

PART : CHEMISTRY

1. Which of the following is correct for adiabatic free expansion ?

(1) $q = 0, \Delta U = 0, w = 0$

(2) $q \neq 0, w = 0, \Delta U = 0$

(3) $q = 0, \Delta U \neq 0, w = 0$

(4) $q = 0, \Delta U \neq 0, w \neq 0$

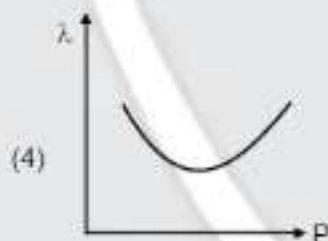
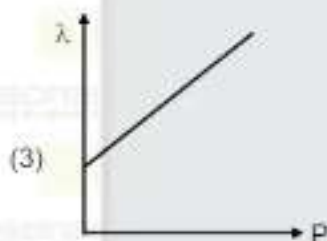
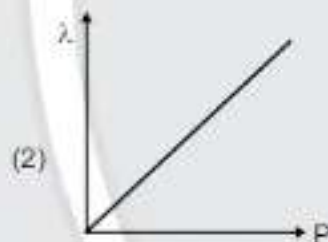
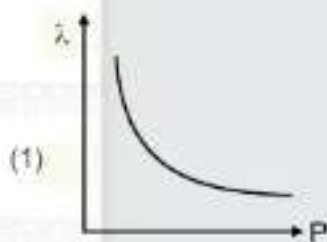
Ans. (1)

Sol. Adiabatic free expansion against vacuum

$$q = 0, P_{\text{ext}} = 0, w = 0$$

$$\therefore \Delta U = q + w = 0 + 0 = 0$$

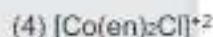
2. Which of the following is correct plot between λ (de-Broglie wavelength) and p (momentum) ?



Ans. (1)

Sol. $\lambda = \frac{h}{p}$ $\lambda \propto \frac{1}{p}$

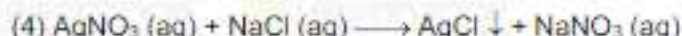
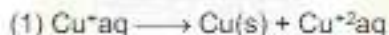
3. Among the following homoleptic complex is



Ans. (1)

Sol. In homoleptic complex only one type of ligand (same ligand) is present

4. Among the following, which is redox disproportionation reaction ?



Ans. (1)

Sol. In redox disproportionation reaction same element of same substance get oxidised as well as reduced

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5. We are given with three NaCl samples and their Van't Hoff factor.

Sample of NaCl Van't Hoff factor

1. 0.1 M

i_1

2. 0.01 M

i_2

3. 0.001 M

i_3

(1) $i_1 = i_2 = i_3$

(2) $i_1 > i_2 > i_3$

(3) $i_3 > i_2 > i_1$

(4) $i_1 > i_3 > i_2$

Ans. (1)

Sol. $\text{NaCl} \longrightarrow \text{Na}^+ + \text{Cl}^-$

$$i = 1 + (n - 1) \alpha = 1 + (2 - 1) \times 1 = 2$$

$$i_1 = i_2 = i_3 = 2$$

6. $\text{Cr}_2\text{O}_7^{2-} + X \text{H}^+ + Y \text{e}^- \longrightarrow 2\text{Cr}^{3+} + A\text{H}_2\text{O}$ Balance the above reaction and find X, Y and A

(1) X = 7, Y = 6, A = 14

(2) X = 14, Y = 6, A = 7

(3) X = 14, Y = 3, A = 7

(4) X = 8, Y = 2, A = 1

Ans. (2)

Sol. $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \longrightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$

7. **Statement-I** : Solution of $[\text{Ni}(\text{H}_2\text{O})_6]^{+2}$ is green in colour.

Statement-II : Solution $[\text{Ni}(\text{CN})_4]^{-2}$ is colourless

Options

(1) Both statements are correct.

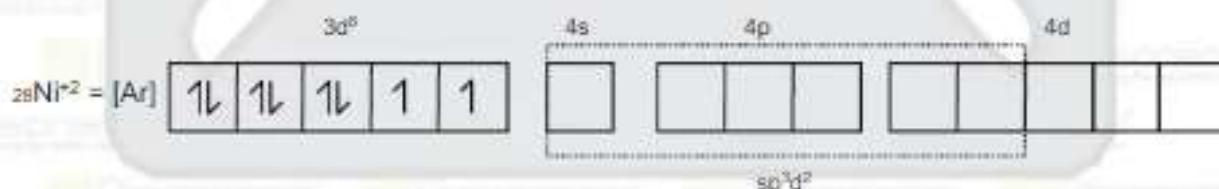
(2) Both Statements are incorrect.

(3) Statement I is correct and statement II is incorrect.

(4) Statement I is incorrect and statement II is correct.

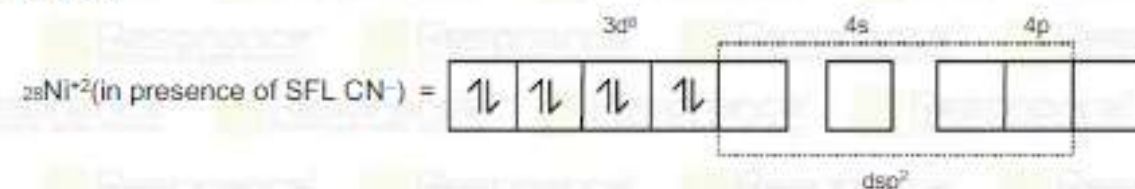
Ans. (1)

Sol. $[\text{Ni}(\text{H}_2\text{O})_6]^{+2}$



n = 2 (unpaired e⁻s), paramagnetic, green

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



n = 0, diamagnetic, colourless

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8. **Statement-I** : Boiling point of NH_3 is greater than PH_3

Statement-II : In PH_3 H-bond is present whereas in NH_3 only vander Waal force is present.

- (1) Both statements are correct.
- (2) Both Statements are incorrect.
- (3) Statement I is correct and statement II is incorrect.
- (4) Statement I is incorrect and statement II is correct.

Ans. (3)

Sol. BP order $\text{NH}_3 > \text{PH}_3$

Reason \longrightarrow In NH_3 H-bond is present

9. Select the correct order of ionic character of given species :

SO_2 , N_2 , ClF_3 , K_2O , and LiF

- (1) $\text{LiF} > \text{K}_2\text{O} > \text{ClF}_3 > \text{SO}_2 > \text{N}_2$
- (2) $\text{LiF} > \text{ClF}_3 > \text{K}_2\text{O} > \text{SO}_2 > \text{N}_2$
- (3) $\text{LiF} > \text{K}_2\text{O} > \text{SO}_2 > \text{ClF}_3 > \text{N}_2$
- (4) $\text{K}_2\text{O} > \text{LiF} > \text{ClF}_3 > \text{N}_2 > \text{SO}_2$

Ans. (1)

Sol. On the basis of electronegative difference.

10. In case of isoelectronic species F^- , Ne and Na^+ the size is affected by

- (1) Principal quantum number
- (2) electron-electron interaction
- (3) Nuclear charge (z)
- (4) None of these

Ans. (3)

Sol. For isoelectronic species (10e^-) $Z \uparrow r \downarrow$

11. In Kjeldahl's method for estimation of nitrogen, CuSO_4 acts as:

- (1) Oxidising agent
- (2) Reducing agent
- (3) Catalytic agent
- (4) Hydrolysis agent

Ans. (3)

Sol. It is fact.

12. Complementary strand of the DNA sequence, ATGCTTCA is :

- (1) TACGAAGA
- (2) TACGAAGT
- (3) TAGCAACA
- (4) TAGCTACT

Ans. (2)

13. **Statement-I** : Aniline & Aminobenzene both are same compound.

Statement-II : Aniline & Aminobenzene both are different compound.

In the light of the above statement choose the most appropriate answer from the option given below.

- (1) **Statement-I** is incorrect & **Statement-II** is correct.
- (2) **Statement-I** is correct & **Statement-II** is incorrect.
- (3) Both **Statements I & II** are incorrect.
- (4) Both **Statements I & II** are correct.

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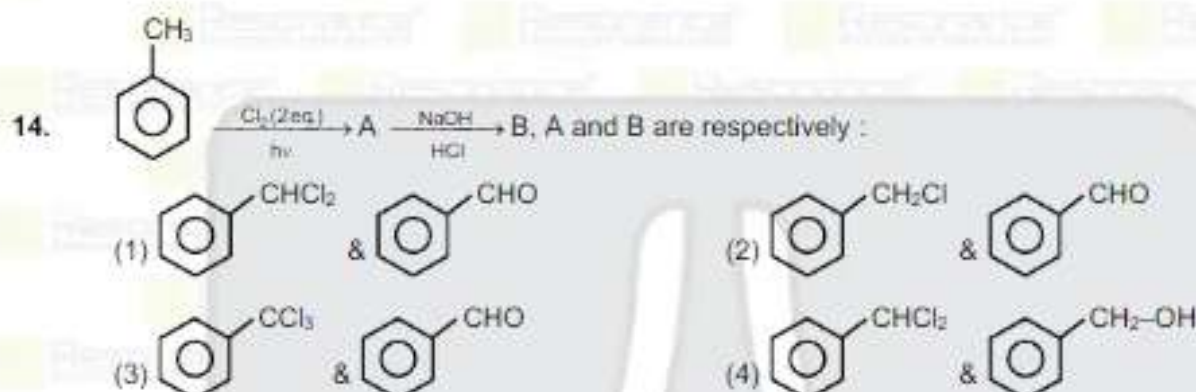
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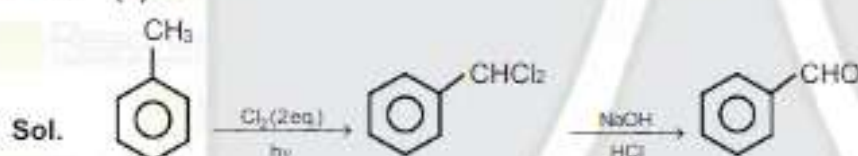
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Ans. (2)

Sol.  Aniline is systematic name, where as Aminobenzene is strict IUPAC name.



Ans. (1)



15. The correct order of reactivity of the given compounds toward electrophilic aromatic substitution reaction is -



Ans. (1)

Sol. Greater the e^- density on benzene ring, faster the rate of EAS reaction.

16. Correct matching for reaction given in column-I with reagent given in column-II:

	Column-I		Column-II
(A)	$Ph-COOH \longrightarrow Ph-CH_2-Ph$	(P)	CH_3MgBr
(B)	$(CH_3)_3COOCH_3 \longrightarrow CH_3-\overset{\overset{CH_3}{ }}{C}-CHO$	(Q)	$NaBH_4$

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(C)	$\text{Ph}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3 \longrightarrow \text{Ph}-\overset{\text{OH}}{\underset{\text{CH}_3}{\text{C}}}-\text{CH}_3$	(R)	Zn, Hg/HCl
(D)	$\text{CH}_3-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3 \longrightarrow \text{CH}_3-\text{CH}_2-\overset{\text{OH}}{\text{CH}}-\text{CH}_3$	(S)	DIBAL-H

- (1) A - R, B - S, C - P, D - Q (2) A - S, B - R, C - Q, D - P
(3) A - Q, B - S, C - P, D - Q (4) A - S, B - Q, C - R, D - P

Ans. (1)

17. **Statement-I** : $-\text{NH}_2$ is strong activating group.

Statement-II : Aniline does not gives Friedel Craft acylation or alkylation reaction.

- (1) **Statement-I** is incorrect & **Statement-II** is correct.
(2) **Statement-I** is correct & **Statement-II** is incorrect.
(3) Both **Statements I & II** are incorrect.
(4) Both **Statements I & II** are correct.

Ans. (4)

Sol. $-\ddot{\text{N}}\text{H}_2$ is strong activating group due to +M effect and aniline does not give Friedel craft acylation or alkylation as it consumes the catalyst AlCl_3 .

18. For ionic reaction in organic compound, which type of bond cleavage occur.

- (1) Heterolytic cleavage
(2) Homolytic cleavage
(3) Free radical formation
(4) No cleavage of bond

Ans. (1)

Sol. Ionic reaction proceed via heterolytic bond cleavage.

19. What is the pH of $\text{CH}_3\text{COO}^- \text{NH}_4^+$ (at 25°C)? Given K_a of $\text{CH}_3\text{COOH} = 1.8 \times 10^{-5}$ and K_b of $\text{NH}_4\text{OH} = 1.8 \times 10^{-5}$

Ans. (7)

Sol. WABA salt : $\text{pH} = \frac{1}{2} (\text{pK}_w + \text{pK}_a - \text{pK}_b)$

$$\text{pH} = \frac{1}{2} (14 + 4.74 - 4.74) = 7$$

20. How many of the following are amphoteric in nature?

SnO₂, PbO₂, SiO₂, P₂O₅, Al₂O₃, CO₂, CO, NO, N₂O, SnO

Ans. (4)

Sol. Amphoteric Oxides: SnO_2 , PbO_2 , Al_2O_3 , SnO

Acidic Oxides: S_2O_2 , P_2O_5 , CO_2

Neutral Oxides: CO, NO, N₂O

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72 mmol 50 mmol

Find milli mole of $\text{Pb}_3(\text{PO}_4)_2$ produced.

Ans. (24)

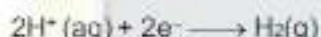


72 mmol 50 mmol

$$\frac{n \text{ PbCl}_2}{3} = \frac{n \text{ Pb}_3(\text{PO}_4)_2}{1}$$

$$n \text{ Pb}_3(\text{PO}_4)_2 = \frac{72}{3} = 24 \text{ mmol}$$

22. For the reaction



If $[\text{H}^+] = 1\text{M}$ & $P_{\text{H}_2}(\text{g}) = 2 \text{ bar}$, If E_{cell} is $-x \times 10^{-3} \text{ V}$, then determine value of x .

Ans. (9)

$$\begin{aligned} \text{Sol. } E_{\text{cell}} &= E_{\text{cell}}^0 - \frac{0.0591}{2} \log \frac{P_{\text{H}_2}(\text{g})}{[\text{H}^+]^2} \\ &= -\frac{0.0591}{2} \log \frac{2 \text{ bar}}{(1)^2} \\ &= -\frac{0.06}{2} \times 0.3 \\ &= -0.009 = -9 \times 10^{-3} \end{aligned}$$

23. Radius of nucleus is 4.8 fermi meter and mass number is 64. Find mass number of nucleus in terms of

$\frac{A}{x}$, when radius is 4 fermi meter. Report your answer for x .

Ans. (27)

Sol. $R = R_0 A^{1/3}$

$$\frac{R_1}{R_2} = \left(\frac{A_1}{A_2} \right)^{1/3}$$

$$\frac{4.8}{4} = \left(\frac{64}{A_2} \right)^{1/3}$$

$$(1.2) = \frac{4}{(A_2)^{1/3}}, (A_2)^{1/3} = \frac{4}{1.2}$$

$$A_2 = \left(\frac{10}{3} \right)^3 = \frac{1000}{27} = \frac{A}{x}$$

$$x = 27$$

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24. How many of the following are trigonal bipyramidal?

 PCl_5 , $[\text{Fe}(\text{CO})_5]$, BF_3 , BrF_5 , AlF_4^- , PF_5

Ans. (3)

Sol. PCl_5 , PF_5 , sp^3d , 5BP + 0LP, trigonal bipyramidal

$[\text{Fe}(\text{CO})_5]$ (dsp^3 , trigonal bipyramidal)

 BrF_5 (sp^3d^2 , 5BP + 1LP square pyramidal) AlF_4^- {sp³, 4BP + 0LP tetrahedral}

25. For A_3B lowest oxidation state of one element is -2 , find number of valence shell e^- in B ?

Ans. (6)

Sol. $A_2^{-1}B^{-2}$

$$\therefore \text{O.N of B} = -2$$

⇒ B can accept two electrons to complete their octet in A_3B

Therefore, no of Valence e^- in B = 6

26. Find out Total possible optical isomer of 2-chlorobutane is

Ans. (2)



It has only one chiral carbon, hence only two optical isomer is possible.

27. The total no. of deactivating group among the following :

$$-\text{CN}, -\text{NHCOCH}_3, -\text{OCOCH}_3, -\text{COCH}_3, -\text{NHCH}_3, -\text{OCH}_3$$

Ans. (2)

Sol. Only $-\text{CN}$, $-\text{COCH}_3$ are deactivating.