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. Polymer which is named as Orlon is
   (1) Polyamide
   (2) Polyacrylonitrile
   (3) Polycarbonate
   (4) Polyethene

Answer (2)

Sol. Orlon is the commercial name of polyacrylonitrile

2. We are given with some diseases in Column-II. Column-I contains name of some vitamins and their deficiencies will cause :

Column-I (Deficiency)		Column-II	
(A)	Vitamin A	(p)	Scurvy
(B)	Vitamin B_2 (Riboflavin)	(q)	Xerophthalmia
(C)	Vitamin B_1 (Thiamine)	(r)	Cheilosis
(D)	Vitamin C	(s)	Beri Beri

   (1) A(q); B(r); C(s); D(p)
   (2) A(r); B(q); C(p); D(s)
   (3) A(q); B(r); C(p); D(s)
   (4) A(p); B(r); C(s); D(q)

Answer (1)

Sol. Vitamin A $\rightarrow$ Xerophthalmia

Vitamin B_2 $\rightarrow$ Cheilosis

Vitamin B_1 $\rightarrow$ Beri Beri

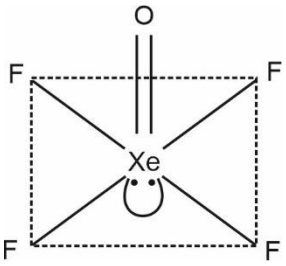
Vitamin C $\rightarrow$ Scurvy

(NCERT ref. : Pg. No. 426, Class XII, Part-II)

3. Which of the following have square pyramidal structure
   (1) $XeOF_4$
   (2) BrF_4
   (3) XeF_4
   (4) XeO_3

Answer (1)

Sol. $XeOF_4$ has sp^3d^2 hybridisation



Shape $\rightarrow$ square pyramidal

5.

Column-I (Compound)		Column-II (Type of Bond)	
A	N_2O	P	(N—N) Bond
B	N_2O_4	Q	(N—O—N) Bond
C	N_2O_5	R	(N=N) or (N≡N) Bond
D	NO_2	S	(N=O)

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

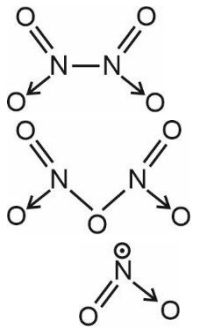
Answer (3)

Sol. A. N_2O $N\equiv N \rightarrow O$

B. N_2O_4

C. N_2O_5

D. NO_2



6. We are given with a reaction

$$R-CH_2-Br+NaI \xrightarrow{\text{Acetone}} R-I+NaBr$$

Which of the following statement is correct?
   (1) This reaction can also take place in acetic acid
   (2) This reaction is called Swarts reaction
   (3) This reaction shifts in forward direction using principle of Le-Chatelier's principle
   (4) This Reaction will take place even if Br is replaced with F.

Answer (3)

Sol. $R-CH_2-X+NaI \xrightarrow{\text{Acetone}} R-CH_2-I+NaX$

X = Cl, Br

Above reaction is called Finkelstein reaction.

NaCl and NaBr are insoluble in acetone and hence this shifts in forward reaction using Le-Chatelier's principle.

7. **Assertion:** Magnetic moment of $[Fe(H_2O)_6]^{3+}$ is 5.92 BM and that of $[Fe(CN)_6]^{3-}$ is 1.73 BM

Reason: Oxidation state of Fe in both the complexes is +3.

(1) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion

(2) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion

(3) Reason is correct but Assertion is not correct

(4) Reason is incorrect but Reason is correct

Answer (2)

Sol. $[Fe(H_2O)_6]^{3+}$ – O.S. of Fe = +3

$Fe^{3+}: 3d^5,\ t_{2g}^3e_g^2;\ \mu=\sqrt{35}=5.92\ BM$

$[Fe(CN)_6]^{3-}$ – O.S. of Fe = +3

$Fe^{3+}: 3d^5,\ t_{2g}^5e_g^0;\ \mu=\sqrt{3}=1.73\ BM$

8. Consider the following reaction

$A_2B_3(g) \rightleftharpoons 2A(g) + 3B(g)$

If initial concentration of $A_2B_3(g)$ is C, find α

(1) $\left(\frac{k_{eq}}{27\,C^4}\right)^{1/5}$ (2) $\left(\frac{k_{eq}}{C^4}\right)^{1/5}$

(3) $\left(\frac{k_{eq}}{108\,C^4}\right)^{1/5}$ (4) $\left(\frac{k_{eq}}{4\,C^4}\right)^{1/5}$

Answer (3)

Sol. $\underset{C(1-\alpha)}{A_2B_3} \rightleftharpoons \underset{2C\alpha}{2A} + \underset{3C\alpha}{3B}$

$$k_{eq}=\frac{4C^2\alpha^2\times 27C^3\alpha^3}{C(1-\alpha)}$$

$$k_{eq}=\frac{108\,C^5\,\alpha^5}{C(1-\alpha)}$$

$$\alpha=\left(\frac{k_{eq}}{C^4(108)}\right)^{1/5}$$

(Assuming $1-\alpha \ll 1$)

9. Which compound is added to cement to increase its setting time?

(1) Gypsum

(2) Lime stone

(3) Clay

(4) Calcium carbonate

Answer (1)

Sol. Gypsum is added to cement to increase its setting time.

10. Which reaction is correct with its correct enzyme used?

(1) Sucrose → glucose + fructose
enzyme : Invertase

(2) Glucose → CO_2 + ethanol
enzyme : maltase

(3) Protein → Amino acid
enzyme : Zymase

(4) Starch → Maltose
enzyme : Pepsin

Answer (1)

Sol. Sucrose $\xrightarrow{\text{Invertase}}$ glucose + fructose

Glucose $\xrightarrow{\text{zymase}} CO_2 + C_2H_5OH$

Protein $\xrightarrow{\text{pepsin}}$ Amino acids

Sucrose $\xrightarrow{\text{diastase}}$ maltose

11. Compound P with molecular formula $C_{14}H_{13}ON$ is hydrolysed to give Q and R Compound Q give effervescence with $NaHCO_3$ while compound R react with Hinsberg reagent to give oily liquid which react with NaOH.

P → Q (give effervescence with $NaHCO_3$) + K (React with Hinsberg reagent)

The products Q and R are respectively

(1) C_6H_5COOH and $C_6H_{13}NH_2$

(2) C_6H_5COOH and $C_6H_5CH_2NH_2$

(3) $CH_3(CH_2)_4COOH$ and $CH_3(CH_2)_6NH_2$

(4) $CH_3(CH_2)_4CONH_2$ and $CH_3(CH_2)_5COOH$

Answer (2)

Sol. $C_6H_5CONH-CH_2C_6H_5 \xrightarrow{\text{Hydrolysis}} \underset{Q}{C_6H_5COOH} + \underset{R}{C_6H_5CH_2NH_2}$

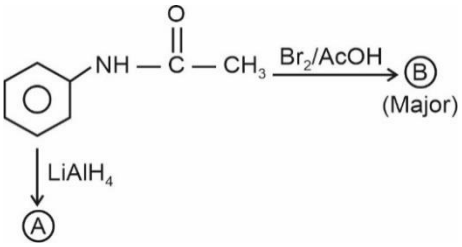
$C_6H_5SO_2Cl + C_6H_5-CH_2NH_2 \longrightarrow C_6H_5SO_2NH-CH_2C_6H_5$

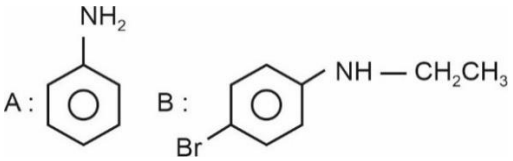
Hinsberg reagent

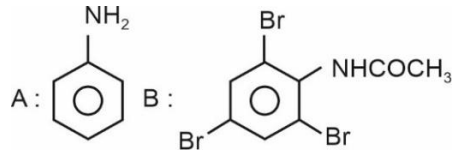
↓

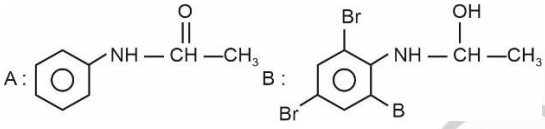
Soluble in NaOH

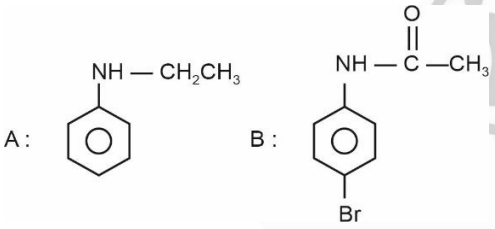
12. In following sequence of reaction, identify A and B



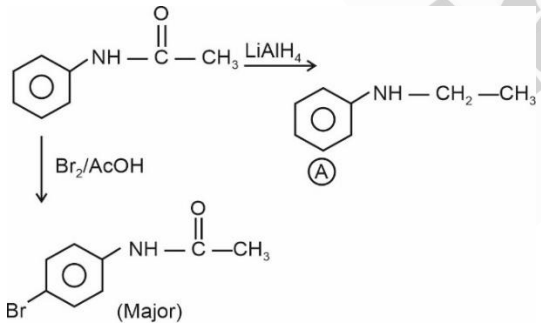
(1) 

(2) 

(3) 

(4) 

Answer (4)

Sol. 

13. Column-I contains some elements and column-II contains final product obtained during their qualitative analysis.

Column-I	Column-II
(A) Nitrogen	(P) AgX
(B) Sulphur	(Q) $(NH_4)_3PO_4 \cdot 12MoO_3$
(C) Phosphorous	(R) $Fe(SCN)_3$
(D) Halogens	(S) $Fe_4\left[Fe(CN)_6\right]_3$

(1) A(P), B(R), C(Q), D(S)

(2) A(Q), B(R), C(Q), D(P)

(3) A(S), B(R), C(Q), D(P)

(4) A(Q), B(R), C(P), D(S)

Answer (3)

Sol. Nitrogen: $Fe_4\left[Fe(CN)_6\right]_3$

Prussian Blue

Sulphur: $[Fe(SCN)]^{2+}$ or $Fe(SCN)_3$

Phosphorous: $(NH_4)_3PO_4 \cdot 12MoO_3$

Halogen: AgCl; AgBr; AgI

14. For the given elements:

Ne, F, Cl, Ar

Which of the following pair of element has highest difference of electronegativity?

(1) Ne — Cl (2) Ne — F

(3) Ne — He (4) Ne — Ar

Answer (2)

Sol. The electronegativity of F (Fluorine) is highest among all the elements of periodic table. Hence highest difference of E.N. arises between Ne and F.

15. Photochemical smog is most likely to be found in which of the following industrial areas?

(1) Marshy areas

(2) Himalayan valley in winters

(3) Warm moist climates

(4) Sunny dessert areas

Answer (4)

Sol. Photochemical smog occurs in warm, dry and sunny climate. Hence the option 4 is most appropriate.

16. A binary compound has Y-atoms forming FCC unit cell and another type of X-atoms occupying 1/3rd of tetrahedral voids. Find out the molecular formula of the compound

(1) XY (2) X_2Y_3

(3) X_3Y_2 (4) XY_2

Answer (2)

Sol. Y-atoms of a binary compound form FCC unit cell.

$\therefore$ No. of Y-atoms per unit = 4

X-atoms of the same compound occupy 1/3rd of tetrahedral voids.

$\therefore$ No. of X-atoms per unit cell = $\frac{8}{3}$

$\therefore$ Formula of the compound $X_{\frac{8}{3}}Y_4$ as X_2Y_3

17. The M^+/M of an element doesn't depend on

(1) $\Delta H_{hyd.}$

(2) $\Delta H_{Sub.}$

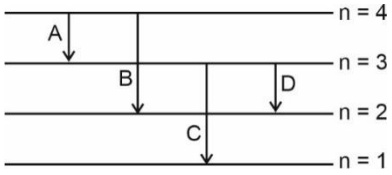
(3) Ionisation enthalpy of gas

(4) Ionisation enthalpy of solid

Answer (4)

Sol. Ionisation enthalpy is calculated for isolated gaseous atom

18. Shortest wavelength will be there for which of the following transition?



(1) Transition A (2) Transition B

(3) Transition C (4) Transition D

Answer (3)

Sol. Shortest $\lambda \Rightarrow$ maximum ΔE

$(\Delta E)_C > (\Delta E)_B$

Energy difference decreases while we move in higher energy levels.

19. Strong reducing & oxidizing agent among the following respectively.

(1) Ce^{+3} & Ce^{+4} (2) Eu^{+2} & Ce^{+4}

(3) Ce^{+4} & Tb^{+4} (4) Ce^{+4} & Eu^{+2}

Answer (2)

Sol. The most stable oxidation state of lanthanides is +3.

$\therefore$ Eu^{+2} is a reducing agent & Ce^{+4} is an oxidising agent.

Hence, correct answer is 2.

20.

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. If Radius of Ground State Hydrogen atom is 51 pm. Find out Radius of 5^{th} orbit of Li^{2+} ions (in pm). (Closest Integer)

Answer (425.00)

Sol. $r_5 = 51 \times \frac{(5)^2}{(3)} = \frac{51 \times 25}{3} = 425$ pm

22. Some amount of urea is added to 1000 gm of H_2O due to which vapour pressure decreases by 25% of the original vapour pressure. Find out mass of urea added (Round off to two decimal places)

Answer (18.52)

Sol.

100

↓

75

$\Rightarrow \frac{25}{75} = \frac{n_{urea}}{\left(\frac{1000}{18}\right)}$

$\Rightarrow n_{urea} = \frac{1}{3} \times \frac{1000}{18} = 18.52$

23. Find logk if $\Delta H° = -54.07$ kJ/mol and T = 298 k, $\Delta S° = 10$ J/mol k

Also given 2.303 × 298 = 5705

Answer (01.20)

Sol. $\Delta G° = \Delta H° - T\Delta S°$

$-2.303\ RT \log k = -54070 - 298 \times 10$

$\log k = 1.2027$

$\Rightarrow$ 1.20

24. Oxidation state of Mo in Ammonium phosphomolybdate is

Sol. Ammonium phosphomolybdate is

$(NH_4)_3PO_4 \cdot 12MoO_3$

Oxidation state of Mo

$\underset{(NH_4^+)}{3(+1)} + \underset{PO_4^{3-}}{(-3)} + \underset{Mo}{12x} + \underset{Oxygen}{36(-2)} = 0$

Calculation gives x = +6

25.

26.

27.

28.

29.

30.