L$

$\simeq 182\ g/L$