JEE Main 2020 Paper

Date : 6th September 2020

Time : 09 : 00 am - 12 : 00 pm

Subject : Chemistry

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1. The INCORRECT statement is :

(1) Cast iron is used to manufacture wrought iron.

(2) Brass is an alloy of copper and nickel.

(3) German silver is an alloy of zinc, copper and nickel.

(4) Bronze is an alloy of copper and tin

Sol. **2**

Brass - (copper Zinc)

Bronze - (copper tin)

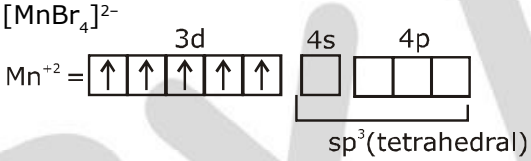
2. The species that has a spin-only magnetic moment of 5.9 BM, is : (T_d = tetrahedral)

(1) $[Ni(CN)_4]^{2-}$ (square planar) (2) $Ni(CO)_4(T_d)$

(3) $[MnBr_4]^{2-}(T_d)$ (4) $[NiCl_4]^{2-}(T_d)$

Sol. **3**

$[MnBr_4]^{2-}$



$\mu = \sqrt{5(5+2)} = 5.9$ BM

3. For the reaction

$$Fe_2N(s) + \frac{3}{2}H_2(g) \rightleftharpoons 2Fe(s) + NH_3(g)$$

(1) $K_c = K_p(RT)^{1/2}$ (2) $K_c = K_p(RT)^{-1/2}$

(3) $K_c = K_p(RT)^{\frac{3}{2}}$ (4) $K_c = K_p(RT)$

Sol. **1**

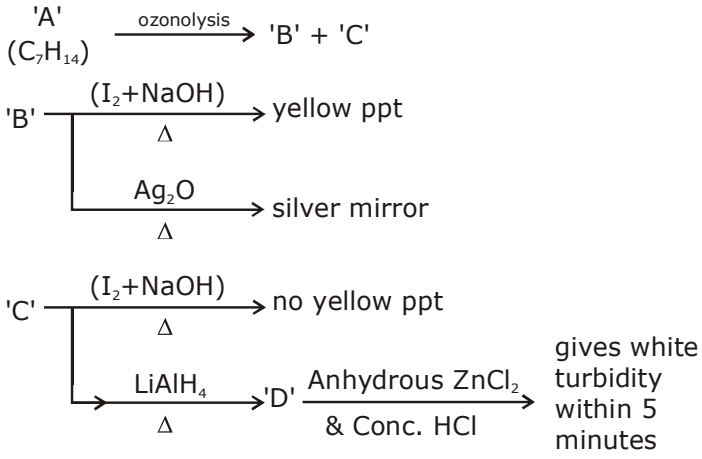
$$Fe_2N(s) + \frac{3}{2}H_2(g) \rightleftharpoons 2Fe(s) + NH_3(g)$$

$$\Delta n_g = 1 - \frac{3}{2} = \frac{-1}{2}$$

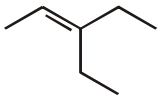
$$\frac{K_p}{K_c} = (RT)^{\Delta n_g} = (RT)^{-1/2}$$

$$K_c = \frac{K_p}{(RT)^{-1/2}} = K_p.(RT)^{1/2}$$

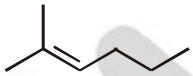
4. Consider the following reactions :

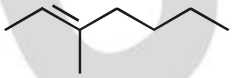


'A' is :

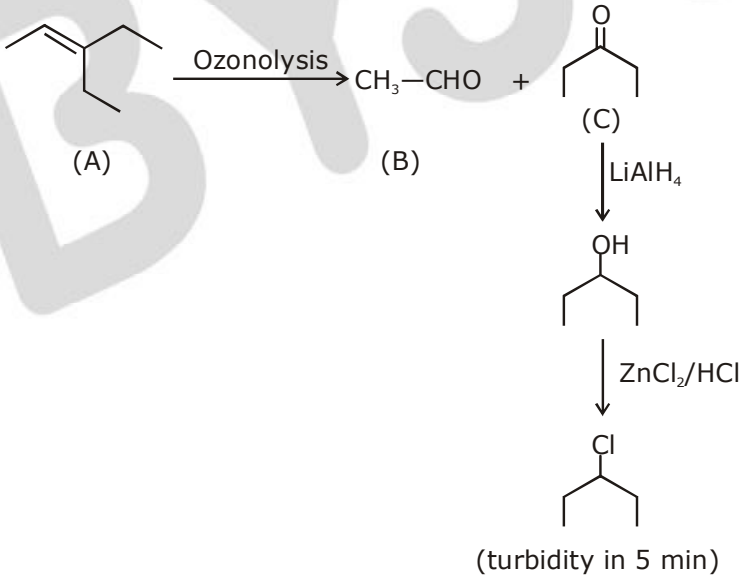
(1) 

(2) 

(3) 

(4) 

Sol. **1**



(turbidity in 5 min)

5. Arrange the following solutions in the decreasing order of pOH :

(A) 0.01 M HCl
(B) 0.01 M NaOH
(C) 0.01 M CH_3COONa
(D) 0.01 M NaCl

(1) (A) > (C) > (D) > (B)
(2) (B) > (D) > (C) > (A)
(3) (B) > (C) > (D) > (A)
(4) (A) > (D) > (C) > (B)

Sol. **4**

(i) 10^{-2} M HCl $\Rightarrow$ $[H^+] = 10^{-2}$ M $\rightarrow$ pH = 2

(ii) 10^{-2} M NaOH $\Rightarrow$ $[OH^-] = 10^{-2}$ M $\rightarrow$ pOH = 2

(iii) 10^{-2} M $CH_3COO^-Na^+ \Rightarrow [OH^+] > 10^{-7} \Rightarrow$ pOH < 7

(iv) 10^{-2} M NaCl $\Rightarrow$ Neutral pOH = 7

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

6. The variation of equilibrium constant with temperature is given below :

Temperature	**Equilibrium Constant**
$T_1 = 25^oC$	$K_1 = 10$
$T_2 = 100^oC$	$K_2 = 100$

The value of ΔH^0, ΔG^0 at T_1 and ΔG^0 at T_2 (in Kj mol^{-1}) respectively, are close to [use R = 8.314JK^{-1} mol^{-1}]

(1) 28.4, -7.14 and -5.71 (2) 0.64, - 7.14 and -5.71

(3) 28.4, - 5.71 and -14.29 (4) 0.64, - 5.71 and -14.29

Sol. **3**

$$\text{In}\left[\frac{k_2}{k_1}\right] = \frac{\Delta H^\circ}{R}\left\{\frac{1}{T_1} - \frac{1}{T_2}\right\}$$

$$\ln(10) = \frac{\Delta H^\circ}{R}\left\{\frac{1}{298} - \frac{1}{373}\right\}$$

$$\frac{373 \times 298 \times 8.314 \times 2.303}{75} = \Delta H^\circ = 28.37 \text{ kJ mol}^{-1}$$

$$\Delta G^\circ_{T_1} = -RT_1 \ln(K_1) = -298R \ln(10) = -5.71 \text{ kJ mol}^{-1}$$

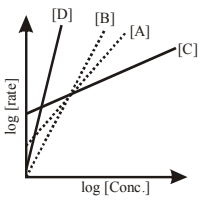
$$\Delta G^\circ_{T_2} = -RT_2 \ln(K_2) = -373R \ln(100)$$

$$= -14.283 \text{ kJ/mol}$$

7. Consider the following reactions

$$A \rightarrow P1;\ B \rightarrow P2;\ C \rightarrow P3;\ D \rightarrow P4,$$

The order of the above reactions are a,b,c and d, respectively. The following graph is obtained when log[rate] vs. log[conc.] are plotted :



Among the following the correct sequence for the order of the reactions is :

(1) c > a > b > d (2) d > a > b > c

(3) d > b > a > c (4) a > b > c > d

Sol. **3**

A → P1 B → P2 C → P3 D → P4

Rate = K (conc.)^{order}

log(rate) = log(K) + order log (case)

y c + m.x

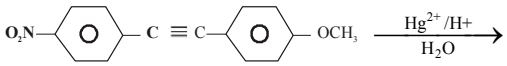
Straight line

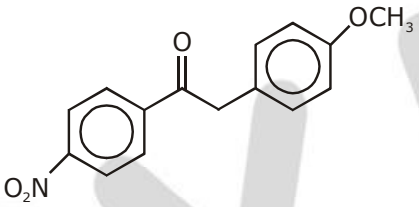
Slope = order

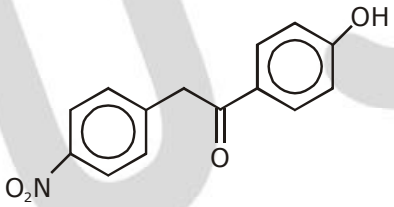
According graph

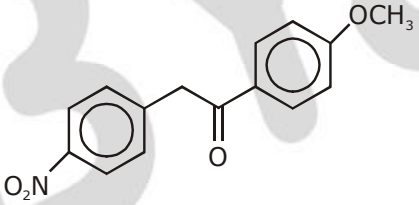
d > b > a > c order of slope

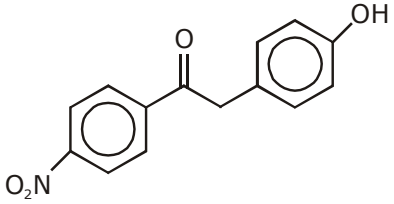
8. The major product obtained from the following reactions is :



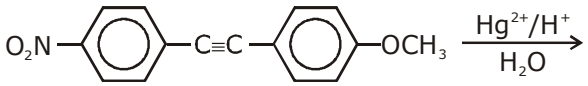
(1) 

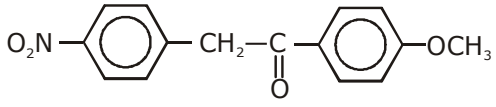
(2) 

(3) 

(4) 

Sol. **3**



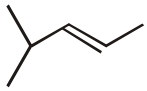


9. Which of the following compounds shows geometrical isomerism ?

(1) 2-methylpent-1-ene (2) 4-methylpent-2-ene

(3) 2-methylpent-2-ene (4) 4-methylpent-1-ene

Sol. **2**



4-Methylpent-2-ene

Can show G.I.

10. The lanthanoid that does NOT shows +4 oxidation state is :

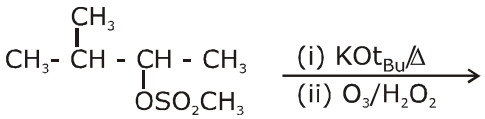
(1) Dy (2) Ce

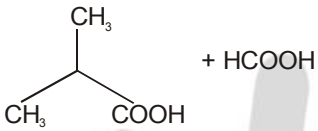
(3) Tb (4) Eu

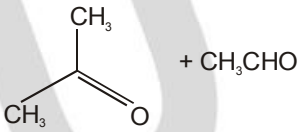
Sol. **4**

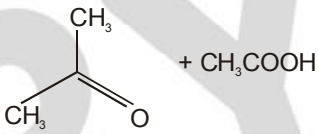
Fact

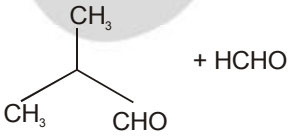
11. The major products of the following reactions are :



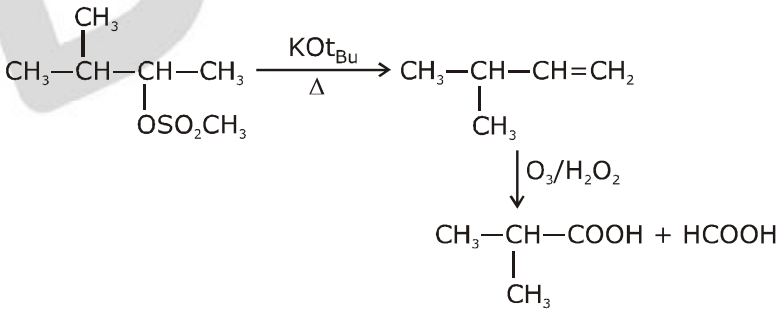
(1) 

(2) 

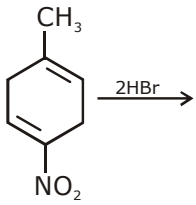
(3) 

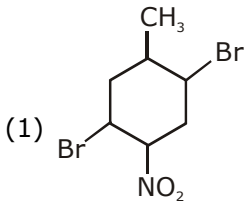
(4) 

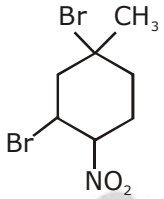
Sol. **1**

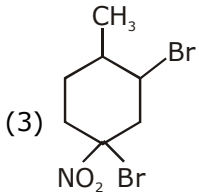


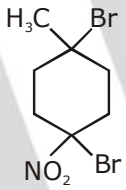
12. The major product of the following reaction is :



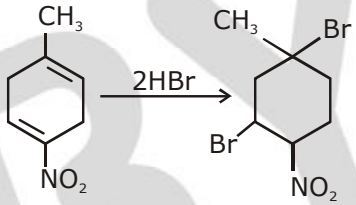
(1) 

(2) 

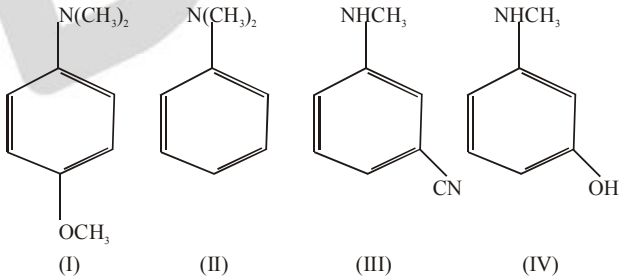
(3) 

(4) 

Sol. **2**



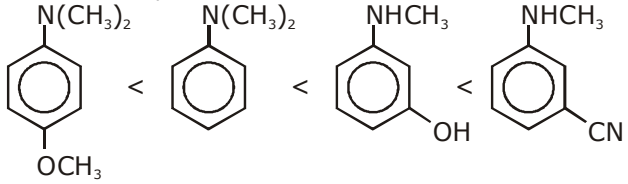
13. The increasing order of pK_b values of the following compounds is :



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

Sol. **3**

Order of pK_b



14. kraft temperature is the temperature :
(1) Above which the aqueous solution of detergents starts boiling
(2) Below which the formation of micelles takes place.
(3) Above which the formation of micelles takes place.
(4) Below which the aqueous solution of detergents starts freezing.

Sol. **3**
T_K + temp. above which formation of micelles takes place.

15. The set that contains atomic numbers of only transition elements, is ?
(1) 9, 17, 34, 38
(2) 21, 25, 42, 72
(3) 37, 42, 50, 64
(4) 21, 32, 53, 64

Sol. **2**
Tranition elements = 21 to 30
37 to 48
57 & 72 to 80
Ans. 21, 25, 42 & 72

16. Consider the Assertion and Reason given below.
Assertion (A) : Ethene polymerized in the presence of Ziegler Natta Catalyst at high temperature and pressure is used to make buckets and dustbins.
Reason (R) : High density polymers are closely packed and are chemically inert.
Choose the correct answer from the following :
(1) (A) and (R) both are wrong.
(2) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(3) (A) is correct but (R) is wrong
(4) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

Sol. **2**
From ziegler - Natta catalyst HDPE is produced, HDPE is closely packed and are chemically inert, so used to make backet and dustbin.

17. A solution of two components containing n_1 moles of the 1st component and n_2 moles of the 2nd component is prepared. M_1 and M_2 are the molecular weights of component 1 and 2 respectively. If d is the density of the solution in g mL^{-1}, C_2 is the molarity and x_2 is the mole fraction of the 2nd component, then C_2 can be expressed as :

(1) $C_2=\frac{dx_1}{M_2+x_2(M_2-M_1)}$
(2) $C_2=\frac{1000x_2}{M_1+x_2(M_2-M_1)}$
(3) $C_2=\frac{dx_2}{M_2+x_2(M_2-M_1)}$
(4) $C_2=\frac{1000dx_2}{M_1+x_2(M_2-M_1)}$

Sol. **4**

$$C_2 = \frac{x_2}{[x_2M_1 + (1-x_2)M_2]/d} \times 1000$$

$$C_2 = \frac{1000\,dx_2}{M_1 + (M_2 - M_1)x_2}$$

18. The correct statement with respect to dinitrogen is ?
(1) Liquid dinitrogen is not used in cryosurgery.
(2) N_2 is paramagnetic in nature
(3) It can combine with dioxygen at 25°C
(4) It can be used as an inert diluent for reactive chemicals.

Sol. **4**
(1) Liquid nitrogen is used as a refrigerant to preserve biological material food items and in cryosurgery.
(2) N_2 is diamagnetic, with no unpaired elctrons.
(3) N_2 does not combine with oxygen, hydrogen or most other elements. Nitrogen will combine with oxygen, however ; in the presence of lightining or a spark.
(4) In iron and chemical Industry inert diluent for reactive chemicals.

19. Among the sulphates of alkaline earth metals, the solubilities of $BeSO_4$ and $MgSO_4$ in water, respectively, are :
(1) Poor and high (2) High and high
(3) Poor and poor (4) High and poor

Sol. **2**
Order of solubility of sulphate of Alkaline earth metals
$BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$

20. The presence of soluble fluoride ion upto 1ppm concentration in drinking water, is :
(1) Harmful to skin (2) Harmful to bones
(3) Safe for teeth (4) Harmful for teeth

Sol. **3**
Environmental chemistry - safe for teeth

21. A spherical balloon of radius 3cm containing helium gas has a pressure of 48×10^{-3} bar. At the same temperature, the pressure, of a spherical balloon of radius 12cm containing the same amount of gas will be.....$\times 10^{-6}$ bar.

Sol. **750**

$$\text{moles} = \frac{48\times10^{-3}\times\frac{4}{3\pi}(3\text{cm})^3}{R\times T}$$

$$\text{moles} = \frac{P\times\frac{4}{3\pi}(12\text{cm})^3}{R\,T}$$

$P \times 144 \times 12 = 48 \times 9 \times 3 \times 10^{-3}$

$$P = \frac{27}{36}\times10^{-3}$$

$$P = \frac{27000}{36}\times10^{-6}$$

$$P = \frac{3000}{4}\times10^{-6}$$

$P = 750 \times 10^{-6}$ bar

22. The elevation of boiling point of 0.10m aqueous $CrCl_3xNH_3$ solution is two times that of 0.05 m aqueous $CaCl_2$ solution. The value of x is..... .
[Assume 100% ionisation of the complex and $CaCl_2$, coordination number of Cr as 6, and that all NH_3 molecules are present inside the coordination sphere]

Sol. **5**

$\Delta T_b = i \times K_b \times m$

$i \times 0.1 \times K_b = 3 \times 0.05 \times K_b \times 2$

$i = 3$

$[Cr(NH_3)_5.\ Cl]\ Cl_2 \rightarrow [Cr(NH_3)_5Cl]^{+2} + 2Cl^-$

$x = 5$

23. Potassium chlorate is prepared by the electrolysis of KCl in basic solution

$6OH^- + Cl^- \longrightarrow ClO_3^- + 3H_2O + 6e^-$

If only 60% of the current is utilized in the reaction, the time (rounded to the nearest hour) required to produce 10g of $KClO_3$ using a current of 2A is .....
(Given : F = 96,500 C mol^{-1}; molar mass of $KClO_3$=122g mol^{-1})

Sol. **11**

$$\frac{10}{122} \times 6 = \frac{2 \times t(hr) \times 3600 \times 60\%}{96500}$$

$$t(hr) = \frac{96500}{122 \times 72} = 10.98\,hr$$

= 11 hours

24. In an estimation of bromine by Carius method, 1.6 g of an organic compound gave 1.88 g of AgBr. The mass percentage of bromine in the compound is ..... .(Atomic mass, Ag=108, Br=80 g mol^{-1})

Sol. **50 %**

Carius method

$$\%\ \text{of Br} = \frac{\text{wt of AgBr}}{\text{wt. of organic compound}} \times 100 \times \frac{\text{molar mass of Br}}{\text{AgBr}}$$

$$= \frac{1.88}{1.6} \times \frac{80}{188} \times 100 = \frac{15040}{300.8} = 50\%$$

25. The number of Cl = O bonds in perchloric acid is, "....."

Sol. **3**