JEE Main 2020 Paper

Date : 4th September 2020

Time : 02 : 00 pm - 05 : 00 pm

Subject : Chemistry

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1. The reaction in which the hybridisation of the underlined atom is affected is :

(1) $H_2\underline{S}O_4 + NaCl \xrightarrow{420\ K}$ (2) $\underline{Xe}F_4 + SbF_5 \longrightarrow$

(3) $\underline{N}H_3 \xrightarrow{H^+}$ (4) $H_3\underline{P}O_2 \xrightarrow{\text{Disproportionation}}$

Sol. **2**

1 $H_2SO_4 + NaCl \xrightarrow{420k} NaHSO_4 + HCl$

sp^3 sp^3

2 $XeF_4 + SbF_5 \longrightarrow (Xe\overset{+}{F}_3)(SbF_6)^-$

sp^3d^2 sp^3d

3 $NH_3 \xrightarrow{H^+} NH_4^+$

sp^3 sp^3

4 $H_3PO_2 \xrightarrow[\text{Reaction}]{\text{Disproportionation}} PH_3 + H_3PO_4$

sp^3 sp^3 sp^3

2. The process that is NOT endothermic in nature is :

(1) $H_{(g)} + e^- \rightarrow H^-_{(g)}$ (2) $Na_{(g)} \rightarrow Na^+_{(g)} \rightarrow e^-$

(3) $Ar_{(g)} + e^- \rightarrow Ar^-_{(g)}$ (4) $O^-_{(g)} + e^- \rightarrow O^{2-}_{(g)}$

Sol. **1**

$H_{(g)} + e^{\ominus} \longrightarrow H^{\ominus}_{(g)}$

is an exothermic Rxn.

Ans (1)

3. If the equilibrium constant for $A \rightleftharpoons B + C$ is $K_{eq}^{(1)}$ and that of $B + C \rightleftharpoons P$ is $K_{eq}^{(2)}$, the equilibrium constant for $A \rightleftharpoons P$ is :

(1) $K_{eq}^{(1)}\ K_{eq}^{(2)}$ (2) $K_{eq}^{(2)} - K_{eq}^{(1)}$ (3) $K_{eq}^{(1)} + K_{eq}^{(2)}$ (4) $K_{eq}^{(1)} / K_{eq}^{(2)}$

Sol. **1**

$A \rightleftharpoons B + C$ $K_{eq}^{(1)}$

$\dfrac{B + C \rightleftharpoons P}{A \rightleftharpoons P}$ $K_{eq}^{(2)}$

$K_{eq} = K_{eq}^{(1)} \times K_{eq}^{(2)}$

Ans.(1)

4. A sample of red ink (a colloidal suspension) is prepared by mixing eosin dye, egg white, HCHO and water. The component which ensures stability of the ink sample is :
(1) HCHO (2) Water (3) Eosin dye (4) Egg white

Sol. **4**
Surface theoritical eggwhite

5. The one that can exhibit highest paramagnetic behaviour among the following is :
gly = glycinato; bpy = 2, 2'-bipyridine

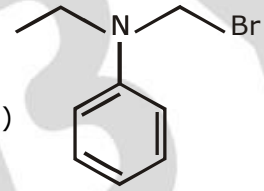
(1) $\left[Ti(NH_3)_6\right]^{3+}$ (2) $\left[Co(OX)_2(OH)_2\right]^-$

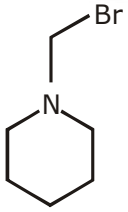
(3) $\left[Pd(gly)_2\right]$ (4) $\left[Fe(en)(bpy)(NH_3)_2\right]^{2+}$

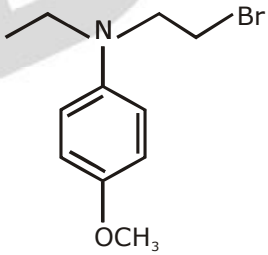
Sol. **2**

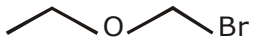
1. $(Ti(NH_3)_6)^{3+} \Rightarrow Ti^{3+}\ (3d^1) \Rightarrow \mu = \sqrt{3}$
2. $[Co(OX_2)(OH_2)^-\ (\Delta_0 > P) \Rightarrow Co^{+5}\ (3d^4) \Rightarrow t_2g^4\ eg^0$
   $n = 2,\ \mu = \sqrt{8}$
3. $(Pd\ (gly)_2) \Rightarrow pd^{2+}\ (4d^8) \rightarrow$ Square planar
   $n = 0,\ \mu = 0$ diamagentic
4. $(Fe\ (en)\ (bpy)\ (NH_3)_2)^{2+}$
   $Fe^{2+} \Rightarrow 3d^6\ (t_2g^6\ eg^o) \Rightarrow n = 0,\ \mu = 0$

6. Which of the following compounds will form the precipitate with aq. $AgNO_3$ solution most readily?

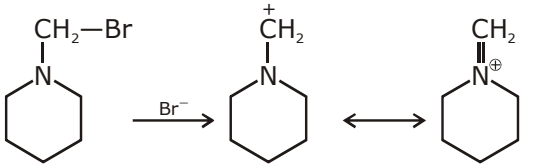
(1) 

(2) 

(3) 

(4) 

Sol. **2**
Rate of reaction α stability of carbocation.



Highly stable due to back bonding

7. Five moles of an ideal gas at 1 bar and 298 K is expanded into vacuum to double the volume. The work done is :

(1) zero (2) $C_V\left(T_2 - T_1\right)$ (3) $-RT\left(V_2 - V_1\right)$ (4) $-RT\ln V_2/V_1$

Sol. **1**

As it is free expansion against zero ext. pressure

$\therefore$ Work Done = zero

Ans. (1)

8. 250 mL of a waste solution obtained from the workshop of a goldsmith contains 0.1 M $AgNO_3$ and 0.1 M AuCl. The solution was electrolyzed at 2 V by passing a current of 1 A for 15 minutes. The metal/metals electrodeposited will be:

$\left(E^0_{Ag^+/Ag} = 0.80\ V,\ E^0_{Au^+/Au} = 1.69\ V\right)$

(1) Silver and gold in proportion to their atomic weights
(2) Silver and gold in equal mass proportion
(3) only silver
(4) only gold

Sol. **1**

Here current is same.Both metals are univalent and of same concentrations. So, Both will be deposited in proportions of their equivalent weight or atomic weight.

9. The mechanism of action of "Terfenadine" (Seldane) is :

(1) Helps in the secretion of histamine (2) Activates the histamine receptor
(3) Inhibits the secretion of histamine (4) Inhibits the action of histamine receptor

Sol. **4**

The mechanism of action of "Terfenadine" (Seldane) is to inhibit the action of histamine receptor.

10. The shortest wavelength of H atom in the Lyman series is λ_1. The longest wavelength in the Balmer series of He^+ is : :

(1) $\frac{9\lambda_1}{5}$ (2) $\frac{27\lambda_1}{5}$ (3) $\frac{36\lambda_1}{5}$ (4) $\frac{5\lambda_1}{9}$

Sol. **1**

$$\frac{1}{\lambda_1} = R_4 \times (1)^2 \times \left\{1 - \frac{1}{\infty^2}\right\} = R_H$$

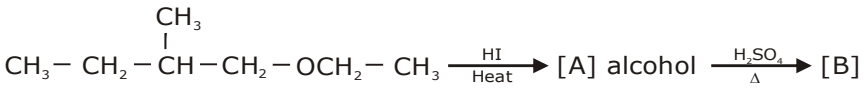
$$\frac{1}{\lambda_2} = R_4 \times (2)^2 \times \left\{\frac{1}{4} - \frac{1}{9}\right\} = R_H\left\{\frac{5}{9}\right\}$$

$$\frac{\lambda_2}{\lambda_1} = \frac{9}{5}$$

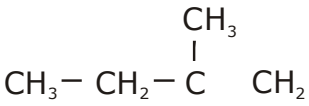
$$\lambda_2 = \frac{9}{5}\lambda_1$$

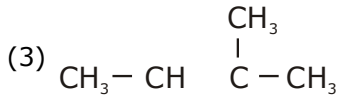
Ans. (1)

11. The major product [B] in the following reactions is :



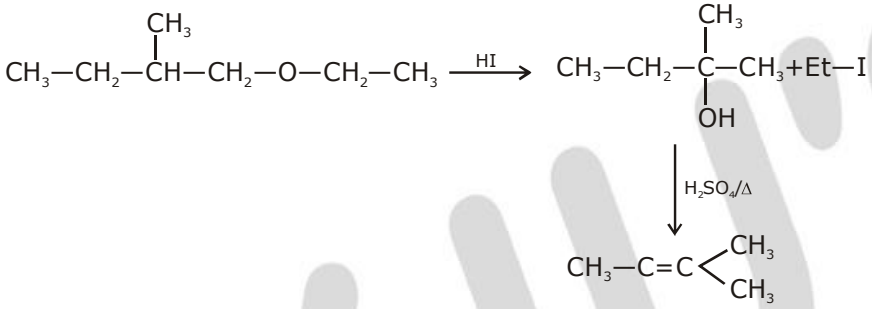
(1) $CH_3-CH_2-CH=CH-CH_3$

(2) 

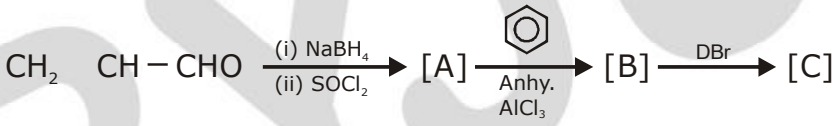
(3) 

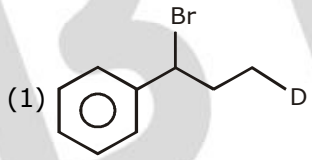
(4) $CH_2=CH_2$

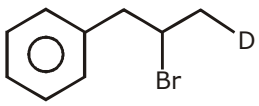
Sol. **3**

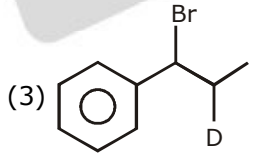


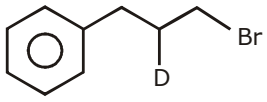
12. The major product [C] of the following reaction sequence will be :



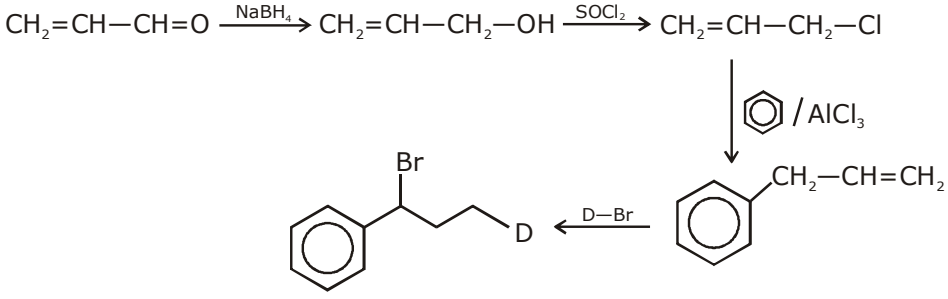
(1) 

(2) 

(3) 

(4) 

Sol. **1**



13. The Crystal Field Stabilizion Energy (CFSE) of $[CoF_3(H_2O)_3]$ $(\Delta_0 < P)$ is:

(1) $-0.8\ \Delta_0$ (2) $-0.8\ \Delta_0 + 2P$

(3) $-0.4\ \Delta_0 + P$ (4) $-0.4\ \Delta_0$

Sol. **4**

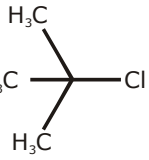
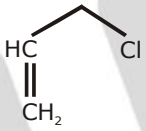
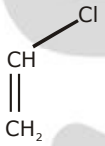
$[CoF_3(H_2O)_3]$ $(\Delta_0 < P)$

CO^{3+} $(3d^6) = t_2g^4\ eg^2$

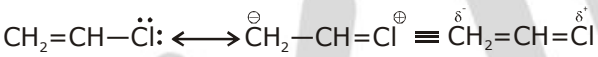
$$CFSE = \left(-\frac{2}{5}\times 4 + \frac{3}{5}\times 2\right)\Delta_0$$

$= -0.4\ \Delta_0$

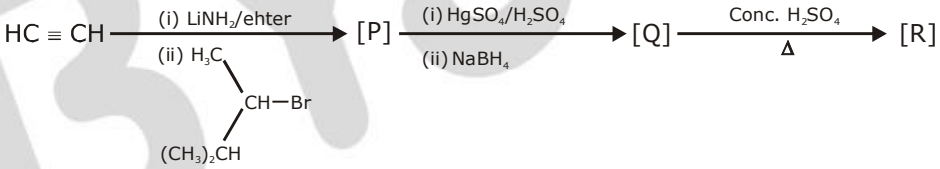
14. Among the following compounds, which one has the shortest $C-Cl$ bond?

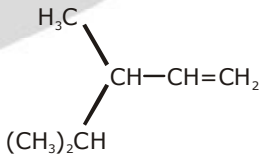
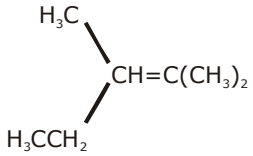
(1)  (2) H_3C-Cl (3)  (4) 

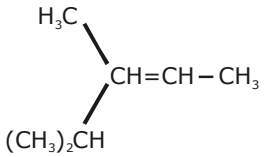
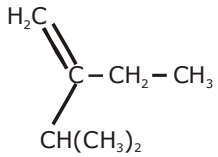
Sol. **4**



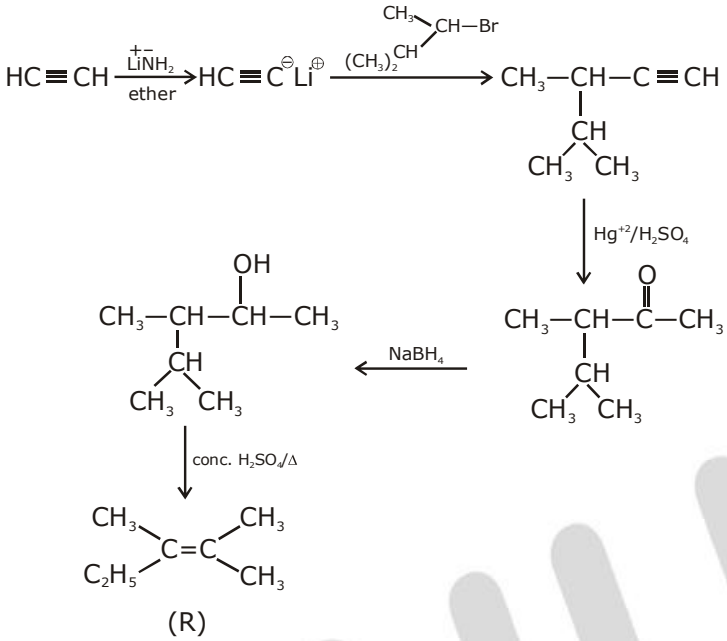
15. The major product [R] in the following sequence of reactions is :



(1)  (2) 

(3)  (4) 

Sol. **2**



(R)

16. The molecule in which hybrid AOs involve only one d-orbital of the central atom is :

(1) $\left[CrF_6\right]^{3-}$ (2) XeF_4 (3) BrF_5 (4) $\left[Ni(CN)_4\right]^{2-}$

Sol. **4**

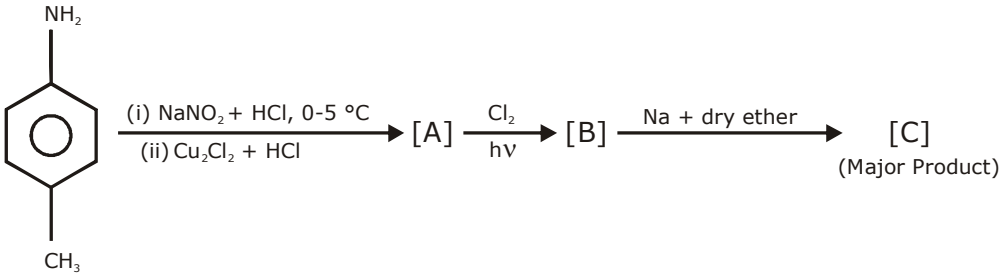
(1) $(CrF_6)^{3-}$ – d^2Sp^3

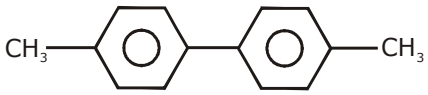
(2) XeF_4 – Sp^3d^2

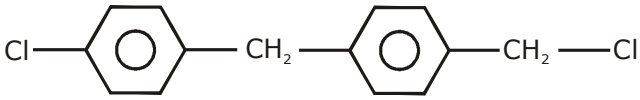
(3) BrF_5 – Sp^3d^2

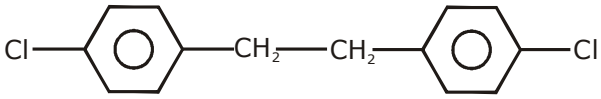
(4) $[Ni(CN)_4]^{2-} \rightarrow dsp^2$

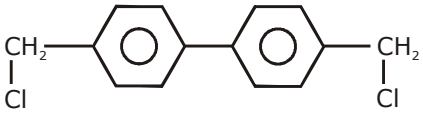
17. In the following reaction sequence, [C] is :



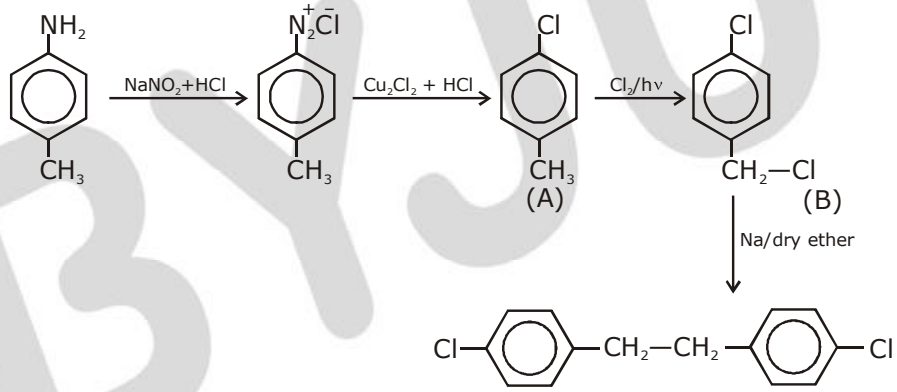
(1) 

(2) 

(3) 

(4) 

Sol. 3



18. The processes of calcination and roasting in metallurgical industries, respectively, can lead to :

(1) Photochemical smog and ozone layer depletion

(2) Photochemical smog and global warming

(3) Global warming and photochemical smog

(4) Global warming and acid rain

Sol. 4

Environmental

Calcination Releases $\rightarrow CO_2 \rightarrow$ Global warming

Roasting Releases $\rightarrow SO_2 \rightarrow$ Acid Rain

Ans. (4)

19. The incorrect statement(s) among (a) - (c) is (are) :
(a) W(VI) is more stable than Cr(VI).
(b) in the presence of HCl, permanganate titrations provide satisfactory results.
(c) some lanthanoid oxides can be used as phosphors.
(1) (a) only (2) (b) and (c) only
(3) (a) and (b) only (4) (b) only

Sol. **4**
Fact

20. An alkaline earth metal 'M' readily forms water soluble sulphate and water insoluble hydroxide. Its oxide MO is very stable to heat and does not have rock-salt structure. M is :
(1) Ca (2) Be (3) Mg (4) Sr

Sol. **2**
Fact

21. The osmotic pressure of a solution of NaCl is 0.10 atm and that of a glucose solution is 0.20 atm. The osmotic pressure of a solution formed by mixing 1 L of the sodium chloride solution with 2 L of the glucose solution is $x \times 10^{-3}$ atm. x is _____. (nearest integer)

Sol. **167**

$$\frac{0.1\times1+0.2\times2}{3}$$

$$= \frac{0.5}{3} = \frac{500}{3} \times 10^{-3} = 167 \text{ Ans.}$$

22. The number of molecules with energy greater than the threshold energy for a reaction increases five fold by a rise of temperature from 27 °C to 42 °C. Its energy of activation in J/mol is _____. (Take ln 5 = 1.6094 ; R = 8.314 J $mol^{-1}K^{-1}$)

Sol. **84297.47**

$$\frac{1}{5} = \frac{e^{-Ea/300R}}{e^{-Ea/315R}}$$

$$5 = e^{\frac{Ea}{R}\left(\frac{1}{300}-\frac{1}{315}\right)}$$

$$\frac{Ea}{R}\left(\frac{15}{300\times315}\right) = \ln(5)$$

$E_a = 1.6094 \times 315 \times 20 \times 8.314$
$E_a = 84297.47$ J/mol Ans.

23. A 100 mL solution was made by adding 1.43 g of $Na_2CO_3 . xH_2O$. The normality of the solution is 0.1 N. The value of x is _____. (The atomic mass of Na is 23 g/mol).

Sol. **10**

$$\frac{0.1}{2}\times\frac{100}{1000} = \frac{1.43}{160+18x}$$

$106 + 18x = 286$
$18x = 180 \Rightarrow x = 10$ Ans.

24. Consider the following equations :

$2\ Fe^{2+} + H_2O_2 \rightarrow x\ A + y\ B$ (in basic medium)

$2\ MnO_4^- + 6\ H^+ + 5\ H_2O_2 \rightarrow x'C + y'D + z'E$ (in acidic medium).

The sum of the stoichiometric coeficients x, y, x',y' and z' for products A, B, C, D and E, respectively, is _____.

Sol. **19**

$2Fe^{2+} + H_2O_2 \longrightarrow xA + yB \longrightarrow 2Fe^{3+} + 2OH^-$

$2MnO_4^- + 6H^{\oplus} + 5H_2O_2 \longrightarrow x`C + y`D + Z`E \longrightarrow 2Mn^{+2} + 5O_2 + 8H_2O$

x = 2 ; y = 2; x' = 2, y' = 5, z' = 8

2 + 2 + 2 + 5 +8 = 19

Ans. 19

25. The number of chiral centres present in threonine is _____.

Sol. **2**