PART : CHEMISTRY

1. 0.02 M CH_3COOH has specific conductance, K = S × 10^{-5} S cm^{-1}. Also given limiting molar conductance of CH_3COOH is 400 S cm^2 mol^{-1}. Therefore, Ka for CH_3COOH is_____×10^{-7} M

Ans. (8)

Sol. $\Lambda_m = \frac{K \times 1000}{M} = \frac{5 \times 10^{-5} \times 10^3}{2 \times 10^{-2}} = 2.5$

$\alpha = \frac{\Lambda_m}{\Lambda_m^0} = \frac{2.5}{400}$

$K_a = \frac{C\alpha^2}{1-\alpha} = 0.02 \times \left(\frac{2.5}{400}\right)^2 = 8 \times 10^{-7}$ M

2. The correct order of Metallic character Be Ca K is

(1) K > Ca > Be
(2) Be > Ca > K
(3) Ca > Be > K
(4) Ca > K > Be

Ans. (1)

Sol.

Li	Be
Na	Mg
K	Ca
Rb	Sr
Cs	Ba
Fr	Ra

Metallic character increases

Metallic character increases

3. Following two columns are provided, find the correct match:

Column I (Complex)	Column II (CFSE)
(a) $[Ti(H_2O)_6]^{3+}$	(i) -1.2 Δ_o
(b) $[V(H_2O)_6]^{2+}$	(ii) -0.6 Δ_o
(c) $[Mn(H_2O)_6]^{3+}$	(iii) 0 Δ_o
(d) $[Fe(H_2O)_6]^{2+}$	(iv) -0.8 Δ_o

(1) a-iv, b-i, c-ii, d-iii
(2) a-i, b-ii, c-iv, d-iii
(3) a-iv, b-iii, c-i, d-ii
(4) a-i, b-ii, c-iii, d-iv

Ans. (1)

Sol. $[Ti(H_2O)_6]^{3+}$
O.N of Ti = +2
$Ti^{+2} = 3d^2$ ($t_{2g}^{1,1}$, $e_g^{0,0}$)
C.F.S.E = -0.8 Δ_o
$[V(H_2O)_6]^{2+}$
O.N of V = +2
$V^{+2} = 3d^3$ ($t_{2g}^{1,1}$, $e_g^{0,0}$)
C.F.S.E = -1.2 Δ_o
$[Mn(H_2O)_6]^{3+}$
O.N of Mn = +3

$Mn^{+2} = 3d^5$ (W.F.L)

$t_{2g}^{1,1,1}$, $e_g^{0,0}$

C.F.S.E = (- 1.2 × 0.6) Δ_o

= - 0.6 Δ_o

$[Fe(H_2O)_6]^{+2}$

O.N of Fe = +3 (W.F.L) $\Rightarrow 3d^5$

$t_{2g}^{1,1,1}$, $e_g^{1,1}$

C.F.S.E = 0

4. **Assertion :** Higher energy required for conversion of Mg to Mg^{+2} than that for Mg to Mg^{+}.
Reason : Mg^{2+} has small size and more charge.
(1) Both **Assertion** and **Reason** are correct and **Reason** is the correct explanation of **Assertion**.
(2) Both **Assertion** and **Reason** are correct and **Reason** is not the correct explanation of **Assertion**.
(3) **Reason** is correct and **Assertion** is not correct
(4) **Assertion** is correct and **Reason** is not correct

Ans. **(2)**

Sol. $Mg \xrightarrow{IE_1} Mg^{+}$

$Mg \xrightarrow{IE_1} Mg^{+} \xrightarrow{IE_2} Mg^{+2}$

The second ionization enthalpy will be higher than that of first ionization enthalpy. Due to more effective nuclear charge.

5.

	List I	List II (All volume are at STP)
(i)	16 gram $CH_4(g)$	(a) 11.2 lit.
(ii)	2 Mole $N_2(g)$	(b) 56 gram
(iii)	$\frac{1}{2}$ Mole $H_2(g)$	(c) 32 gram
(iv)	$\frac{1}{2}$ Mole $SO_2(g)$	(d) 22.4 lit

identify the correct match.
(1) i-d, ii-b, iii-a, iv-c
(2) i-a, ii-b, iii-c, iv-d
(3) i-d, ii-a, iii-b, iv-c
(4) i-d, ii-b, iii-c, iv-a

Ans. **(1)**

Sol. (i) No. of Mole of $CH_4 = \frac{16}{16} = 1$ Mole

Volume of CH_4 = 22.4 lit

(ii) Mass of N_2 = 2 x 28 = 56 g

Volume of N_2 = 2 x 22.4 = 44.8 lit

(iii) Mass of $H_2(g)$ = 1 gram

Volume of (at STP) = $\frac{1}{2}$ x 22.4 = 11.2 lit

(iv) Mass of $SO_2(g)$ = $\frac{1}{2}$ x 64 = 32 gram

Volume of SO_2 = $\frac{1}{2}$ x 22.4 = 11.2 lit

6. The magnetic movement of an ion is 4. 9 B.M. Find the number of unpaired electron is

Ans. (4)

Sol. $\sqrt{n(n+2)} = 4.9$

Upon solving we get n = 4

7. The relationship between radius of lattice (r) and edge length 'a' of an FCC and BCC is :

(1) $a = 2\sqrt{2}r$ and $\sqrt{3}a = 4r$ (2) $a = 2r$ & $a\sqrt{3} = 4r$

(3) $a\sqrt{3} = 4r$ & $a = 2r$ (4) $a = \sqrt{\frac{2}{3}}r$ & $a = 2\sqrt{2}r$

Ans. (1)

Sol. F.C.C. $a\sqrt{2} = 4r$ for BCC $\sqrt{3}a = 4r$

$a = \frac{4r}{\sqrt{2}} = 2\sqrt{2}r$

8. **Assertion :** Isotopes of hydrogen have different physical properties.
Reason : Isotopes of hydrogen have very large mass difference.
(1) Both **Assertion** and **Reason** are true and **Reason** is the correct explanation of **Assertion**.
(2) Both **Assertion** and **Reason** are true but **Reason** is not correct explanation of **Assertion**.
(3) **Assertion** is true but **Reason** is false.
(4) **Assertion** and **Reason** are false.

Ans. (1)

Sol. Isotopes of hydrogen difference in physical properties due to their large mass defence.

9. How many electrons are gained by MnO_4^- in strongly alkaline reaction

Ans. (1)

Sol. $e^- + \overset{+7}{MnO_4^-} \longrightarrow \overset{+6}{MnO_4^{2-}}$

10. Consider a mixture of 2 moles of oxygen & 4 moles of neon gas neglect any vibrational degree of freedom. The total internal energy of the system is XRT. The value of X is :
[Assume E = 0 at T = 0 k]

Ans. (11)

Sol.

Gas	f_{trans}	f_{rot}	f_{total}
O_2	3	2	5
Ne	3	0	3

$E = \frac{f}{2}nRT$

$E_{total} = E_{O_2} + E_{Ne}$

$= \frac{5}{2} \times 2RT + \frac{3}{2} \times 4 \times RT$

= 11 RT

11. For a first order reaction, if the value of $t_{1/2}$ is t then the value of $t_{1/x}$ will be xt. Find x.

Ans. (3)

Sol. For first order reaction

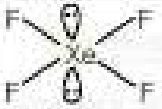
$t_{1/3} = 3t_{1/2}$

So x = 3 Ans.

12. Has many of the following have two lone pairs XeF_4, N_2, CO, CO_2, NO, H_2O.

Ans. (3)

Sol.

Molecule/Species	Structure	No. of lone pairs
(1) XeF_4		2
(2) N_2	:N ≡ N:	2
(3) CO	C ≡ O:	2
(4) CO_2	:O = C = O:	4
(5) NO	:N = O:	3
(6) H_2O		2

13. Number of endothermic reaction(s) among following :

(1) $2HCl(g) \longrightarrow H_2(g) + Cl_2(g)$

(2) $H_2O(l) \longrightarrow H_2O(g)$

(3) Dissolution of NH_4Cl

(4) $I_2(g) \longrightarrow 2I(g)$

(5) $C(s) + O_2(g) \longrightarrow CO_2(g)$

Ans. (4)

Sol. Burning of carbon is exothermic, all other are endothermic

14. During bleeding from a cut, $FeCl_3$ is used to stop bleeding as :

(1) Cl^- cause coagulation

(2) Ferric ion cause coagulation

(3) $FeCl_3$ dilute blood

(4) Bleeding does not stop

Ans. (2)

Sol. Blood is a negative charge colloid hence cation of $FeCl_3$ is Fe^{+3} will act as coagulation agent.

15. Correct order of magnetic moment of the given compound is :

(a) $[Ni(CO)_4]$ (b) $[COF_6]^{3-}$

(c) $[FeF_6]^{3-}$ (d) $[Cr(H_2O)_6]^{+3}$

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

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

Ans. (1)

Sol. (a) $[Ni(CO)_4]$

O.N = 0 $\quad Ni = 3d^8\,4s^2$

$\Rightarrow \quad 3d^{10}$

$\mu = 0$

(b) $[CoF_6]^{3-}$

O.N of Co = +3

$Co^{+3} = 3d^6\ [t_{2g}^{2,1,1},\ e_g^{1,1}]$

$\mu = \sqrt{24}$ B.M

(c) $[FeF_6]^{3-}$

O.N of Fe = +3

$Fe^{+3} = 3d^5\ [t_{2g}^{1,1,1},\ e_g^{1,1}]$

$\mu = \sqrt{35}$ B.M

(d) $[Cr(H_2O)_6]^{3+}$
O.N of Cr = +3
$= 3d^3 [t_{2g}^{3,1,1} , e_g^{0,1}]$
$\mu = \sqrt{15}$ B.M
so order of magnetic moment
c > b > d > a

16. Water of crystallization in soda ash and washing soda is respectively
(1) 0, 10 (2) 10, 0
(3) 0, 0 (4) 0, 1

Ans. **(1)**

Sol. Soda ash → Na_2CO_3
Washing Soda → $Na_2CO_3 . 10H_2O$

17. Delicate balance of CO_2 and O_2 is not disturbed by :
(1) Photosynthesis (2) Deforestation
(3) Burning of coal (4) Burning of petroleum

Ans. **(1)**

Sol. It is fact (Photosynthesis is a natural phenomenon).

18. The process to making soap from fat is called :
(1) Saponification (2) Electrolysis
(3) Solvay process (4) Haber process

Ans. **(1)**

Sol. Formation of soap by the alkaline hydrolysis of structure fat is called saponification.

19. The correct structure of Buna-S is :

(1) 

(2) 

(3) 

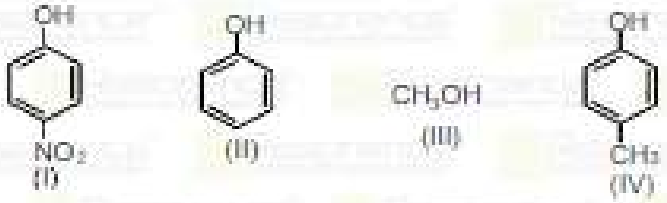
(4) 

Ans. **(1)**

Sol. 

1,3-butadiene

20. The correct order of acidic strength for the given compound is



(1) I > II > IV > III (2) I > III > II > IV

(3) II > III > I > IV (4) II > I > IV > III

Ans. (1)

Sol. Greater the stability of conjugate base, greater the acidity. For phenols, –M group ($-NO_2$) present at para position stabilize the conjugate base, whereas hyperconjugation of $-CH_3$ decreases the stability.

21. An unknown organic compound is heated with fuming HNO_3.The reaction mixture is treated with aq. $BaCl_2$ solution which gives white precipitate. Identify the unknown organic compound.

(1) Phenylalanine (2) Proline

(3) Cysteine (4) Valine

Ans. (3)

Sol. Cysteine has 'S', and 'S' with fuming HNO_3 get oxidised to SO_4^{2-} ion, which gives while ppt with $BaCl_2$.

Cysteine

22. Which of the following is the correct hydride affinity order of carbocations.

Ans. (a > d > b > c)

Sol. Greater the hydride affinity, lesser the stability of carbocation.

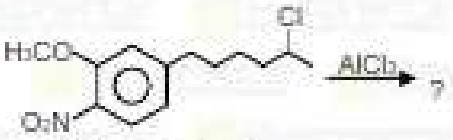
23.

Ans. (1)

Sol.

$LiAlH_4$ reduced amide to amine and ketone to alcohol.

24.



(1)

(2)

(3)

(4)

Ans. (1)

Sol.