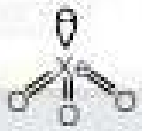
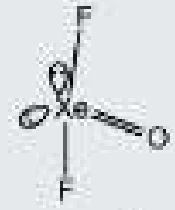
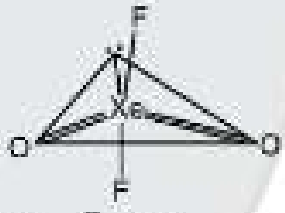
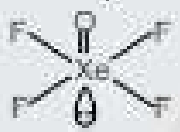
PART : CHEMISTRY

1. How many of following compound of Xenon have one lone pair on central atom :
XeO_3, $XeOF_2$, XeO_2F_2, $XeOF_4$, XeF_5^-

Ans. **(3)**

Sol. XeO_3, $XeOF_2$, XeO_2F_2, $XeOF_4$, XeF_5^-

		number of lone pair of electron on central atom :
XeO_3		(Pyramidal) (1)
$XeOF_2$		(T-shape) (2)
XeO_2F_2		(See-saw) (1)
$XeOF_4$		(Square pyramidal) (1)
$[XeF_5]^-$		(Pantagonal Planner) (2)

2. The sum of oxidation number of central atom in $[Fe(CO)_5]$, VO^{2+}, WO_3 is_____

Ans. **(10)**

Sol. $[Fe(CO)_5]$ oxidation number of Fe = 0
VO^{2+} oxidation number of V = +4
WO_3 oxidation number of W = +6

3. **Statement – I** : Methyl arrange is a weak acid.
Statement – II : Benzenoid form of methyl orange have more intense colour then its quinonoid form.
on the basis of above statement identify correct option :
(1) Statement-I is correct and **Statement – II** is incorrect.
(2) Statement-I is incorrect and Statement-II is correct.
(3) Both statements I and II are correct.
(4) Both statements I and II are incorrect.

Ans. **(2)**

Sol.

Benzenoid form of anion (yellow in colour)

Quinonoid form of the anion (Pinkish red in colour)

Methyl orange is basic in nature

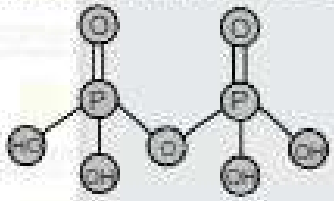
MeOH ⟶ $Me^+ + OH^-$

Yellow Red

4. The sum of σ and π bond in pyrophosphoric acid is _____

Ans. **(14)**

Sol. Pyrophosphoric acid ⟶ $H_4P_2O_7$



$H_4P_2O_7$

Pyrophosphoric acid

Number of σ bond = 12

Number of π bond = 2

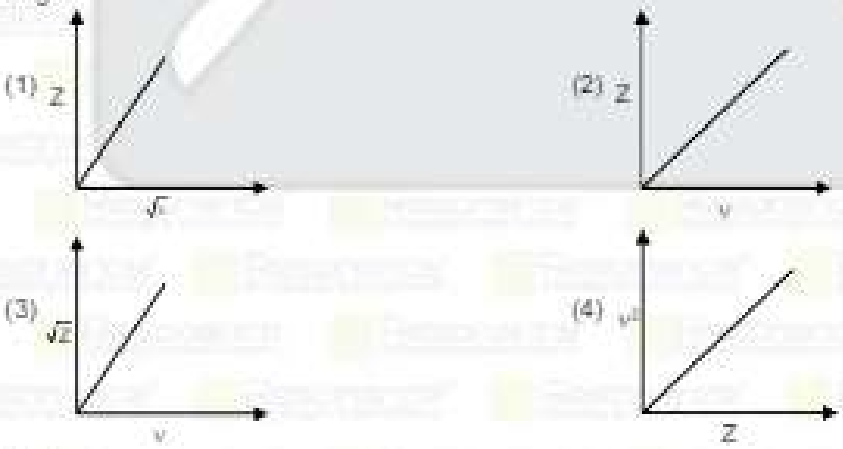
5. In good quality cement ratio of lime stone to total oxides of silicon (SiO_2),alumina(Al_2O_3) and iron (Fe_2O_3) should be close to :

(1) 1 (2) 2 (3) 3 (4) 4

Ans. **(2)**

Sol. For a good quality cement, the ratio of silica (SiO_2) to alumina (Al_2O_3) should be between 2.5 and 4 and **the ratio of lime (CaO) to the total of the oxides of silicon (SiO_2) aluminium (Al_2O_3) and iron (Fe_2O_3) should be as close as possible to 2.**

6. Which of the following relationship is correct between Z and $\sqrt{v}$ during bombardment of electron on metal target.

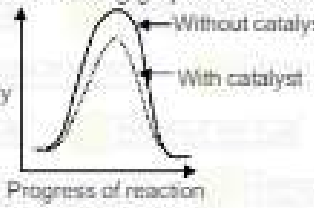


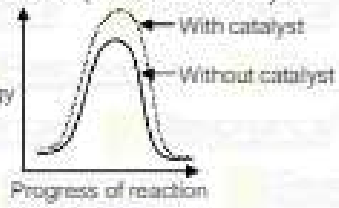
Ans. **(1)**

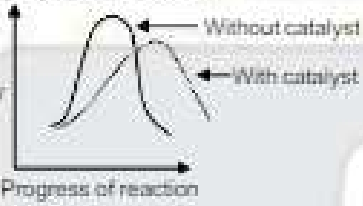
Sol. During bombardment of electron on metal surface.

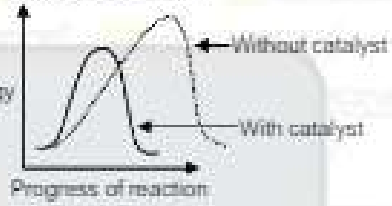
$Z \propto \sqrt{v}$

7. Which of the following graph is correct regarding without and with presence of catalyst.

(1) 

(2) 

(3) 

(4) 

Ans. **(1)**

Sol. A catalyst drives the reaction through a low energy path and hence E_a is less. That is, the function of the catalyst is to lower down the activation energy.
E_a = Energy of activation in absence of catalyst.
E'_a = Energy of activation in presence of catalyst.
$E_a - E'_a$ = lowering of activation energy by catalyst.

8. Which of the following is responsible for reduction of Al_2O_3 in Hall-Heroult process
(1) Graphite
(2) CaF_2
(3) Na_3AlF_6
(4) Mg

Ans. **(1)**

Sol. **Electrolytic reduction (Hall-Heroult process) :**
The purified Al_2O_3 is mixed with Na_3AlF_6 (cryolite) or CaF_2 (fluorspar) which lowers the melting point of the mixture and brings conductivity. The fused matrix is electrolysed. Steel cathode and graphite anode are used. **The graphite anode is useful here for reduction to the metal. The overall reaction may be taken as :** $\mathbf{2Al_2O_3 + 3C \longrightarrow 4Al + 3CO_2}$
The electolysis of the molten mass is carried out in an electrolytic cell using carbon electrodes. In hall Heroult process graphite is act as reducing agent

9. Complex ion $[Mn(NCS)_6]^{x-}$ has magnetic moment (spin only) 6.06 BM. The value of X is_____.

Ans. **(5)**

Sol. On the basic magnetic moment number of unpaired electron = 6
$_{25}Mn = 3d^5\ 4s^2$
So $Mn^{+1} = 3d^5\ 4s^1$
$[Mn(NCS)_6]^{x-} \Rightarrow [(+1)+(-1)6] = -X$
So $x = 5$; complex is $[Mn(NCS)_6]^{5-}$

10.

Column-I (Complex)	Column-II (No. of unpaired elctron)
(i) $[Cr(CN)_6]^{3-}$	(a) 0
(ii) $[Fe(H_2O)_6]^{2+}$	(b) 2
(iii) $[Ni(NH_3)_6]^{2+}$	(c) 3
(iv) $[Co(NH_3)_6]^{3+}$	(d) 4

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

Ans. **(1)**

Sol.

complex ion	Configuration		number of unpaired electron
(i) $Cr(CN)_6]^{3-}$	$_{24}Cr^{3+} = 3d^3$	$\Rightarrow t_{2g}^{1,1,1}$, $e_g^{0,0}$	3
(ii) $[Fe(H_2O)_6]^{2+}$	$_{26}Fe^{2+} = 3d^6$	$\Rightarrow t_{2g}^{2,1,1}$, $e_g^{1,1}$	4
(iii) $[Ni(NH_3)_6]^{2+}$	$_{28}Ni^{2+} = 3d^8$	$\Rightarrow t_{2g}^{2,2,2}$, $e_g^{1,1}$	2
(iv) $[Co(NH_3)_6]^{3+}$	$_{27}Co^{3+} = 3d^6$	$\Rightarrow t_{2g}^{2,2,2}$, $e_g^{0,0}$	0

11. The boiling point of two solvent X and Y are in the ratio of 2 : 1 and their enthalpy of vaporisation is in the ratio of 1 : 2. Find the ratio of elevation in boiling point when same moles of solutes are added to the same mass of both the solvent, if the molar mass of X is twice that of Y

Ans. **(16)**

Sol. $\Delta T_b = K_b\, m \qquad Kb = \dfrac{RTb^2 xM_{solvent}}{1000x\Delta H_{vap}}$

$$\frac{(\Delta Tb)_X}{(\Delta Tb)_Y} = \left[\frac{(Tb)_X}{(Tb)_Y}\right]^2 x\frac{M_X}{M_Y} x\frac{\Delta H_Y}{\Delta H_X} = \left(\frac{2}{1}\right)^2\left(\frac{2}{1}\right)x\frac{2}{1} = 16$$

12. Ratio of wavelength of H_α and H_β of blamer series is $\left(\frac{x}{20}\right)$, then X is _____.

Ans. **(27)**

Sol. For Balmer series $n_1 = 2$; $n_2 = 3, 4, 5.....$

For H –atom

$$\frac{1}{\lambda_\alpha} = R_H\left[\frac{1}{(2)^2} - \frac{1}{(3)^2}\right] = R_H\left(\frac{5}{36}\right)$$

$$\frac{1}{\lambda_\beta} = R_H\left[\frac{1}{(2)^2} - \frac{1}{(4)^2}\right] = R_H\left(\frac{3}{16}\right)$$

$$\frac{(\lambda_\alpha)_H}{(\lambda_\beta)_H} = R_H\left(\frac{3}{16}\right)\frac{36}{5} = \frac{27}{20}$$

So X = 27

13. Coagulating value of $AlCl_3$ and NaCl are 0.09 and 50.04 then ratio of coagulating power of $AlCl_3$ and NaCl is_____ [Nearest integer]

Ans. **(556)**

Sol. Coagulating power $\propto \frac{1}{\text{Coagulating value}}$

$$\frac{\text{Coagulating power of } AlCl_3}{\text{Coagulating power of NaCl}} = \frac{\text{Coagulating value of NaCl}}{\text{Coagulating value of } AlCl_3}$$

$$= \frac{50.04}{0.09} = 556$$

14. Which combination of following number have same number of signification figure.
(i) 0.00252 (ii) 1.0003 (iii) 15.0 (iv) 163
(1) i, iii, iv, only
(2) i, ii, iii, only
(3) ii, iii, only
(4) i, ii, only

Ans. **(1)**

Sol.

Number	signification figure
(i) 0.00252	3
(ii) 1.0003	5
(iii) 15.0	3
(iv) 163	3

15. Which compound is added to reduce decomposition of H_2O_2.
(1) alkali
(2) urea
(3) dust
(4) glass

Ans. **(2)**

Sol. H_2O_2 decomposes slowly on exposure to light.

$2H_2O_2$ (l) $\rightarrow 2H_2O$ (l) + O_2 (g)

In the presence of metal surfaces or traces of alkali (present in glass containers), the above reaction is catalysed. It is, therefore, stored in wax-lined glass or plastic vessels in dark. **Urea can be added as a stabiliser.** It is kept away from dust because dust can induce explosive decomposition of the compound

16. Identify the correct order of vander-waal constant "a" for Ar, CH_4, H_2O and C_6H_6
(1) $H_2O > C_6H_6 > Ar > CH_4$
(2) $Ar > H_2O > CH_4 > C_6H_6$
(3) $Ar > C_6H_6 > H_2O > CH_4$
(4) $C_6H_6 > H_2O > CH_4 > Ar$

Ans. **(4)**

Sol. Vander wall constant a depends on intermolecular force of attraction so correct order of a is
$C_6H_6 > H_2O > CH_4 > Ar$

Gas	Vander-waal constant "a" (atm. L^2. mol^{-2})
Ar	1.355
C_6H_6	18.57
CH_4	2.253
H_2O	5.536

17. How many from following orbitals have 5 radial nodes :
7s, 7p, 8s, 8d, 6s

Ans. **(3)**

Sol. Number of radial node = (n-ℓ-1)

orbital	number of radial node = (n-ℓ-1)
(i) 7s	(7-0-1) = 6
(ii) 7p	(7-1-1) = 5
(iii) 8s	(8-0-1) = 7
(iv) 8d	(8-2-1) = 5
(v) 6s	(6-0-1) = 5

18. **Statement – I** : Sea water contain 30 times sodium than potassium.

Statement – II : Size of sodium is smaller than potassium.

(1) Both **statements-I** and **statements-**II are correct.

(2) Both **statements-I** and **statements-**II 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. **Statements-I** sodium is about 30 times abundant as potassium in oceans.
Statements-II size of sodium is smaller than potassium.

19. The correct order of acidity is:

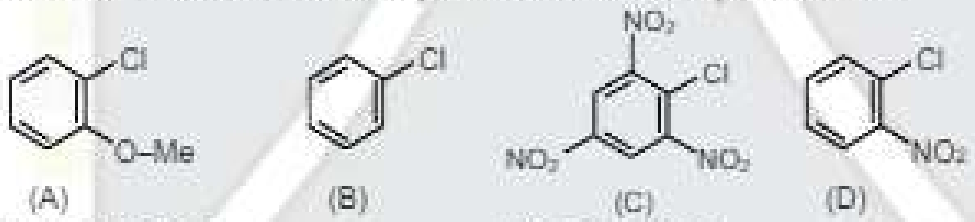
(A) CF_3COOH (B) $CH_2(F)-COOH$ (C) $CH_2(Cl)-COOH$ (D) $CH_2(Br)-COOH$ (E) CH_3-COOH

(1) A > B > C > D > E
(2) A > C > B > D > E
(3) E > B > C > D > A
(4) D > E > C > B > A

Ans. (1)

Sol. –I effect of F > Cl > Br and greater the extent of –I effect, greater the acidity.

20. The correct order of rate of nucleophilic substitution with aqueous NaOH is



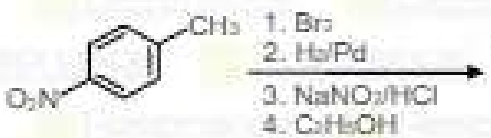
(A) (B) (C) (D)

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

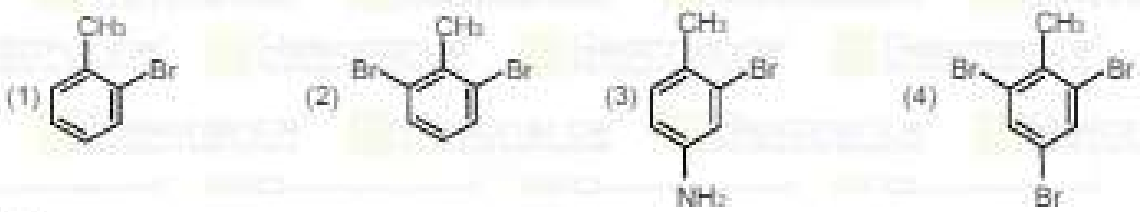
Ans. (2)

Sol. Chlorobenzene undergoes aromatic nucleophilic substitution via carbanion intermediate in such a reaction greater the –M group (–NO_2, –CN etc) at O & P position greater the stability of carbanion intermediate and faster the rate of reaction.

21.

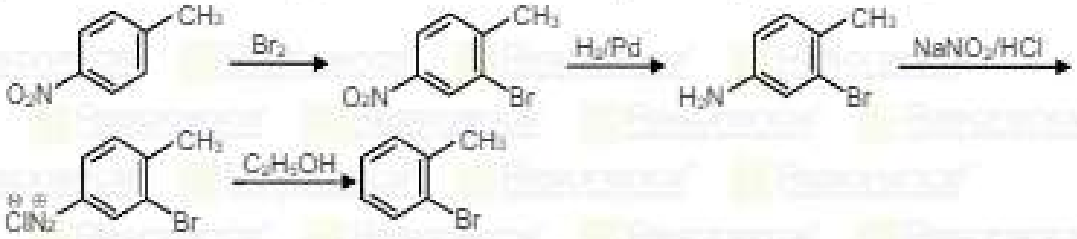


Product is



Ans. (1)

Sol.



22. Which reaction is not used in the formation of Ozone hole.

(1) $CF_2Cl_2(g) \xrightarrow{UV} \dot{Cl} + \dot{C}F_2Cl$

(2) $\dot{Cl} + O_3(g) \longrightarrow \dot{ClO}_{(g)} + O_2(g)$

(3) $\dot{ClO}_{(g)} + O(g) \longrightarrow \dot{Cl}_{(g)} + O_2(g)$

(4) $O_3 \longrightarrow O_2 + O$

Ans. **(4)**

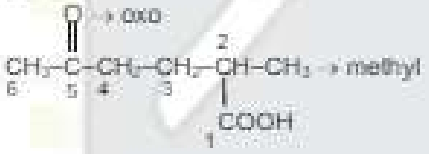
Sol. Formation of Ozone hole proceed with the decomposition of chlorofluorocarbons and formation of $\dot{Cl}$ radical.

23. IUPAC name of the given compound is

(1) 2-Methyl-5-oxohexanoic acid
(2) 5-Carboxyhexan-2-one
(3) 5-Oxo-2-carboxyhexane
(4) 2-Methylhexan-5-one-2-oic acid

Ans. **(1)**

Sol.



2-Methyl-5-oxohexanoic acid

24. The correct match of the amino acids and their code.

	List-I (Amino acid)		List-II (Code)
(A)	Glutamine	(i)	Y
(B)	Tryptophan	(ii)	Q
(C)	Tyrosine	(iii)	E
(D)	Glutamic acid	(iv)	W

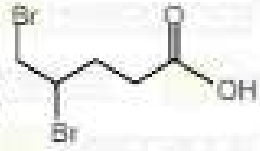
(1) A – (ii) ; B – (iv) ; C – (i) ; D – (iii)
(2) A – (iii) ; B – (ii) ; C – (iv) ; D – (i)
(3) A – (i) ; B – (ii) ; C – (iii) ; D – (iv)
(4) A – (iv) ; B – (ii) ; C – (i) ; D – (iii)

Ans. **(1)**

Sol. Based on fact.

25. 

Product is

(1) 

(2) 

(3) 

(4) 

Ans. **(4)**

Sol. 

26. A compound (H) react with Pthallic anhydride with NaOH to form Y, which is an indicator X and Y is respectively.
(1) Salicyldehyde and Phenopthalein
(2) Carbolic acid and Phenophthalein
(3) Ansole and Methyl Orange
(4) Salicylic and Phenophthalein

Ans. **(2)**

Sol. Carbolic acid = phenol