JEE Main September 2020

Question Paper With Text Solution

5 September| Shift-2

CHEMISTRY

MATRIX

JEE Main & Advanced | XI-XII Foundation| VI-X Pre-Foundation

Office : Piprali Road, Sikar (Raj.) | Ph. 01572-241911
Website : www.matrixedu.in ; Email : smd@matrixacademy.co.in

JEE MAIN SEP 2020 | 5 Sep SHIFT-2

1. Which one of the following polymers is not obtained by condensation polymerisation?

(1) Nylon 6 (2) Bune – N (3) Bakelite (4) Nylon 6, 6

Ans (2)

S. (1) $NH_2 - (CH_2)_5 - COOH \xrightarrow{\Delta} -NH-(CH_2)_5-C[NH-(CH_2)_5-C]_n$

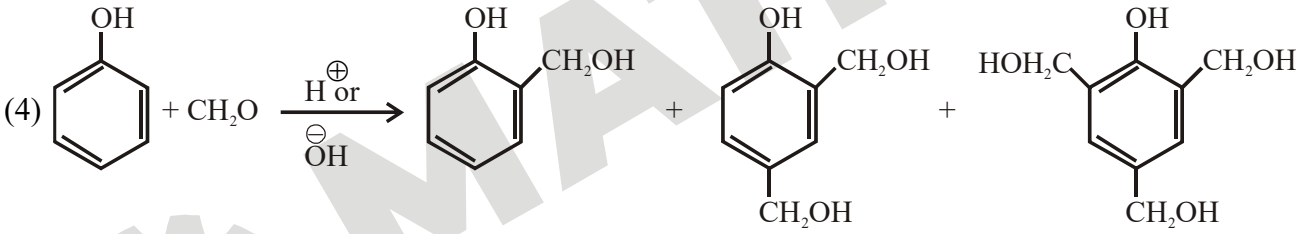
6–Aminohexanoic acid — Nylon–6

(2) $nH_2N - (CH_2)_6 - NH_2 + nHOOC - (CH_2)_4 - COOH \longrightarrow [NH-(CH_2)_6 - CO - (CH_2)_4 - CO]_n$

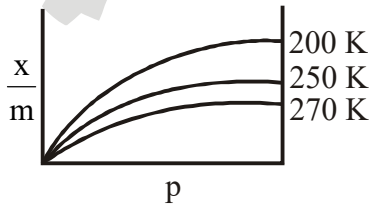
Hexamethylene diamine + Adipic acid — Nylon–6,6

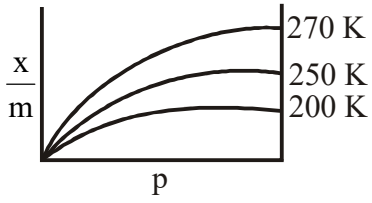
(3) $nCH_2 = CH - CH = CH_2 + nCH_2 = CH(CN) \xrightarrow{\text{Copolymerisation}} (CH_2 - CH = CH - CH_2 - CH_2 - CH(CN))_n$

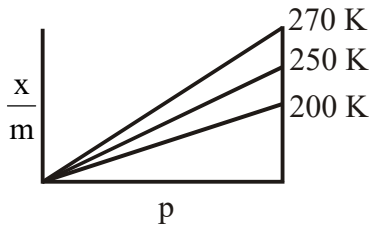
1,3–Butadiene + Acrylonitrile — Buna–N

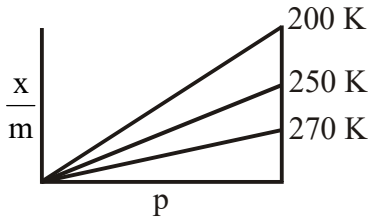
(4) 

2. Adsorption of a gas follows Freundlich adsorption isotherm. If x is the mass of the gas adsorbed on mass m of the adsorbent, the correct plot of $\frac{x}{m}$ versus p is :

(1) 

(2) 

(3) 

(4) 

Ans (1)

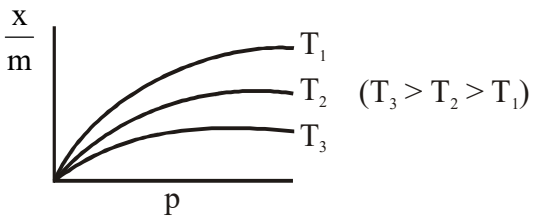
S. From Freundlich adsorption isotherm

$\frac{x}{m} \propto P^{1/n}$

$\frac{x}{m} \propto P$ (At low pressure)

$\frac{x}{m} \propto P^{\circ}$ (At high pressure)

$\rightarrow$ On increasing temperature physical adsorption decreases.



3. The correct statement about probability density (except at infinite distance from nucleus) is :

(1) It can be zero for 3p orbital

(2) It can be negative for 2p orbital

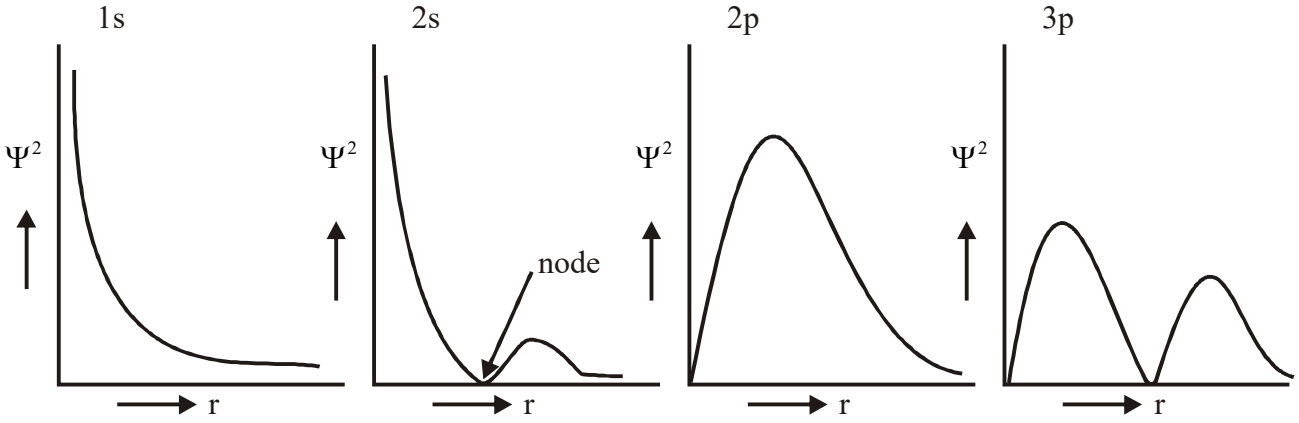
(3) It can never be zero for 2s orbital

(4) It can be zero for 1s orbital

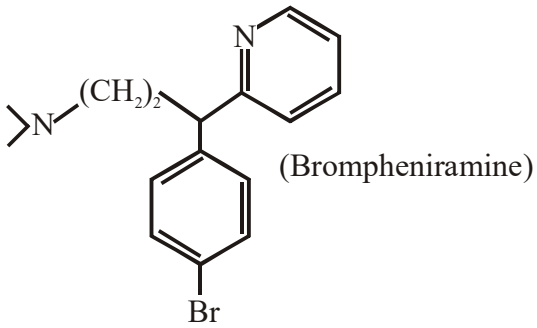
Ans (1)

S. From the following Ψ^2 function graph (Ψ^2 = probability density)

Ψ^2 can be zero for 3p orbital other than infinity.



4. The following molecule acts as an :



(Brompheniramine)

(1) Antiseptic (2) Anti–depressant (3) Anti–bacterial (4) Anti–histamine

Ans (4)

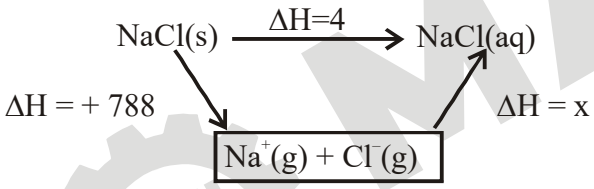
S. Synthetic drugs, brompheniramine act as antihistamines.

5. Lattice enthalpy and enthalpy of solution of NaCl are 788 kJ mol^{-1} and 4 kJ mol^{-1}, respectively. The hydration enthalpy of NaCl is :

(1) 784 kJ mol^{-1} (2) –784 kJ mol^{-1} (3) –780 kJ mol^{-1} (4) 780 kJ mol^{-1}

Ans (2)

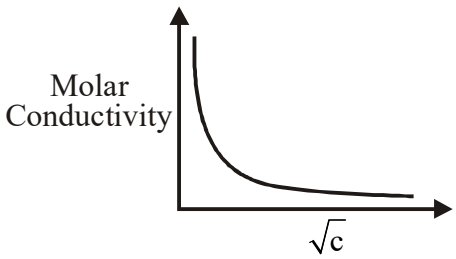
S.



$4 = 788 + x$

$x = -784$ kJ

6. The variation of molar conductivity with concentration of an electrolyte (X) in aqueous solution is shown in the given figure.



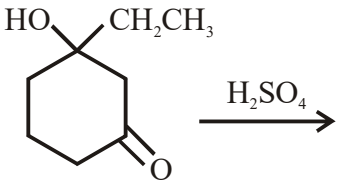
The electrolyte X is :

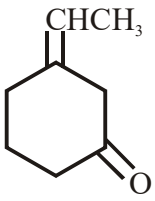
(1) KNO_3 (2) CH_3COOH (3) HCl (4) NaCl

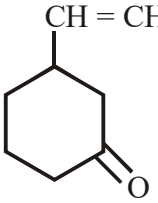
Ans (2)

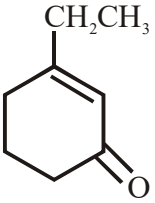
S. Graph represent variation of λ_M^C with respect to $\sqrt{C}$ for weak electrolyte.

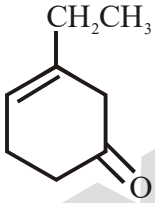
7. The major product of the following reaction is :



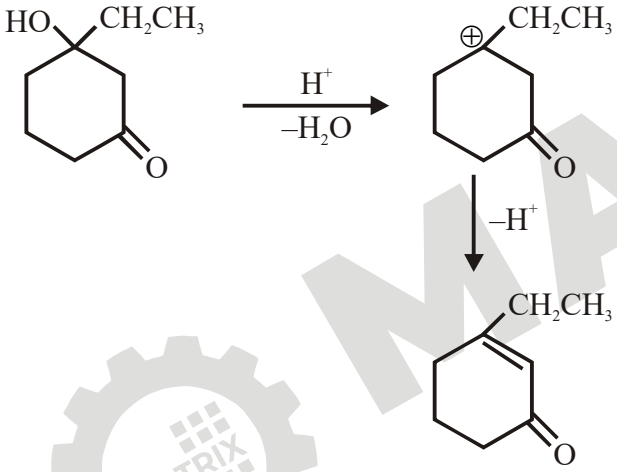
(1) 

(2) 

(3) 

(4) 

Ans (3)

S. 

Conjugated enone

8. Reaction of ammonia with excess Cl_2 gives :

(1) NCl_3 and NH_4Cl (2) NCl_3 and HCl

(3) NH_4Cl and HCl (4) NH_4Cl and N_2

Ans (2)

S. $NH_3 + 3Cl_2 \longrightarrow NCl_3 + 3HCl$

limiting excess

$8NH_3 + 3Cl_2 \longrightarrow 6NH_4Cl + N_2$

excess limiting

9. Boron and silicon of very high purity can be obtained through :

(1) electrolytic refining (2) vapour phase refining

(3) zone refining (4) liquation

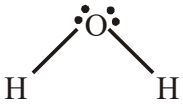
Ans (3)

S. Germanium, Silicon, Boron, Gallium and Indium can be obtained in pure state by zone refining process.

10. The compound that has the largest H – M – H bond angle (M = N, O, S, C), is :

(1) H_2O (2) H_2S (3) CH_4 (4) NH_3

Ans (3)

S. 

sp^3, ℓ.p = 2, B. A. = 104º30'

$H_2S \rightarrow$ No hybridisation [Drago's rule], bond angle = 92º

$\ddot{N}H_3$ sp^3 ℓ.p = 1, B.A. = 107º

CH_4 sp^3 ℓ.p = 0. B.A. = 109º28'

11. Hydrogen peroxide, in the pure state, is :

(1) planar and blue in colour (2) linear and blue in colour

(3) linear and almost colorless (4) non–planar and almost colorless

Ans (4)

S. Structure of H_2O_2 is of open book shape. It is a colour less viscous liquid but in large quantity appears blue in colour.

12. Consider the complex ions, *trans*–$[Co(en)_2Cl_2]^+$ (A) and

cis–$[Co(en)_2Cl_2]^+$ (B).

The correct statement regarding them is :

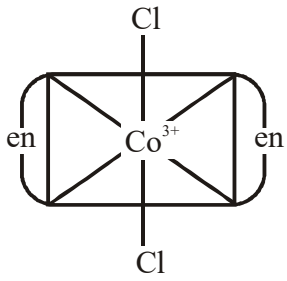
(1) both (A) and (B) can be optically active.

(2) (A) can be optically active, but (B) cannot be optically active.

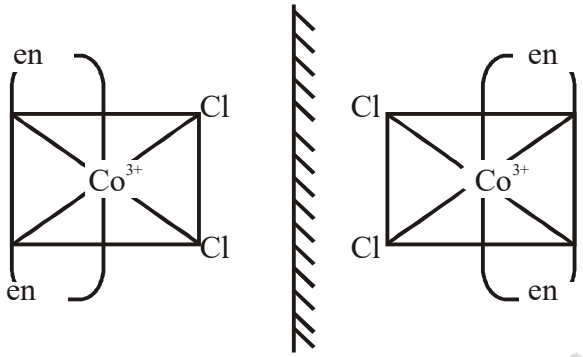
(3) both (A) and (B) cannot be optically active

(4) (A) cannot be optically active, but (B) can be optically active.

Ans (4)

S.  Have Plane of symmetry so will be optically inactive.

Trans-$[Co(en)_2Cl_2]^+$



cis-$[Co(en)_2Cl_2]^+ \rightarrow$ is optically active without plane of symmetry.

13. The one that is NOT suitable for the removal of permanent hardness of water is :

(1) Treatment with sodium carbonate

(2) Ion–exchange method

(3) Clark's method

(4) Calgon's method

Ans (3)

S. Clark's Method is used to remove temporary hardness by using lime water (or) $Ca(OH)_2$.

14. The correct order of the ionic radii of O^{2-}, N^{3-}, F^-, Mg^{2+}, Na^+ and Al^{3+} is :

(1) $Al^{3+} < Na^+ < Mg^{2+} < O^{2-} < F^- < N^{3-}$

(2) $N^{3-} < O^{2-} < F^- < Na^+ < Mg^{2+} < Al^{3+}$

(3) $Al^{3+} < Mg^{2+} < Na^+ < F^- < O^{2-} < N^{3-}$

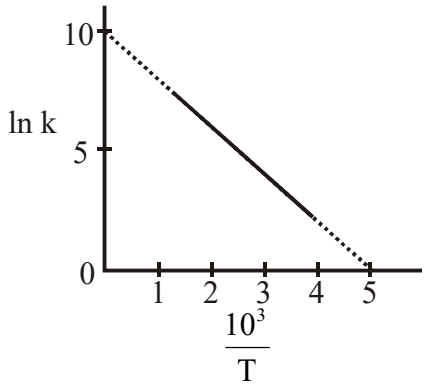
(4) $N^{3-} < F^- < O^{2-} < Mg^{2+} < Na^+ < Al^{3+}$

Ans (3)

S. $Al^{3+} < Mg^{2+} < Na^+ < F^- < O^{2-} < N^{3-}$

All are isoelectronic species so more is the z_{eff} less will be the ionic size.

15. The rate constant (k) of a reaction is measured at different temperatures (T), and the data are plotted in the given figure. The activation energy of the reaction in kJ mol^{-1} is : (R is gas constant)



(1) $\frac{2}{R}$ (2) R (3) 2R (4) $\frac{1}{R}$

Ans (3)

S. $k = Ae^{-Ea/RT}$

$$\ln k = \ln A - \left(\frac{E_a}{R}\right)\frac{1}{T}$$

$$\ln k = \ln A - \left(\frac{E_a}{R\times 10^3}\right)\times\frac{10^3}{T}$$

$$\text{Slope of graph} = \frac{-E_a}{R\times 10^3} = \frac{-10}{5}$$

$E_a = 2R \times 10^3$ J

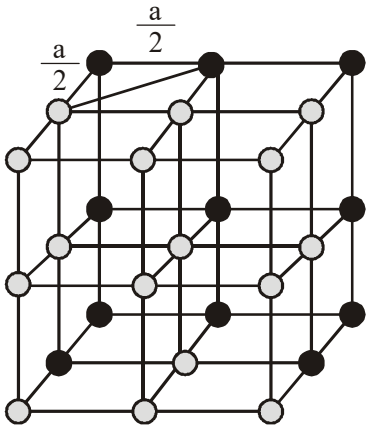
$E_a = 2R$ kJ

16. An element crystallises in a face–centred cubic (fcc) unit cell with cell edge a. The distance between the centres of two nearest octahedral voids in the crystal lattice is :

(1) $\frac{a}{2}$ (2) $\sqrt{2}a$ (3) a (4) $\frac{a}{\sqrt{2}}$

Ans (4)

S. In FCC octahedral voids are present at the edge centers and body center.



Minimum distance between centers of two octahedral voids

$$= x = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2} = \frac{a}{\sqrt{2}}$$

17. The major product formed in the following reaction is :

$CH_3CH = CHCH(CH_3)_2 \xrightarrow{HBr}$

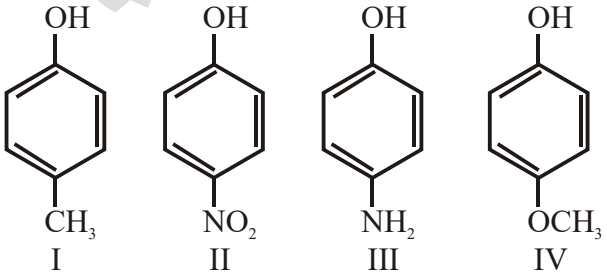
(1) $CH_3CH_2CH(Br)CH(CH_3)_2$ (2) $CH_3CH(Br)CH_2CH(CH_3)_2$

(3) $CH_3CH_2CH_2C(Br)(CH_3)_2$ (4) $Br(CH_2)_3CH(CH_3)_2$

Ans (2)

S. $CH_3CH=CHCH(CH_3)_2 \xrightarrow{H^{\oplus}} CH_3-\overset{\oplus}{C}H-\underset{H}{CH}-\underset{CH_3}{CH}-CH_3 \xrightarrow{Br^{\ominus}} CH_3-\underset{Br}{CH}-CH_2-\underset{CH_3}{CH}-CH_3$

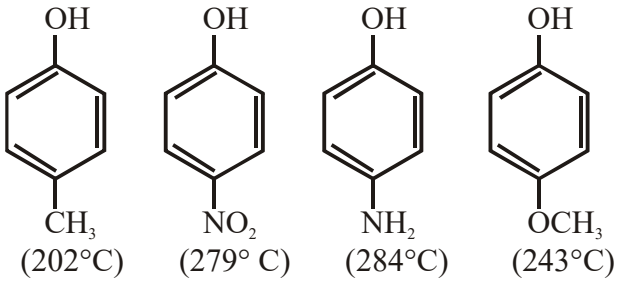
18. The increasing order of boiling points of the following compounds is :



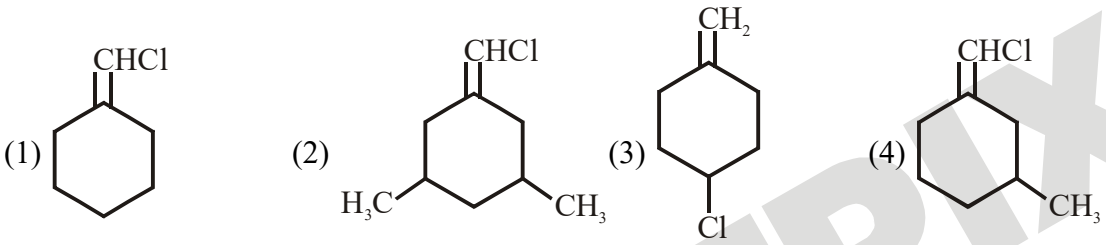
(1) IV < I < II < III (2) III < I < II < IV (3) I < III < IV < II (4) I < IV < III < II

Ans (4)

S.



19. Among the follwoing compounds, geometrical isomerism is exhibited by :

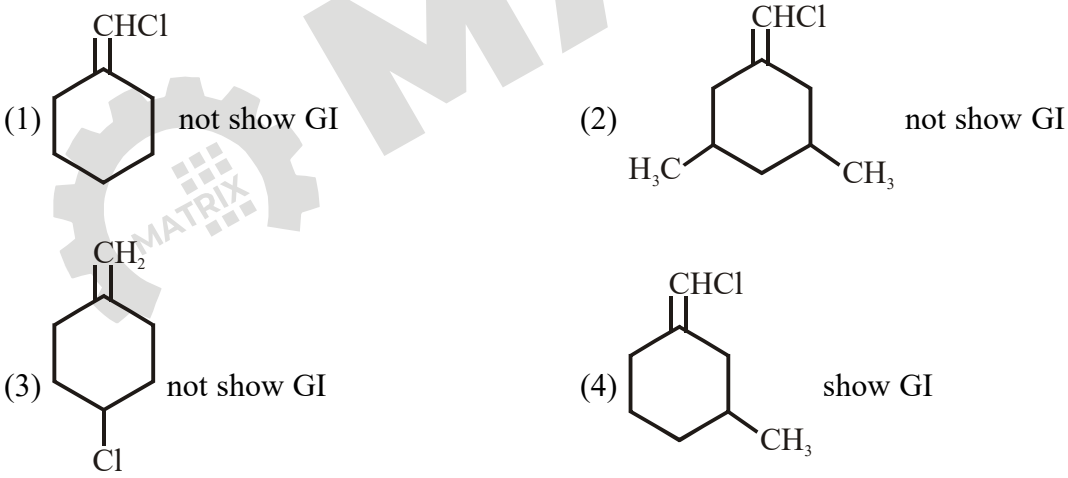


Ans (4)

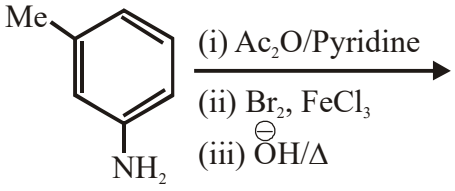
S. Geometrical isomerism arises due to

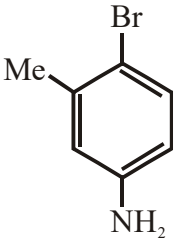
(1) The presence of a restricted rotation (double bond or a ring structure).

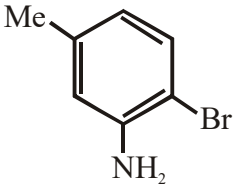
(2) Two different groups should be attached to any two carbon atoms of restricted rotation.

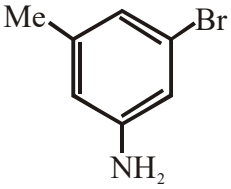


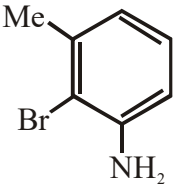
20. The final major product of the following reaction is :



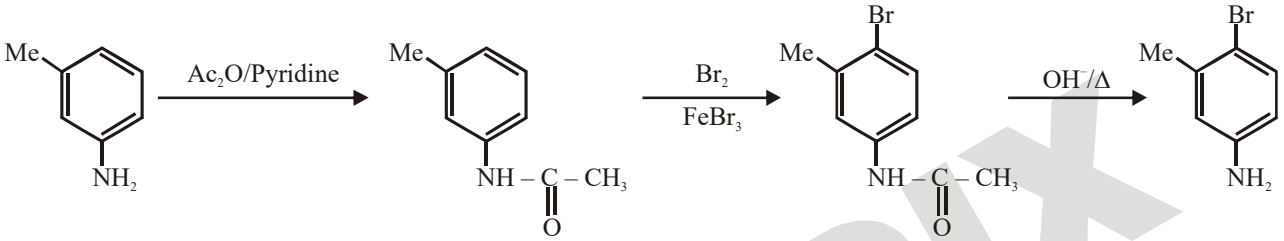
(1) 

(2) 

(3) 

(4) 

Ans (1)

S. 

21. Considering that $\Delta_0 > P$, the magnetic moment (in BM) of $[Ru(H_2O)_6]^{2+}$ would be _____.

Ans (0)

S. Magnetic moment (in B.M.) of $[Ru(H_2O)_6]^{2+}$ would be; while considering that $\Delta_0 > P$,

$Ru_{(44)}$; $[Kr]4d^75s^1$ (in ground state)

$\Rightarrow$ In $Ru^{2+} \Rightarrow 4d^6 \Rightarrow (t_2g)^6(eg)^0$

$\Rightarrow$ Here number of unpaired electrons in

$Ru^{2+} = (t_2g)^6\,(eg)^0 = 0$ and Hence

$\mu = \sqrt{n(n+2)}\ \text{B.M.} = 0\ \text{B.M.}$

22. For a reaction $X + Y \rightleftharpoons 2Z$, 1.0 mol of X, 1.5 mol of Y and 0.5 mol of Z were taken in a 1 L vessel and allowed to react. At equilibrium, the concentration of Z was 1.0 mol L^{-1}. The equilibrium constant of the reaction is _____ $\frac{x}{15}$. The value of x is _____.

Ans (16)

S.

	x	+	y	$\rightleftharpoons$	2z
t = 0	1 mol		1.5 mol		0.5 mol

Since moles of Z are increased at equilibrium therefore reaction goes in forward direction to attain the equilibrium.

x	+	y	$\rightleftharpoons$	2z

$t = t_{eq}$ 1 – a 1.5 – a 0.5 + 2a = 1 mole

$\Rightarrow a = 0.25$

x + y $\rightleftharpoons$ 2z

0.75 mol 1.25 mol 1mol

$$k_{eq} = \frac{[z]^2}{[x][y]} = \frac{1}{0.75 \times [1.25]} = \frac{X}{15}$$

X = 16

23. The volume, in mL, of 0.02 M $K_2Cr_2O_7$ solution required to react with 0.288 g of ferrous oxalate in acidic medium is _____. (Molar mass of Fe = 56 g mol^{-1})

Ans (50)

S. milliequivalent of $K_2Cr_2O_7$ = milliequivalent of FeC_2O_4

n-factor of $k_2Cr_2O_7 = 6$

n-factor of $FeC_2O_4 = 3$

$$V_{ml} \times 0.02 \times 6 = \frac{0.288}{144} \times 3 \times 1000$$

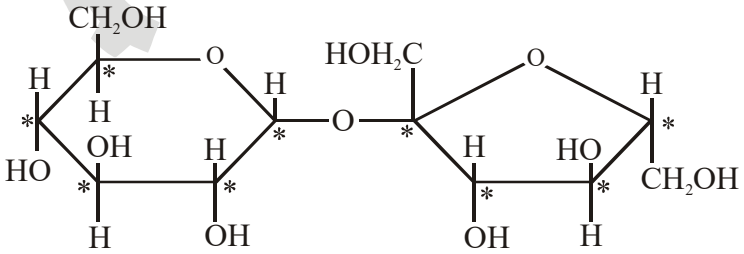
$V_{ml} \times 0.02 \times 6 = 2 \times 6$

$V_{ml} = 50$ ml

24. The number of chiral carbons present in sucrose is _____ .

Ans (9)

S.



(Sucrose)

* represents chiral carbon atom

25. For a dimerization reaction,

$2A(g) \rightarrow A_2(g)$,

at 298 K, $\Delta U^{\ominus} = -20$ kJ mol^{-1}, $\Delta S^{\ominus} = -30$ J K^{-1} mol^{-1}, then the $\Delta G^{\ominus}$ will be _____ J.

Ans (–13538)

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

$\Delta H = \Delta U + \Delta n_g RT$

$\Delta H = -20 \times 1000 - 1 \times 8.314$ J/mol. K $\times$ 298 K

$= -22477.572$ J

$= -13537.572$ J