PART : CHEMISTRY

1. Arrange the following in ascending order wavelength
λ_1 = Infrared
λ_2 = Micro
λ_3 = X-ray
λ_4 = U.V.
(1) $\lambda_3 < \lambda_4 < \lambda_1 < \lambda_2$ (2) $\lambda_3 < \lambda_1 < \lambda_4 < \lambda_2$ (3) $\lambda_2 < \lambda_1 < \lambda_4 < \lambda_3$ (4) $\lambda_1 < \lambda_4 < \lambda_2 < \lambda_3$

Ans. **(1)**

Sol. Order of wavelength in EM spectrum:
Cosmic <Gamma <X-rays <UV <Visible <Intra Red < Micro <Radio

2. $t_{2g}^3\ e_g^1$ configuration is possible in:
(1) WFL; high spin (2) WFL; low spin (3) SFL; high spin (4) SFL; low spin

Ans. **(1)**

Sol. WFL will not cause pairing & above is high spin arrangement (greater no. unpaired e^-).

3. When ethane -1, 2-diammine is progressive added to aqueous of Nickel (II) chloride the sequence of colour changed observed will be
(1) Pale blue → Blue → Green → Violet (2) Violet → Blue → Pale blue → Green
(3) Pale blue → Blue → Violet → Green (4) Green → Pale blue → Blue → viole

Ans. **(4)**

Sol.

$[Ni(H_2O)_6]^{2+}$ (Green) $\xrightarrow{en(aq)}$ $[Ni(H_2O)_4\ en]^{2+}$ (Pale blue)

$\downarrow$ en(aq)

$[Ni(H_2O)_2\ (en)_2]^{2+}$ (Blue)

$\downarrow$ en(aq)

$[Ni(en)_3]^{2+}$ (Violet)

4. **Statement-I :** IE_1 of Sn >Pb
Statement-II : IE_1 of Si >Ge
(1) Both Statement I and statement II are true (2) Both statement I and statement II are false
(3) Statement I is true but statement II is false (4) Statement I is false but statement II is true

Ans. **(4)**

Sol. IE decreases down the gap. So S1 >Ge & Pb, Sn exceptional

5. Compound $\xrightarrow{\text{aquaregia}}$ B $\xrightarrow[CH_3COOH]{KNO_2}$ Yellow ppt
(1) NiS (2) ZnS (3) CoS (4) MnS

Ans. **(3)**

Sol. $CoS \xrightarrow{\text{aquaregia}} CoCl_2 \xrightarrow[CH_3COOH]{KNO_2} K_3[Co(NO_2)_6]\downarrow$ Yellow

6. 54.2% C, 9.2% H & 36.6% O are present in a compound. If its molar mass is 132 g, its molecular formula is

(1) $C_6H_{12}O_3$ (2) $C_4H_8O_2$ (3) $C_6H_{12}O_6$ (4) None of these

Ans. **(1)**

Sol. $C : H : O = \frac{54.2}{12} : \frac{9.2}{1} : \frac{36.6}{16}$

$=4.6 : 9.2 : 2.3$

$=2 : 4 : 1$

$Ef = C_2H_4O_1 \quad (E.F.)_{mass} = 44$

$n = \frac{132}{44} = 3 \therefore Mf = (C_2H_4O)_3 = C_6H_{12}O_3$

7. Consider the following reactions

$S_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow SO_{3(g)} + 2x$ kJ

$SO_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow SO_{3(g)} + y$ kJ

Calculate heat of reaction (kJ) for the given reaction

$S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$

(1) $-(x+y)$ (2) $-(2x+y)$ (3) x/y (4) $y-2x$

Ans. **(4)**

Sol. $\Delta H_1 = -2x$

$\Delta H_2 = -y$

$S_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow SO_{3(g)}, \Delta H_1 = -2x$

$SO_{3(g)} \rightarrow SO_{2(g)} + \frac{1}{2}O_{2(g)}, \Delta H_2 = y$

$S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$

$\Delta H_r = \Delta H_1 + \Delta H_2$

$= -2x + y$

$= y - 2x$ kJ

8. Match the following cations with respective spin magnetic moment

Ions	H(B.M)
(i) Ti^{3+}	(p) 2.83
(ii) Sc^{+3}	(q) 0.00
(iii) V^{+2}	(r) 1.73
(iv) Ni^{+2}	(s) 3.87

(1) i-r; ii-q ; iii-s ; iv-p (2) i-p; ii-q ; iii-r ; iv-s

(3) i-s; ii-p ; iii-q ; iv-r (4) i-s; ii-p ; iii-r ; iv-q

Ans. **(1)**

9. Calculate the overall activation energy

$K = \sqrt{\frac{k_1 k_3}{k_2}}$ $E_{a_1} = 60$kJ

$E_{a_2} = 40$kJ

$E_{a_3} = 20$kJ

Ans. **(20)**

Sol. $e^{-Ea/RT} = \sqrt{\frac{e^{-Ea_1/RT} \cdot e^{-Ea_3/RT}}{e^{-Ea_2/RT}}}$

$e^{-Ea/RT} = \sqrt{e^{\frac{(Ea_2 - Ea_1 - Ea_3)}{RT}}}$

$-E_a = (Ea_2 - Ea_1 - Ea_3) \times \frac{1}{2}$

$E_a = (Ea_1 + Ea_3 - Ea_2) \times \frac{1}{2}$

$E_a = \frac{1}{2}(60 + 20 - 40) = 20\,kJ$

10. **Statement-I :** Oxygen-oxygen bond length in O_3 is greater than O_2.
Statement-II : O–O bond order in O_3 is 1.5 and O–O bond order is O_2 is 2.
(1) Both Statement I and statement II are true (2) Both statement I and statement II are false
(3) Statement I is true but statement II is false (4) Statement I is false but statement II is true

Ans. **(1)**

11. The successive ionisation energy (I.E.) of an element 'X' is given

	IE_1	IE_2	IE_3	IE_4	IE_5
$X \rightarrow$	500	600	2000	2200	2600

Data given in kJ /mol.
Find out the group number of element X.
(1) Group-13 (2) Group-14 (3) Group-2 (4) Group-13

Ans. **(3)**

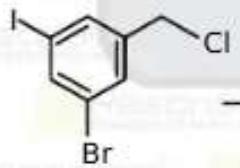
12. MX_2 observed molar mass: 65.6 Normal molar mass: 164
Find percentage dissociation.

$MX_2 \longrightarrow M^{+2} + 2X^-$

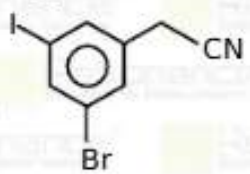
Ans. **(78)**

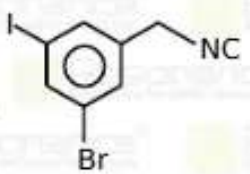
Sol. $i = \frac{\text{normal molar mass}}{\text{abnormal molar mass}} = \frac{164}{65.6} = 2.5$

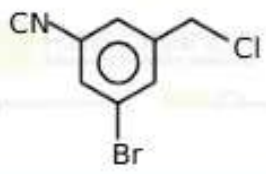
$2.5 = 1 + 2\alpha$
$1.5 = 2\alpha$
$\alpha = 0.75$
$\%\alpha = 75$

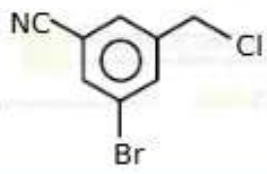
13. 

$\xrightarrow{AgCN}$ P Major Product?

(1) 

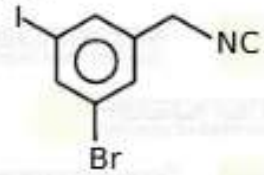
(2) 

(3) 

(4) 

Ans. **(2)**

Sol.



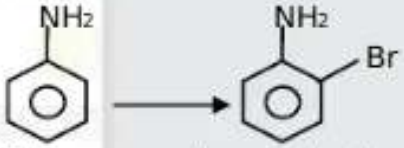
14. Match the following reactions given in Column-I with respective reagents given in Column-II.

	Column-I		**Column-II**
(a)	Etard Reaction	(p)	$SnCl_2$ +HCl
(b)	Gattermann Reaction	(q)	CrO_2Cl_2
(c)	Gattermann Koch Reaction	(r)	Cu +HCl
(d)	Staphen Reaction	(s)	CO +HCl, Anhydrous $AlCl_3$

(1) a-(q); (b)-(r); (c)-(s); (d)-(p)
(2) a-(p); (b)-(q); (c)-(r); (d)-(s)
(3) a-(q); (b)-(s); (c)-(p); (d)-(r)
(4) a-(p); (b)-(r); (c)-(q); (d)-(s)

Ans. **(1)**

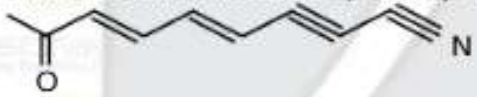
15.



Above conversion can be done by using which reagents among the following.
(1) Fe/Br_2, $H_2O(\Delta)$, H_2SO_4 (2) Ac_2O, H_2SO_4, Br_2,NaOH
(3) Ac_2O, $Br_2/AcOH$, H_2O/H^+ (4) Ac_2O, Br_2/Fe, NaOH

Ans. **(2)**

16. Find the total number of sp and sp^2 hybridised carbon atoms in the given compound.



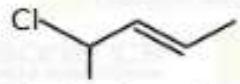
Ans. **(8)**

Sol. $sp^2 = 5$
$sp = 3$
Total = 8

17. In the carius method, 0.25 gm organic compound is heated with fuming HNO_3 then $AgNO_3$ is added it gives 0.15 gm AgBr if molecular mass of AgBr is 188 then find mass percentage of Br in that organic compound

Ans. **(25.53%)**

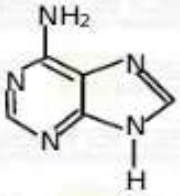
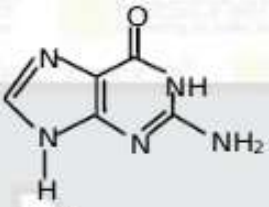
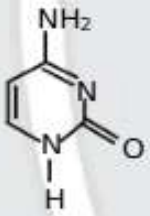
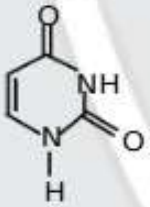
18.



Find total number of stereoisomers of the given compound.

Ans. **(4)**

19. Match the following Nitrogenous Bases with their respective structures.

	Column-I		**Column-II**
(a)	Cytosine	(p)	
(b)	Uracil	(q)	
(c)	Guanine	(r)	
(d)	Adenine	(s)	

(1) a-(q); (b)-(r); (c)-(s); (d)-(p)
(2) a-(r); (b)-(s); (c)-(q); (d)-(p)
(3) a-(q); (b)-(s); (c)-(p); (d)-(r)
(4) a-(p); (b)-(r); (c)-(q); (d)-(s)

Ans. (2)

20. A hydrocarbon X that has molar mass 80 gm contains 90% carbon. Find degree of unsaturation in X.

Ans. (3)