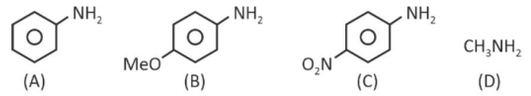
CHEMISTRY

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 :

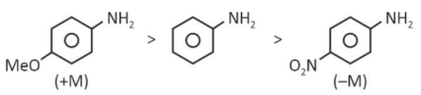
1. The correct order to basic strength of the following molecules is



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

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

Answer (3)

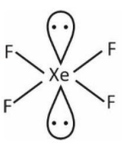
Sol. CH_3NH_2 (I.p. is not delocalised) >  > >

2. Which of the following is the correct Hybridisation of Xe in XeF_4?

(1) sp^3d (2) sp^3

(3) sp^3d^2 (4) sp^3d^3

Answer (3)

Sol. 

$\Rightarrow$ 2 lone pair, 4 Bond pair $\rightarrow sp^3d^2$ Hybridisation

3. Which of the following is correct order of acidic character of oxides of vanadium?

(1) $V_2O_5 > VO_2 > V_2O_3$ (2) $V_2O_3 > VO_2 > V_2O_5$

(3) $V_2O_5 > V_2O_3 > VO_3$ (4) $VO_2 > V_2O_3 > V_2O_5$

Answer (1)

Sol. Acidic strength of oxides increases with increase in oxidation no. of central atom. Correct order is $V_2O_5 > VO_2 > V_2O_3$

4. Consider the following species

(i) $\underline{S}O_2$

(ii) $\underline{N}_3^-$

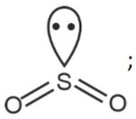
(iii) $\underline{N}O_2^-$

Find the hybridisation of underlined atom.

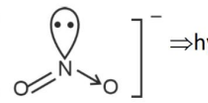
(1) (i) sp^2 (ii) sp^2 (iii) sp^2 (2) (i) sp^2 (ii) sp (iii) sp^2

(3) (i) sp^3 (ii) sp (iii) sp^2 (4) (i) sp (ii) sp^2 (iii) sp^3

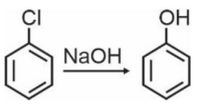
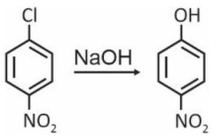
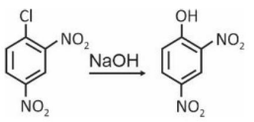
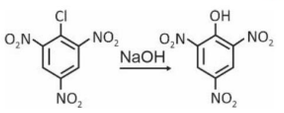
Answer (2)

Sol. (i)  ; hybridisation $\Rightarrow sp^2$

(ii) $\underline{N}_3^- \Rightarrow \bar{N}=\overset{+}{N}=\bar{N}$; hybridisation $\Rightarrow sp$

(iii) $NO_2^- =$  $\Rightarrow$hybridisation $\Rightarrow sp^2$

5. Match the following list-I with list-II :

List-I (Reactions)	List-II (Reaction Temperature)
(A) 	(I) Slight Warming
(B) 	(II) 368 K
(C) 	(III) 443 K
(D) 	(IV)623 K, 300 atm

Choose the correct answer from the options given below :

(1) A-II, B-III, C-I, D-IV

(2) A-IV, B-III, C-II, D-I

(3) A-I, B-II, C-III, D-I

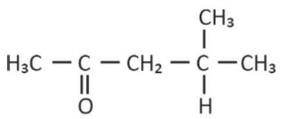
(4) A-II, B-IV, C-III, D-I

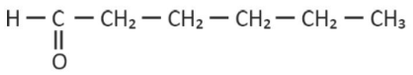
Answer (2)

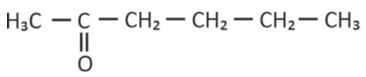
Sol. A-IV, B-III, C-II, D-I

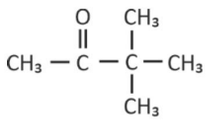
The presence of electron withdrawing group ($-NO_2$) at ortho and para position increases the reactivity of haloarenes.

6. Which of the following compounds of molecular formula $C_6H_{12}O$ give positive 2, 4-DNP test and Tollen's reagent test

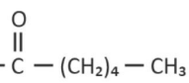
(1) 

(2) 

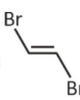
(3) 

(4) 

Answer (2)

Sol.  gives positive 2, 4-DNP test and Tollen's reagent test.

7. **Assertion :**  has more dipole moment than 

Reason :  has more boiling point than 

Choose the correct option.

(1) Both Assertion & Reason are correct, Reason is correct explanation of Assertion

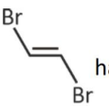
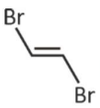
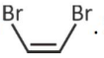
(2) Both Assertion & Reason are correct, Reason is not correct explanation of Assertion

(3) Assertion is correct, Reason is incorrect

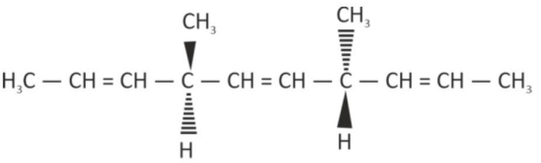
(4) Assertion is incorrect, Reason is correct

Answer (3)

Sol.  has more dipole moment as C – Cl bond is more polar than C – Br bond. So Assertion is correct

 has lesser boiling point as  is non-polar & will have low intermolecular force forces compared to  . So Reason is incorrect

8. Consider the following molecule



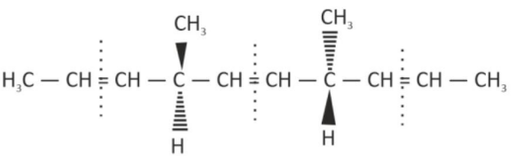
Number of optically active molecule(s) formed after complete reductive ozonolysis of above compound is

(1) 2 (2) 1

(3) 0 (4) 4

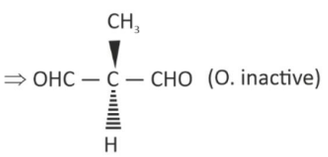
Answer (3)

Sol.



Product are

$\Rightarrow CH_3CHO$ (O. inactive)



9. If $P_A^\circ = 350$ torr and $P_B^\circ = 750$ torr and the two volatile liquids (A) and (B) form an ideal solution. X_A and X_B are the respective mole fraction of (A) and (B) in solution and Y_A and Y_B are the respective mole fractions of (A) and (B) in the vapour phase. Which one of the following relation is correct?

(1) $\frac{Y_A}{Y_B} = \frac{X_A}{X_B}$

(2) $\frac{Y_A}{Y_B} < \frac{X_A}{X_B}$

(3) $\frac{Y_A}{Y_B} > \frac{X_A}{X_B}$

(4) $\frac{Y_A}{Y_B} = \frac{X_B}{X_A}$

Answer (2)

Sol. For an ideal solution of (A) and (B)

$$Y_A = \frac{P_A^\circ X_A}{P} = \frac{350X_A}{P}$$

$$Y_B = P_B^\circ X_B = \frac{750X_B}{P}$$

$$\frac{Y_A}{Y_B} = \frac{350}{750}\frac{X_A}{X_B}$$

$$\Rightarrow \frac{Y_A}{Y_B} < \frac{X_A}{X_B}$$

10. Among the given order, the incorrect order of atomic radii is

(1) $r_{Rb} < r_{Cs}$

(2) $r_{Mg} < r_{Al}$

(3) $r_{Cl} < r_{Br}$

(4) $r_K < r_{Rb}$

Answer (2)

Sol. $r_{Mg} > r_{Al}$

11. Match List-I with List-II and select the correct option.

	List-I (Solution)		**List-II (Properties)**
(A)	Benzene + Toluene	(P)	Show +ve deviation
(B)	Aniline + CH_3COOH	(Q)	$\Delta V_{mix} = 0$
(C)	Water + ethanol	(R)	ΔH_{mix} = –ve
(D)	Acetone + $CHCl_3$	(S)	Form minimum boiling Azeotrope.

(1) A → Q, B → R, C → P, S, D → R

(2) A → S, B → Q, R, C → P, S, D → R

(3) A → Q, B → P, S, C → R, D → P

(4) A → P, S, B → S, C → P, D → R

Answer (1)

Sol. (A → Q, B → R, C → P, S, D → R)

12. List-I mentions thermodynamic process of list-II mention property

	List-I		List-II
(A)	Isothermal	I.	Q = 0
(B)	Adiabatic	II.	$\Delta T = 0$
(C)	Isobaric	III.	$\Delta V = 0$
(D)	Isochoric	IV.	$\Delta P = 0$

(1) A-II, B-I, C-IV, D-III

(2) A-I, B-II, C-III, D-IV

(3) A-I, B-IV, C-III, D-II

(4) A-II, B-I, C-III, D-IV

Answer (1)

Sol. For isothermal process, T = constant, $\Delta T = 0$

For adiabatic process, heat exchange = 0, q = 0

For isobaric process, P = constant, $\Delta P = 0$

For Isochoric process, V = constant, $\Delta V = 0$

13. In electrolysis of aqueous solution of $AgNO_3$, $Cu(NO_3)_2$, $Hg(NO_3)_2$ and $Au(NO_3)_3$ is carried out, then correct order of deposition of metal cathode give

Metal ion/Metal	SRP(V)
Ag^+/Ag	0.79
Cu^{2+}/Cu	0.34
Hg^{2+}/Hg	0.85
Au^{3+}/Au	1.4

(1) Au > Hg > Ag > Cu

(2) Au > Hg > Cu > Ag

(3) Au > Ag > Hg > Cu

(4) Cu > Ag > Hg > Au

Answer (1)

Sol. More the standard reduction potential of metal ion more will be tendency to deposit as metal on cathode.

14. Hydration energy of K^+ is –x kJ/mol and of $Cl^{\ominus}$ is –y kJ/mol and lattice energy of KCl is –Z kJ/mol then what is the heat of dissolution of KCl ?

(1) z – (x + y)

(2) –z – (x + y)

(3) z + x + y

(4) –z + (x + y)

Answer (1)

Sol.

$$KCl(s) \longrightarrow K^+(g) + Cl^-(g), \Delta H_1 = Z \text{ kJ/mol}$$

$$K^+(g) + aq \longrightarrow K^+(aq), \ \Delta H_2 = -x \text{ kJ/mol}$$

$$Cl^-(g) + aq \longrightarrow Cl^-(aq), \Delta H_3 = -y \text{ kJ/mol}$$

$$KCl(0) + aq \longrightarrow X^+(aq) + Cl^-(aq)$$

$$\Delta H_{dis} = \Delta H_1 + \Delta H_2 + \Delta H_3$$

$$= z - x - y$$

$$\Delta H_{dis} = z - (x + y)$$

15. How many of the following coordination compounds having same coordination number and paramagnetic in nature?

$K_3[Fe(CN)_6]$, $K_4[Fe(CN)_6]$ $[Cu(NH_3)_4]SO_4$, K_2HgI_4, $[Ni[H_2O)_6]^{2+}$

(1) 2

(2) 3

(3) 1

(4) 4

Answer (1)

Sol. $K_3[Fe(CN)_6]$ and $[Ni(H_2O)_6]^{2+}$ have same coordination number and paramagnetic in nature due to presence of unpaired electron

16. **Statement-I :** Consider the following statements on hydrolysis of proteins, it give β amino acids.

Statement-II : Fibrous proteins after denaturation becomes water soluble

In the light of above statement, choose the correct option.

(1) Statement-I and Statement-II both are correct

(2) Statement-I is correct, Statement-II in incorrect

(3) Statement-I is incorrect, Statement-II in correct

(4) Statement-I and Statement-II both are incorrect

Answer (4)

Sol. Only α-amino acids are obtained on hydrolysis of protein Statement-I is incorrect

17. Choose correct option for Reducing Nature/Stability of oxidation in following.

(1) Stability $Tl^+ < Tl^{3+}$

(2) Reducing nature $Tl^+ > Tl^{3+}$

(3) Stability $Al^+ > Al^{3+}$

(4) Reducing nature $Al^+ > Al^{3+}$

Answer (4)

Sol. Stability of higher oxidation state decreases down the group due to inert pair effect so stability order $Al^{3+} > Al^{+}$ $Tl^{+} > Tl^{3+}$

18. ??

19. ??

20. ??

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. Consider the following oxides of d-block elements

V_2O_5, Cr_2O_3, Mn_2O_7, V_2O_3, V_2O_4

Number of oxides which are acidic is x. Consider the following complex compound $[Co(NH_2CH_2CH_2NH_2)_3]_2(SO_4)_3$, the primary valency of complex is y

The value of (x + y) is

Answer (4)

V_2O_5 – Amphoteric

$Cr_2O_3 \rightarrow$ Amphoteric

Mn_2O^{+} – Acidic

V_2O_3 – Basic

V_2O_4 – Basic

x = 1

Primary valency = charge on metal ion

= +3

y = 3

(x + y) = 4

22. Consider the reaction given below:

$$C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O.$$

If 174 g of Butane reacts with 320 g of O_2. Find the volume of H_2O formed in ml. (Given density of H_2O is 1 g/ml)

Answer (138 ml)

Sol. $C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O$

$$\therefore n_{C_4H_{10}} = \frac{174}{58} = 3\,\text{mol}$$

$$\therefore n_{o_2} = \frac{320}{32} = 10\,\text{mol}$$

$\therefore$ 3 mol C_4H_{10} require $\frac{13}{2} \times 3\,\text{mol}\,O_2$

$$= \frac{39}{2} = 19.5\,\text{mol}\,O_2$$

$\therefore$ O_2 is limiting resent.

$\therefore \frac{13}{2}$ mol of $O_2 \rightarrow$ 5 mol H_2O

$$\therefore \text{10 mol of } O_2 \rightarrow \frac{5\times2}{13} \times 10 = \frac{100}{13} = 7.69\,\text{mol}$$

$\therefore$ mass of H_2O = 7.69 × 18 g

= 138.4 g

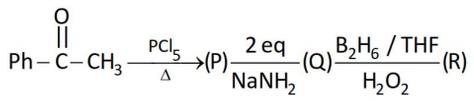
$$\therefore \text{Volume of } H_2O = \frac{\text{Mass}}{\text{Density}}$$

$$= \frac{138.4}{1}\text{ml}$$

= 138.4 ml

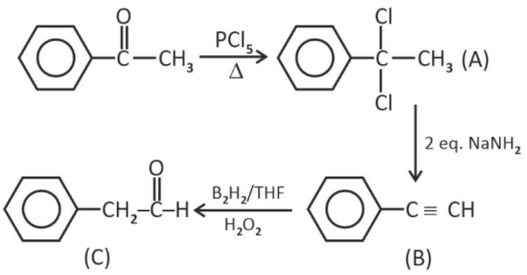
$\approx$ 138 ml

23. Find no. of sp^2 hybridised C-atoms in major (R) in the following sequence of reactions :



Answer (7)

Sol.



No. of sp^2 hybridised C in (C) = 7

24. In Dumas method, 292 mg of organic compound yields 50 mL $N_2(g)$ at 300 K and 715 mm Hg pressure. Find % of 'N' in organic compound.

Aqueous tension i = 15 mm Hg

Answer (18)

Sol. V_{N_2} at STP $= \dfrac{273\times(715-15)\times 50}{300\times 760}$

$= 41.9$ mL

$m_{N_2} = \dfrac{41.9}{22400}\times 28 = 0.052\ g$

% of N $= \dfrac{0.052\ g}{0.292}\times 100 = 17.94\%$

$\simeq 18\%$

25. A buffer solution have 0.1M NH_4Cl & 0.1M NH_4OH. If 0.05 mole HCl is added in the solution. The change in pH is $x \times 10^{-1}$ (log3 = 0.48)

Answer (5)

Sol. Initially

$$pOH = pK_b + \log\frac{[NH_4Cl]}{[NH_4OH]} = pK_b + \log\frac{0.1}{0.1}$$

$pOH = pK_b$

$pH = 14 - pOH = 14 - pK_b$ ...(i)

When 0.05 mole HCl is added

$NH_4OH + H^+ \rightleftharpoons NH_4^+ + H_2O$

0.1	0.05	0.1
0.1–0.05	0	0.15

$= 0.05$

$$pOH = pK_b + \log\frac{[NH_4^+]}{[NH_4OH]} = pK_b + \log\frac{0.15}{0.05}$$

$$pH = 14 - pK_b - \log\frac{0.15}{0.05}$$

$$\text{Change in pH} = 14 - pk_b - \log\frac{0.15}{0.05} - 14 + pK_b$$

$= -\log 3 = -0.48$

Change in pH = 0.48 or 4.8×10^{-1}

$= x = 4.8 \approx 5$