JEE MAIN SEP 2020 (MEMORY BASED) | 5th Sep. SHIFT-2

Note: The answers are based on memory based questions which may be incomplete and incorrect.

1. In pure form H_2O_2 is found as:

(1) Linear, Blue colour (2) Linear, Colourless

(3) Planar, Blue colour (4) Non planar, Blue colour

Ans. (4)

Sol. 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.

2. The products obtained by reaction of ammonia with excess of Chlorine are :

(1) $NH_4Cl + HCl$ (2) $NCl_3 + N_2$ (3) $NCl_3 + HCl$ (4) $NH_4Cl + N_2$

Ans. (3)

Sol. $NH_3 + 3Cl_2 \rightarrow NCl_3 + 3HCl$

limiting excess

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

excess limiting

3. A diatomic gas expands adiabatically in such a way that final density is 32 times of initial density and final pressure become N times of initial pressure. The value of N is :

(1) 128 (2) $\frac{1}{32}$ (3) 32 (4) $\frac{1}{128}$

Ans. (1)

Sol. for diatomic gas $\gamma = \frac{7}{5}$

3. Use $PV^{\gamma} = K$

$P_1V_1^{\gamma} = P_2V_2^{\gamma}$ $\Rightarrow = \frac{P_2}{P_1} = \left(\frac{V_1}{V_2}\right)^{\gamma}$

Given $\frac{d_2}{d_1} = 32 = \frac{\frac{m}{V_2}}{\frac{m}{V_1}} = 32$ $\Rightarrow \frac{V_1}{V_2} = 32$

$\frac{P_2}{P_1} = 2^7$ $\Rightarrow P_2 = 128P_1$

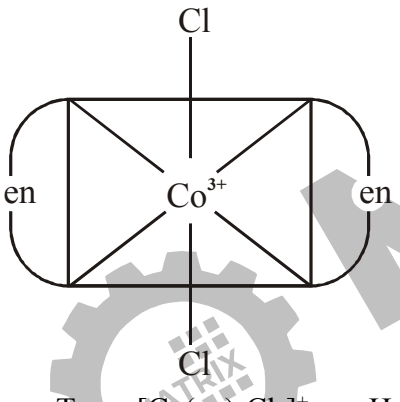
4. (A) = cis$[Co(en)_2Cl_2]^{\oplus}$ & (B) = trans$[Co(en)_2Cl_2]^{\oplus}$

Which of the above complexes is / are optically active ?

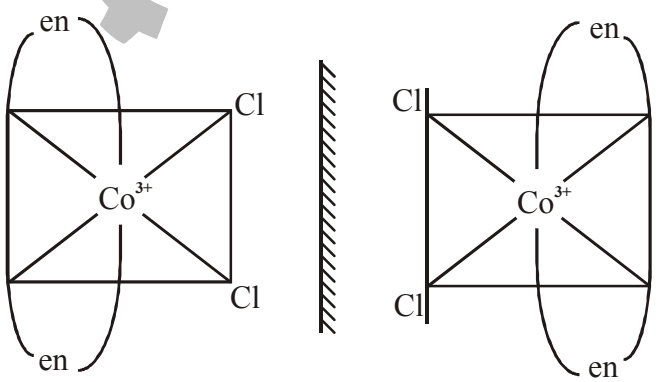
(1) Only A (2) Only B (3) Both (4) None

Ans. (1)

Sol.



Trans-$[Co(en)_2Cl_2]^+$ → Have Plane of symmetry so will be optically inactive.



cis-$[Co(en)_2Cl_2]^+$ → Plane of symmetry is absent so will be optically acitve

5. Boron and silicon can be obtained in pure form by

(1) Electrolytic refining (2) Vapour phase refining

(3) Zone refining (4) Mond's process

Ans. (3)

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

6. 0.02 M $K_2Cr_2O_7$ is treated with 0.288 gram of Ferrous oxalate. How much volume (in mL) of $K_2Cr_2O_7$ is required?

Ans. 100.00

Sol. milliequivalent of $K_2Cr_2O_7$ = milliequivalent of FeC_2O_4

n-factor of $k_2Cr_2O_7 = 6$

n-factor of $FeC_2O_4 = 3$

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

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

$V_{ml} = 100$ ml

7. For the following reaction, $2A(g) \longrightarrow A_2(g)$

following data is obtained at 298 K. $\Delta U = -20$ kJ, $\Delta S = -30$ J then find ΔG (in kJ).

Ans. (–13.5)

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

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

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

$= -22477.572$ J

$= -13537.572$ J

$= -13.5$ kJ

8. For the reaction, $x + y \rightleftharpoons 2z$

initially 1 mol of x, 1.5 mole of y and 0.5 mole z are taken, then at equilibrium 1 mole of z is formed

If $k_{eq} = \frac{X}{15}$ then, find the value of 'X'.

Ans. (16.00)

Sol.

	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 = 0	1		1.5		0.5
$t = t_{eq}$	1-a		1.5 - a		0.5 + 2a = 1 mol

$\Rightarrow$ a = 0.25

x	+	y	$\longrightarrow$	2z
0.75 mol		1.25 mol		1 mol

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

$$X = \frac{15}{(0.75 \times 1.25)} = 16$$

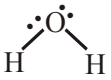
9. Which of the following has maximum bond angle [consider C, N, O, S as central atom]

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

Ans. (4)

Sol. For same hybridisation

$$\text{Bond angle} \propto \frac{1}{\text{no of lone pair on central atom}}$$



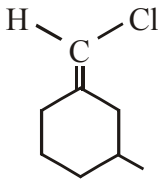
sp^3, $\ell.p = 2$, B. A. = 104°30'

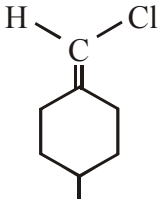
$H_2S \rightarrow$ No hybridisation [Drago's rule], bond angle = 92°

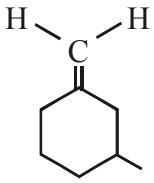
$\ddot{N}H_3$ sp^3 $\ell.p = 1$, B.A. = 107°

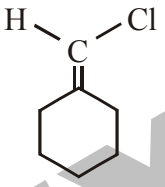
CH_4 sp^3, $\ell.p = 0$, B. A. = 109°28'

10. Which of the following compound will show geometrical Isomerism ?

(1) 

(2) 

(3) 

(4) 

Ans. (1)

Sol. Restricted rotation on double bond or ring structure with 2 different groups attached 2 C atoms present on system of restricted rotation generates Geometrical isomerism

11. Which one of the following is not a condensation polymer ?

(1) Nylon-6 (2) Nylon-6,6 (3) Buna-N (4) Bakelite

Ans. (3)

Sol. (1) $H_2N-(CH_2)_5-COOH \xrightarrow{\Delta} -[NH-(CH_2)_5-C(=O)]_n-$

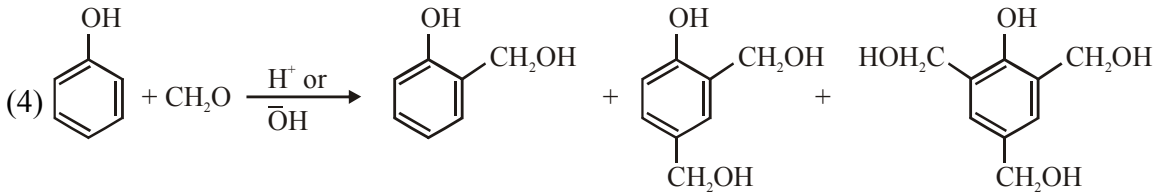
6-Aminohexanoic acid Nylon-6

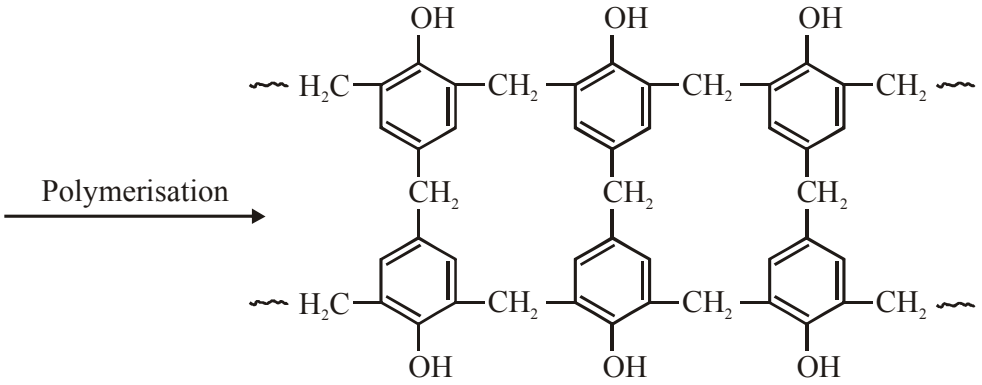
(2) $nH_2N-(CH_2)_6-NH_2 + nHOOC-(CH_2)_4-COOH \longrightarrow -[NH-(CH_2)_6-NH-C(=O)-(CH_2)_4-C(=O)]_n-$

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) 



12. $CH_2=CH-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3 \xrightarrow{HBr}$ (Product)

The product will be :

(1) $CH_3-\underset{\displaystyle Br}{\underset{|}{CH}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

(2) $CH_2-\underset{\displaystyle Br}{\underset{|}{CH_2}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

(3) $CH_3-CH_2-\underset{\displaystyle Br}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_3$

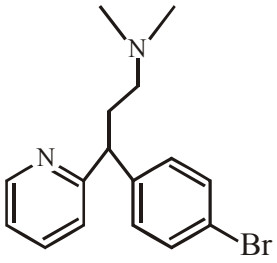
(4) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-Br$

Ans. (3)

Sol. $CH_2=CH-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3 \xrightarrow{HBr} CH_3-\overset{+}{CH}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3 \xrightarrow[\text{rearrangement}]{\text{carbocation}}$

$CH_3-CH_2-\underset{+}{\overset{\displaystyle CH_3}{\overset{|}{C}}}-CH_3 \xrightarrow{Br^-} CH_3-CH_2-\underset{\displaystyle Br}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_3$

13. Brompheniramine is used as a drug for what purpose?



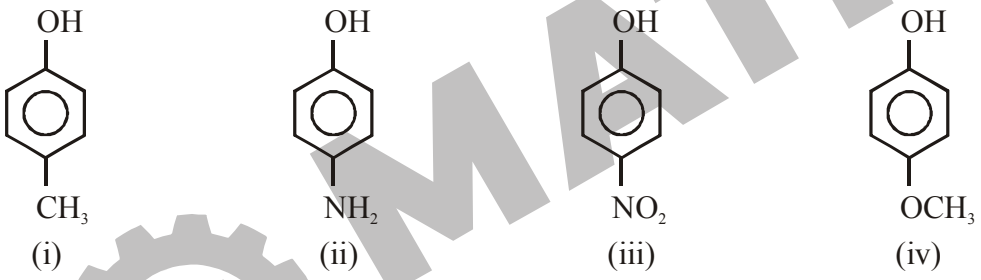
Brompheniramine

(1) Antidepresent (2) Anithistamines (3) Antiseptic (4) Analgensic

Ans. (2)

Sol. Synthetic drugs, brompheniramine (Dimetapp) act as antihistamine.

14. Which is the correct decreasing order of Boiling point for given compounds ?

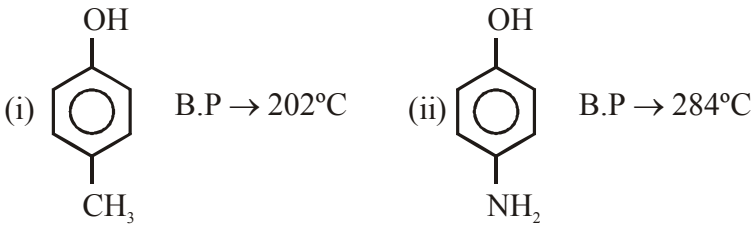


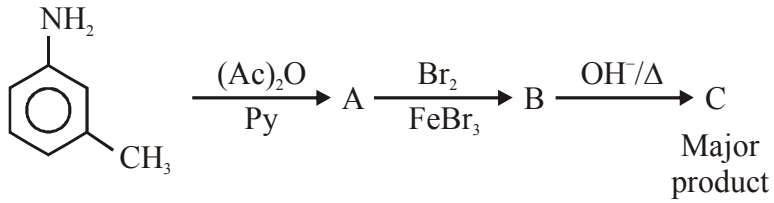
(i) (ii) (iii) (iv)

(1) (ii) > (iii) > (iv) > (iv) (2) (ii) > (i) > (iv) > (iii)

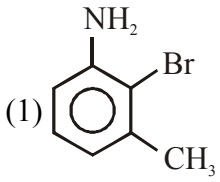
(3) (i) > (iii) > (iv) > (ii) (4) (i) > (iii) > (ii) > (iv)

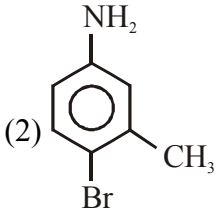
Ans. (1)

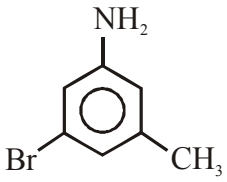
Sol. 

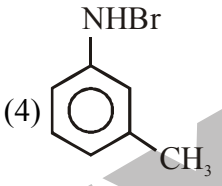
15. 

Product 'C' will be :

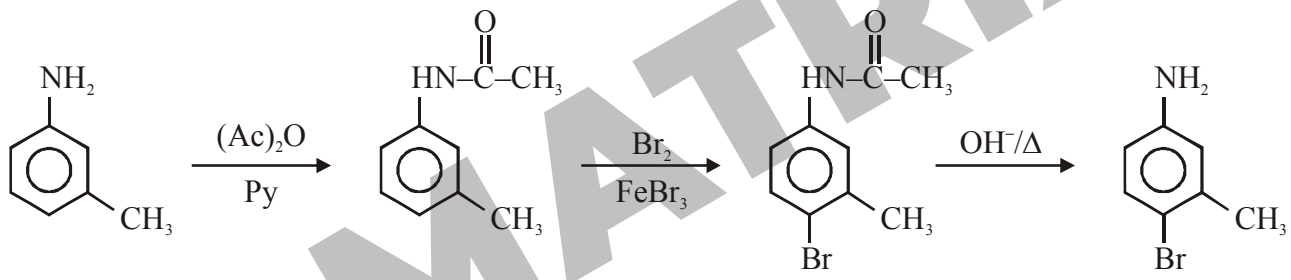
(1) 

(2) 

(3) 

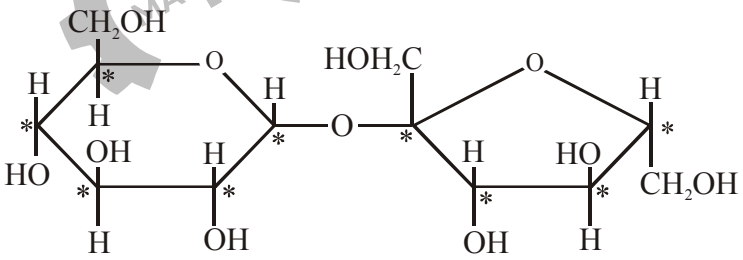
(4) 

Ans. (2)

Sol. 

16. How many chiral carbon atoms are present in structure of sucrose?

Ans. (9)

Sol. 

(Sucrose)

* represents chiral carbon atom

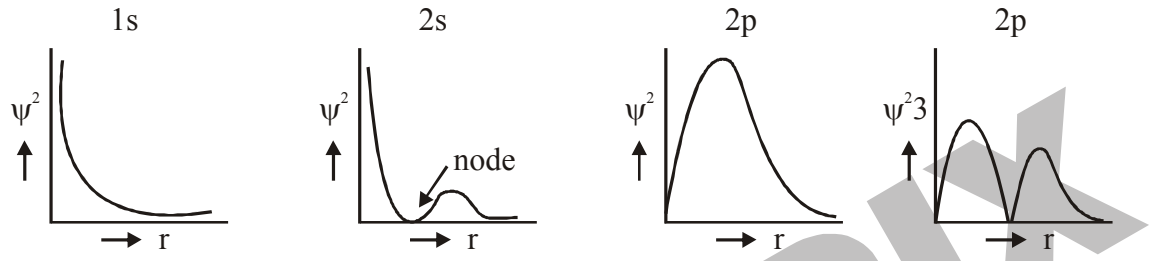
17. Which of the following statement is correct regarding probability density for different subshell (except infinity)

(1) For $2p \neq 0$ (2) For $3p = 0$

(3) For $1s = 0$ (4) For $2s \neq 0$

Ans. (2)

Sol. From the following ψ^2 vs r plot (ψ^2 = probability density) ψ^2 can be zero for 3p orbital other than infinity.

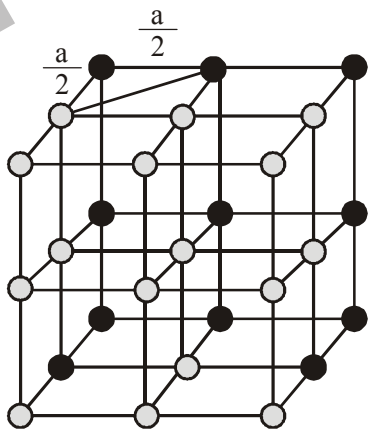


18. The minimum distance between the centre of two octahedral voids in FCC present on edge centre is

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

Ans. (3)

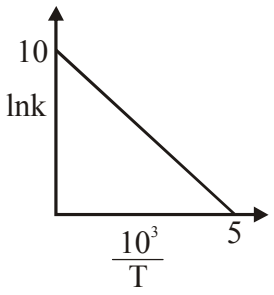
Sol. In FCC octahedral voids are present at the edge centres and body centre position.



Minimum distance between centres of two octahedral voids

$$= x = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2} = \sqrt{\frac{a^2}{4} + \frac{a^2}{4}} = \frac{a}{\sqrt{2}}.$$

19. Observe the following plot of lnk vs $\frac{10^3}{T}$ where T is temperature find activation energy (in kJ)



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

Ans. (3)

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

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

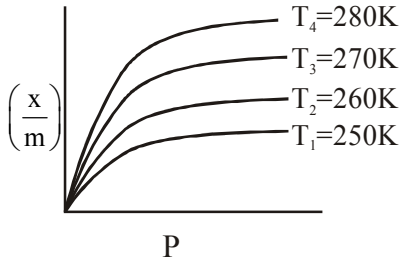
$$\ln k = \ln A - \left(\frac{E_a}{R\times 10^3}\right)\times\frac{10^3}{T}$$

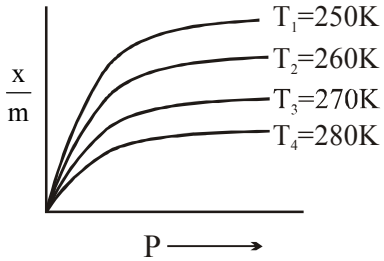
$$\text{Slope of graph} = \frac{-E_a}{R\times 10^3} = \frac{-10}{5}$$

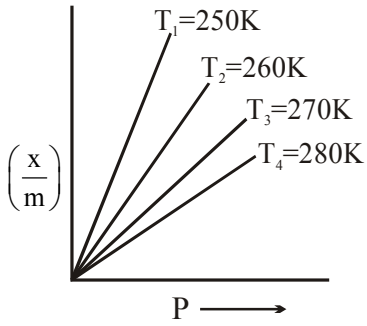
$$E_a = 2R \times 10^3 \text{ J}$$

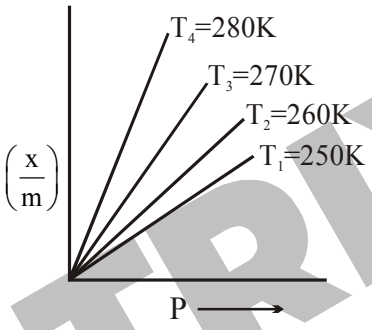
$$E_a = 2R \text{ k J}$$

20. Plot of of x/m vs P for a gas at different T is given then which one of the following graph is correct?

(1) 

(2) 

(3) 

(4) 

Ans. (2)

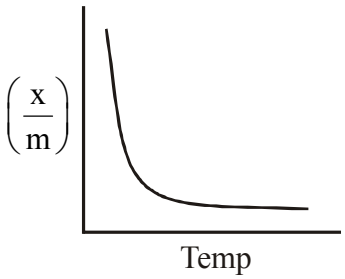
Sol. From Freundlich adsorption isotherm

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

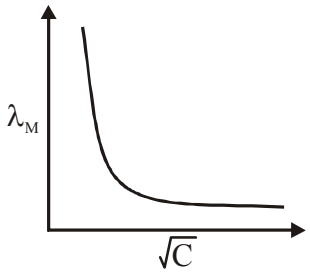
$\frac{x}{m} \propto P^{1/n}$ (at moderate pressure)

$\frac{x}{m} \propto P^{0}$ (At high pressure)

$\rightarrow$ On increasing temperature physical adosroption decreases.



21. λ_M vs $\sqrt{C}$ is plotted for a certain electrolyte then which electrolyte is correct for this graph



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

Ans. (1)

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

22. Correct order of following species in the increasing order of their size is:

$N^{3-}, O^{2-}, F^-, Na^+, Mg^{2+}, Al^{3+}$

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

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

Ans. (1)

Sol. For isoelectronic species

$$\text{Ionic size} \propto \frac{1}{Z_{\text{effective}}}$$

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

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