# PART : CHEMISTRY

**1.** If the radius of hydrogen atom is 51 pm then what will be the radius of 5th orbit of $LP^{+}$ (in pm) ?
(Report your answer to the nearest integer).

**Ans.** **(425)**

**Sol.** $r_H$ = 51 pm

$$r_{Li^{+2}} = \frac{r_H \times n^2}{Z} = \frac{51 \times 5^2}{3} = 17 \times 25 = 425 \text{ pm}$$

**2.** If X forms CCP and Y occupy $\frac{1}{3}$ of octahedral voids then what will be the formula of the compound ?

(1) $XY_3$ (2) $X_2Y_3$ (3) $X_3Y$ (4) $X_3Y_2$

**Ans.** **(3)**

**Sol.** Number of X atom = 4

Number of Y atom = $4 \times \frac{1}{3} = \frac{4}{3}$

Formula of compound $(X_4Y_{4/3}) \times \frac{3}{4} = X_3Y$

**3.** What is the Oxidation state of Mo in ammonium phosphomolybdate ?

**Ans.** **(6)**

**Sol.** the Oxidation state of Mo in ammonium phosphomolybdate = + 6

$(NH_4)_3PO_4.12MoO_3$

**4.** Find log $K_{eq}$ value for a reaction for which $\Delta H^\circ$ = –54.07 KJ/mol and $\Delta S^\circ$ = 10 J/K at T = 293K
Given : 2.303 RT = 5610 (Report your answer in to nearest integer)

**Ans.** 10

**Sol.** $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$

$\Delta G^\circ = -54070 - 293 \times 10 = -57000$ J

$\Delta G^\circ = -2.303\ RT \log K_{eq}$

$-57000\ J = -5610 \log K_{eq}$

$\log K_{eq} = 10.16 \approx 10$

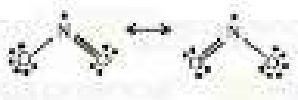
**5.** Match the following

| | List-I (species) | | List-II (type of bond) | |
|---|---|---|---|---|
| (A) | $NO_2$ | (P) | N – N | |
| (B) | $N_2O$ | (Q) | N = O | |
| (C) | $N_2O_4$ | (R) | N – O – N | |
| (D) | $N_2O_5$ | (S) | N = O / N = N | |

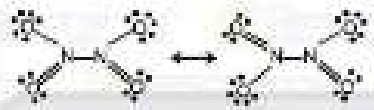
| | (A) | (B) | (C) | (D) |
|---|---|---|---|---|
| (1) | Q | S | P | R |
| (2) | P | R | Q | S |
| (3) | Q | S | R | P |
| (4) | S | P | Q | R |

**Ans.** **(1)**

**Sol.**

$NO_2$ 

$N_2O$ 

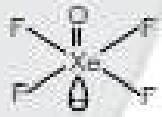
$N_2O_4$ 

$N_2O_5$ 

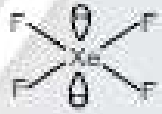
**6.** Which of the following have square pyramidal structure :

(1) $XeOF_4$ (2) $BrF_5$ (3) $XeF_4$ (4) $XeO_3$

**Ans.** (1)

**Sol.** (1) $XeOF_4$  (Square pyramidal)

(2) $BrF_5$  (T-shape)

(3) $XeF_4$  (Square planner)

(4) $XeO_3$  (Pyramidal)

**7.** For a reversible reaction

$A_2B_3(g) \rightleftharpoons 2A(g) + 3B(g)$ the initial concentration of $A_2B_3$ is C mol/L and equilibrium constant of the reaction is K, then degree of dissociation ($\alpha$) is :

(1) $\alpha = \left[\frac{K}{108\,C^3}\right]^{1/5}$ (2) $\alpha = \left[\frac{108\,C^4}{K}\right]^{1/5}$

(3) $\alpha = \left[\frac{K}{27\,C^4}\right]^{1/5}$ (4) $\alpha = \left[\frac{4\,C^2}{K}\right]^{1/3}$

**Ans.** (1)

**Sol.**

| | $A_2B_3$ | $\rightleftharpoons$ | $2A$ | + | $3B$ |
|---|---|---|---|---|---|
| Initial conc. | C | | 0 | | 0 |
| | C – Cα | | 2Cα | | 3Cα |

$$K = \frac{(2C\alpha)^2(3C\alpha)^3}{(C - C\alpha)}$$

$$K = \frac{108C^5\alpha^5}{C} = 108C^4\alpha^5$$

$$\alpha = \left[\frac{K}{108C^4}\right]^{1/5}$$

**8.** Total number of ambidentate ligand in the complex $[Co(en)(SCN)_4]^{-1}$ is

**Ans.** (4)

**Sol.** $SCN^-$ is an ambidentate ligand.

**9.** Amongst the following select the best oxidising & reducing agent respectively :

(1) $Ce^{+4}$, $Tb^{+3}$ (2) $Ce^{+3}$, $Eu^{+2}$ (3) $Ce^{+4}$, $Eu^{+2}$ (4) $Tb^{+3}$, $Eu^{+3}$

**Ans.** (3)

**Sol.** $(E^{\circ}_{Ce^{+4}/Ce^{+3}})_{H_2O} = 1.74\ V$

$Eu^{+2}$ is a strong reducing agent changing to common oxidation state + 3.

**10.** **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 not correct and **Reason** is 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.** In $[Fe(H_2O)_6]^{+3}$, $H_2O$ is a weak field ligend so configuration of $Fe^{+3}$ is $t_{2g}^{1,1,1}$ , $e_g^{1,1}$

so number of unpaired electron are 5 and magenetic momentum is 5.92 BM

In $[Fe(CN)_6]^{-3}$, $CN^-$ is a weak field ligend so configuration of $Fe^{+3}$ is $t_{2g}^{2,2,1}$ , $e_g^{0,0}$

so number of unpaired electron are 1 and magenetic momentum is 1.73 BM

**11.** Which substance is added in cement for increase in setting time of cement

(1) silica (2) clay (3) gypsum (4) lime stone

**Ans.** (3)

**Sol.** The purpose of adding gypsum is only to slow down the process of setting of the cement so that it gets sufficiently hardened.

**12.** For which of the following pair of elements have maximum difference in value of electron gain enthalpy ($\Delta H_{eg}$)

(1) Ne, Cl (2) Ar, F (3) Ar, Cl (4) Ne, F

**Ans.** (1)

**Sol.** Cl has maximum –ve $\Delta H_{eg}$ and Ne has most +ive $\Delta H_{eg}$ hence difference will be maximum for Ne and Cl.

| Element | $\Delta H_{eg}$ (KJ/mole) |
|---|---|
| F | –333 |
| Cl | –349 |
| Ne | +48 |
| Ar | +116 |

**13.** When 5 mole of $BaCl_2$ mixed with 2 mole of $Na_3PO_4$ then Maximum Number of mole of $Ba_3(PO_4)_2$ are formed.

**Ans.** **1.00**

**Sol.** $3BaCl_2 + 2Na_3PO_4 \longrightarrow Ba_3(PO_4)_2 + 6NaCl$

inicial mole 5 2

L.R. $\frac{5}{3} = 1.67$ $\frac{2}{2} = 1$ (L.R. = $Na_3PO_4$)

$$\frac{\text{mole}\,Na_3PO_4}{2} = \frac{\text{mole}\,Ba_3(PO_4)_2}{1}$$

maximum number of mole of $Ba_3(PO_4)_2 = \frac{2}{2} = 1$ mole

**14.** $2Na[Ag(CN)_2]_{aq} + Zn(s) \longrightarrow Na_2[Zn(CN)_4]_{aq} + 2Ag(s)$ the given reaction is an example of

(I) Redox reaction

(II) Displacement reaction

(III) Combination reaction

(IV) Decomposition reaction

correct answer is

(1) I, II (2) I, III (3) I, IV (4) II, IV

**Ans.** **(1)**

**Sol.** Theory based

**15.** Standard electrode potential $M^{2+}/M$ does not depends upon :

(1) Sublimation enthalpy (2) Hydration enthalpy

(3) Ionisation enthalpy (4) Concentration of metal ion

**Ans.** **(4)**

**Sol.** Theory based

**16.** Polymer which is named as orlon is

(1) Polyamide (2) Polyacrylonitrile

(3) Polycarbonate (4) Polythene

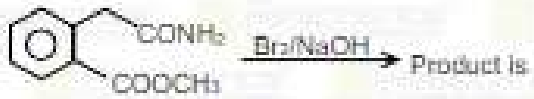
**Ans.** **(2)**

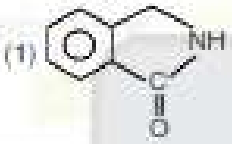
**Sol.** $CH_2=\underset{\displaystyle CN}{\underset{|}{CH}} \longrightarrow \left(-CH_2-\underset{\displaystyle CN}{\underset{|}{CH}}-\right)_n$

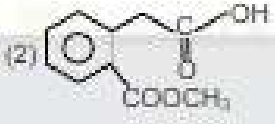
Polyacrylonitrile (PAN = orlon)

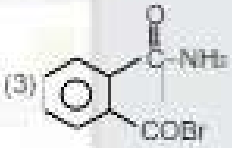
17. Photochemical smog occurs in which area?
(1) Himalaya village area (2) Industrial area
(3) Plain area (4) Muddy area

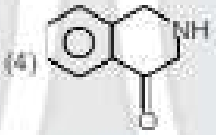
**Ans.** **(2)**

18. 
Product is

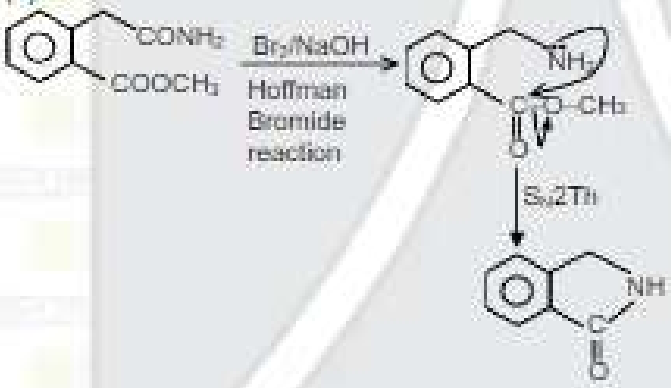
(1) 

(2) 

(3) 

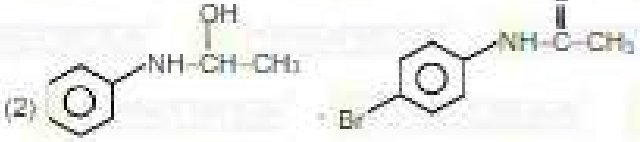
(4) 

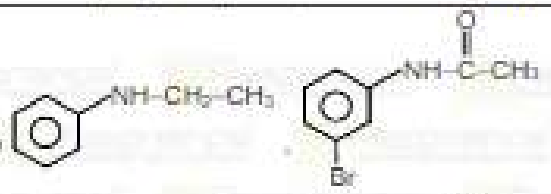
**Ans.** **(1)**

**Sol.** 


19. 
Identify A and B

(1) 

(2) 

(3) 

(4) 

**Ans.** (1)

**20.** Match the following :

| | List-I (Element) | | List-II (Reagent use to identify) |
|---|---|---|---|
| (A) | Halogen | (I) | $Fe(CN)_6$ |
| (B) | Sulphur | (II) | $AgNO_3$ |
| (C) | Nitrogen | (III) | $[Fe(CN)_5NO]^{-2}$ |
| (D) | Phosphorous | (IV) | $(NH_4)_2MoO_4$ |

(1) A – II ; B – III ; C – I ; D – IV (2) A – III ; B – I ; C – II ; D – IV
(3) A – I ; B – II ; C – III ; D – IV (4) A – II ; B – I ; C – IV ; D – III

**Ans.** (1)

**Sol.** (1) Halogen + $AgNO_3$ → AgX ppt
(2) 'S' + Sodium nitro prusside → Violet colour
(3) 'N' + $[Fe(CN)_6]^{-4}$ → Blue colour
(4) 'P' + $(NH_4)_2MoO_4$ → $(NH_4)_3PO_4.12MoO_3$ →Yellow colour

**21.** Match the following :

| | List-I | | List-II |
|---|---|---|---|
| (A) | Vitamin A | (I) | Beri-Beri |
| (B) | Thiamine | (II) | Scurvery |
| (C) | Ascorbic acid | (III) | Chelosis |
| (D) | Riboflavin | (IV) | Xeropthalmia |

(1) A – IV ; B – I ; C – II ; D – III (2) A – I ; B – II ; C – III ; D – IV
(3) A – III ; B – IV ; C – II ; D – I (4) A – II ; B – I ; C – III ; D – IV

**Ans.** (1)

**Sol.** Vitamin A » Xeropthalmia
Thiamine » Beri-Beri
Ascorbic acid » Chelosis
Riboflavin » Xeropthalmia

**22.** Match the following :

| | List-I | | List-II |
|---|---|---|---|
| (A) | Etard | (I) | CO + HCl |
| (B) | Gatterman-koach | (II) | $CrO_2Cl_2 + CS_2$ |
| (C) | H.V.Z | (III) | Red P + $X_2$ |
| (D) | Haloform reaction | (IV) | $I_2$/NaOH |

(1) A – II ; B – I ; C – IV ; D – III (2) A – IV ; B – III ; C – I ; D – II
(3) A – I ; B – II ; C – IV ; D – III (4) A – III ; B – II ; C – I ; D – IV

**Ans.** (1)

**Sol.** (A) 

Etard

(B) 

Gatterman-koach reaction

(C) $CH_3-COOH \xrightarrow[\text{Red P}]{X_2} CH_2(X)-COOH$

H.V.Z. Reaction

(D) $CH_3-\underset{\underset{O}{\|}}{C}-R \xrightarrow{I_2/NaOH} CHI_3 + R-\underset{\underset{O}{\|}}{C}-O^-Na^+$

Haloform reaction

**23.** Match the following :

| | List-I | | List-II |
|---|---|---|---|
| (A) | Sucrose → Glucose | (I) | Invertase |
| (B) | Protein → Amino acid | (II) | Zymase |
| (C) | Glucose → ethylalcohol | (III) | Pepsin |
| (D) | Starch → Maltose | (IV) | Diastase |

(1) A – I ; B – II ; C – III ; D – IV (2) A – I ; B – III ; C – II ; D – IV
(3) A – III ; B – II ; C – I ; D – IV (4) A – III ; B – IV ; C – I ; D – II

**Ans.** **(2)**

**Sol.** Cansugar $\xrightarrow{\text{Invertase}}$ Glucose + Fructose

Glucose $\xrightarrow{\text{Zymase}}$ ethylalcohol

Starch $\xrightarrow{\text{Diastase}}$ Maltose

Maltose $\xrightarrow{\text{Maltase}}$ Glucose

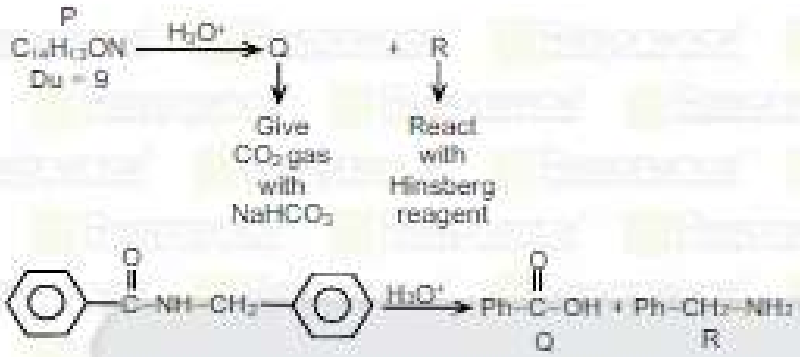
Protein $\xrightarrow{\text{Pepsin}}$ Amino acid

**24.** $\underset{\underset{(C_{14}H_{13}ON)}{\text{Compund P}}}{} \xrightarrow{H_3O^+} Q + R$

Q gives effervescence with $NaHCO_3$ while compound R react with Hinsberg reagent to give oily liquid which react with NaOH. Find product Q and R respectively.
(1) $C_6H_5COOH$ and $C_6H_{13}NH_2$
(2) $C_6H_5COOH$ and $C_6H_5CH_2NH_2$
(3) $CH_3(CH_2)_6COOH$ and $CH_3-(CH_2)_6-NH_2$
(4) $CH_3(CH_2)_6CONH_2$ and $CH_3(CH_2)_6COOH$

**Ans.** **(2)**

**Sol.**




**25.** How many total products obtain when ethane react with excess of $Br_2$ in presence of sunlight.

**Ans.** **(9)**

**Sol.**