JEE Main 2020 Paper

Date : 5th September 2020

Time : 02 : 00 pm - 05 : 00 pm

Subject : Chemistry

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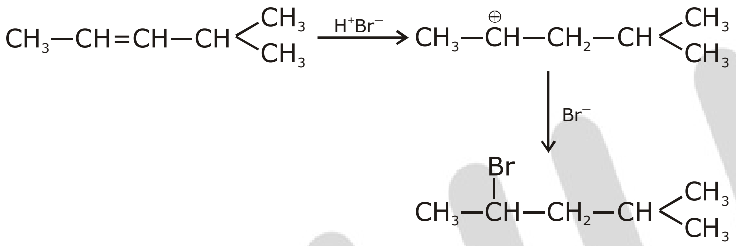
1. The major product formed in the following reaction is :

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

(1) $CH_3CH(Br)CH_2CH(CH_3)_2$ (2) $CH_3CH_2CH_2C(Br)(CH_3)_2$

(3) $CH_3CH_2CH(Br)CH(CH_3)_2$ (4) $Br(CH_2)_3CH(CH_3)_2$

Sol. **1**



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

(1) Linear and blue in color (2) Linear and almost colorless

(3) Non-planar and almost colorless (4) Planar and bluein color

Sol. **3**

H_2O_2 has openbook structure it is non planar

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

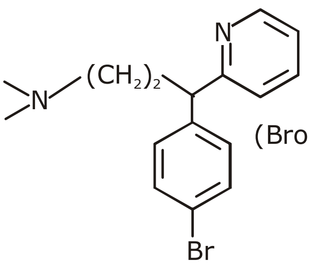
(1) Liquation (2) Electrolytic refining

(3) Zone refining (4) Vapour phase refining

Sol. **3**

Fact

4. The following molecule acts as an :



(Brompheniramine)

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

Sol. **1**

Anti-histamine

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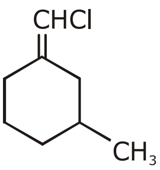
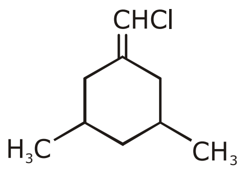
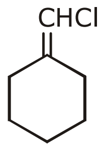
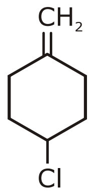
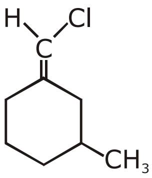
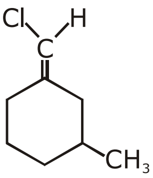
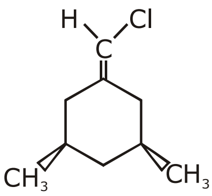
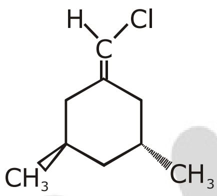
5. Among the following compounds, geometrical isomerism is exhibited by :

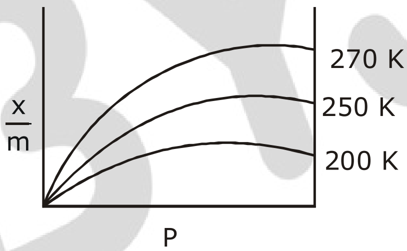
(1)  (2)  (3)  (4) 

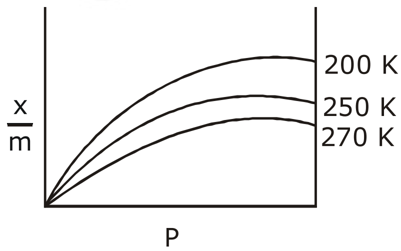
Sol. 1 & 2

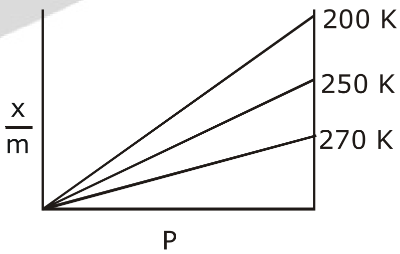
 and  are geometrical isomer

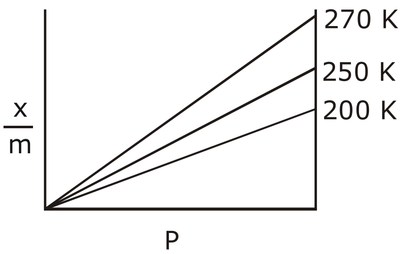
 and  are geometrical isomer

6. 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) 

Sol. 2
As temp. increases extent of Adsorption decreases
Therefore correct option (2)

$\frac{x}{m} = KP^{1/n}$

$\frac{x}{m}$ v/s P $\rightarrow$ non linear curve

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

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

Sol. **1**

CH_4	>	NH_3	>	H_2O	>	H_2S
Sp^3(ℓp = 0)		Sp^3(ℓp = 1		Sp^3(ℓp = 2)		Sp^3 (ℓp = 2)
BA $107^{o}28^{1}$		BA = 107^{o}		BA = $104^{o}5^{1}$		BA =92^{o}

8. 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 zero for 1s orbital

(3) It can never be zero for 2s orbital (4) It can negative for 2p orbital

Sol. **1**

$\psi^2_{R/S}$ > 0 always

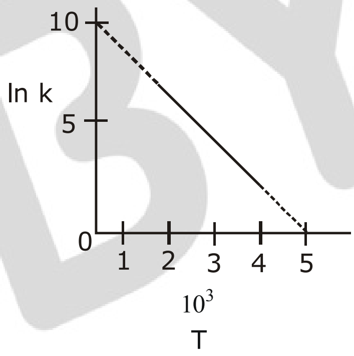
$\psi^2_{R/S}$ can be = 0; As '2s' has 1 Radial Node

ψ^2_{R} can never be negative

ψ^2_{R} (3P) can be = 0 as 3P has Radial Nodes

Ans. Option (1)

9. The rate constant (k) of a reaction is measured at differenct 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) R (2) 2/R (3) 1/R (4) 2R

Sol. **4**

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

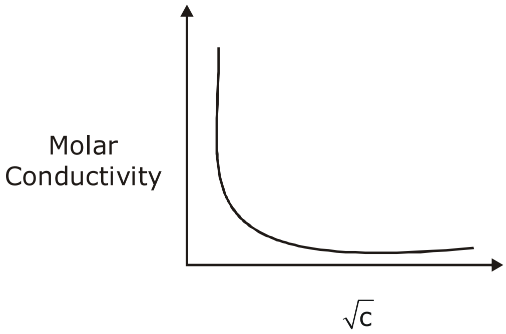
ln(A) = 10

$$\text{Slope} = \frac{-Ea}{R} \times 10^{-3} = -10/5$$

E_a = 2000R J/mol

E_a = 2R KJ/mol

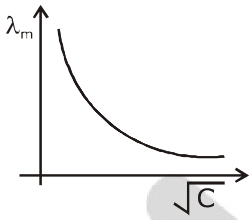
10. The variation of molar conductivity with concentration of an electrolyte (X) in aqueous solution is shown in the given figure.



The electrolyte X is :

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

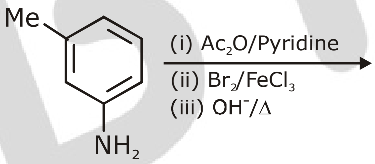
Sol. **2**

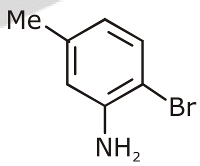


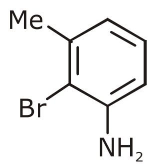
Such type of variation is always for weak electrolyte

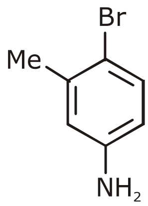
Hence Ans (2) CH_3COOH

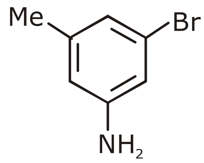
11. The final major product of the following reaction is :



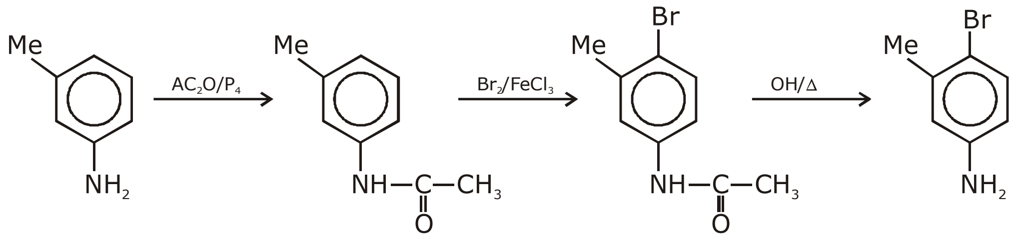
(1)


(2)


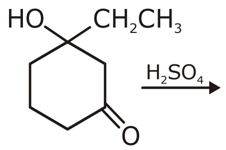
(3)


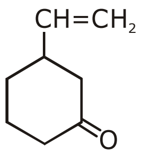
(4)


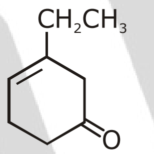
Sol. **3**

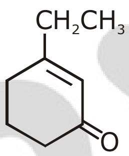


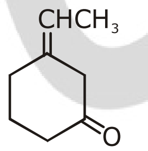
12. The major product of the following reaction is :



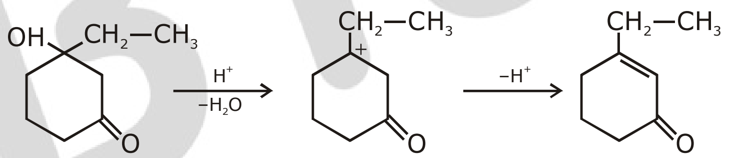
(1) 

(2) 

(3) 

(4) 

Sol. **3**



13. 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) –780 kJ mol^{-1}
(2) 784 kJ mol^{-1}
(3) –784 kJ mol^{-1}
(4) 780 kJ mol^{-1}

Sol. **3**

$\Delta H_{sol} = L.E. + \Delta H_{hyd}$

$4 = 788 + \Delta H_{Hyd}$

$\Delta H_{Hyd} = -784$ KJ/mol Ans

14. Reaction of ammonia with excess Cl_2 gives :

(1) NH_4Cl and N_2
(2) NH_4Cl and HCl
(3) NCl_3 and HCl
(4) NCl_3 and NH_4Cl

Sol. **3**

(1) $NH_3 + \underset{\text{(excess)}}{3Cl_2} \longrightarrow NCl_3 + 3HCl$

(2) $\underset{\text{(excess)}}{8NH_3} + 3Cl_2 \longrightarrow 6NH_4Cl + N_2$

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

(1) Bakelite (2) Nylon 6

(3) Buna-N (4) Nylon 6, 6

Sol. **2**

$$n\ CH_2{=}CH{-}CH{=}CH_2 + n\ CH_2{=}\underset{}{\overset{CN}{\overset{|}{C}H}} \longrightarrow \left[CH_2{-}CH{=}CH{-}CH_2{-}\overset{CN}{\overset{|}{C}H}{-}CH_2 \right]_n$$

1,3-Butadiene Acrylo nitrile Buna - n

16. Consider the comples 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.

Sol. **4**

Due to presence of Pos (A) cannot be optically active, but (B) can be optically active

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

Sol. **4**

Nearest octahedral voids

One along edge center & other at Body centre

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

$$= \frac{a}{\sqrt{2}} \text{ Ans.}$$

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

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

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

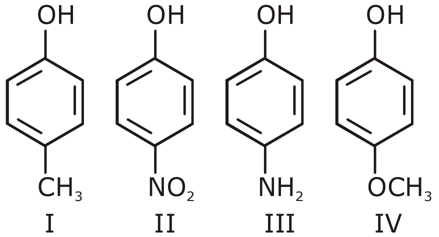
Sol. **4**

all are Isoelectronic

(1) $\dfrac{N^{3-}O^{2-}F^-Na^+Mg^{2+}Al^{3+}}{Z\uparrow, Zeff\uparrow, Ionic\,Radii\downarrow}$

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

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

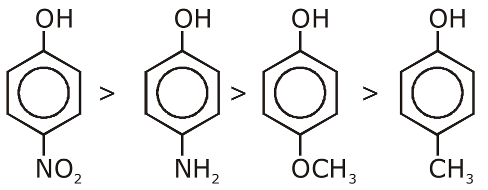


I II III IV

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

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

Sol. **3**



(II) > (III) > (IV) > (I)

20. The one that is NOT suitable for the removal of permanent hardness of water is :
(1) Ion-exchange method (2) Calgon's method
(3) Treatment with sodium carbonate (4) Clark's method

Sol. **4**
Clark's method is used for Removal of Temporary hardness
$Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2CaCO_3\downarrow + 2H_2O$
$Mg(HCO_3)_2 + 2Ca(OH)_2 \rightarrow 2CaCP_3 + Mg(OH)_2\downarrow + 2H_2O$

21. 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 reaction is ________ $\frac{x}{15}$. The value of x is ________.

Sol. **16**

	x +	y ⇌	2Z	
t = 0	1mol	$\frac{3}{2}$mol	$\frac{1}{2}$mol	
t_{eq}	–	–	1 mol	$2x = \frac{1}{2}$
t_{eq}	1– x	$\frac{3}{2}-x$	$\frac{1}{2}+2x$	$x = \frac{1}{4}$
t_{eq}	$\frac{3}{4}$mol	$\frac{5}{4}$mol	1 mol	

$$K_{eq} = \frac{(1)^2}{\frac{5}{4}\times\frac{3}{4}} = \frac{16}{15}$$

x = 16 Ans.

22. 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})

Sol. **50 ml**
$K_2Cr_2O_7 + FeC_2O_4 \rightarrow Cr^{3+} + Fe^{3+} + CO_2$

$$\frac{0.02\times vol\times 6}{1000} = 3\times\frac{0.288}{144}\times 100$$

$$Vol. = \frac{200}{4} = 50 \text{ ml Ans.}$$

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

Sol. **0**

$[Ru(H_2O)_6]^{2+}$

$Ru^{2+} = 3d^6$ ($\Delta_0 > P$)

$= t_2g^6\ eg^0$

n = 0, u = 0

24. For a dimerization reaction, $2A(g) \rightarrow A_2(g)$ at 298 K, $\Delta U^{\ominus} = -20$ kJ mol^{-1}, $\Delta S^{\ominus} = -30$ kJ mol^{-1}, then the $\Delta G^{\ominus}$ will be __________ J.

Sol. **–13538 J**

$2A \longrightarrow A_2$

$\Delta U^{\ominus} = -20$ kJ

$\Delta H^{\ominus} = -20000 + (-1)R \times 298$

$\Delta G^{\ominus} = -20000 - 298R + 30 \times 298$

$\Delta G^{\ominus} = -20,000 + 298\left(\frac{90-25}{3}\right)$

$\Delta G^{\ominus} = 20,000 + \frac{298 \times 65}{3}$

$\Delta G^{\ominus} = -13538$ J

25. The number of chiral carbons present in sucrose is ______.

Sol. **9**