

**JEE(MAIN) – 2018 TEST PAPER WITH SOLUTION
(HELD ON SUNDAY 08th APRIL, 2018)**

PART A – CHEMISTRY

1. Which of the following salts is the most basic in aqueous solution ?

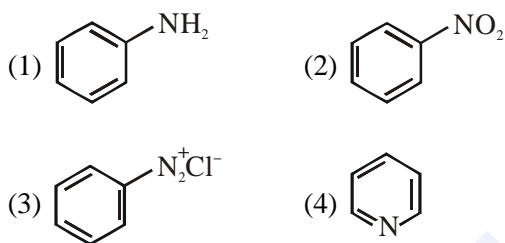
- (1) CH_3COOK (2) FeCl_3
(3) $\text{Pb}(\text{CH}_3\text{COO})_2$ (4) $\text{Al}(\text{CN})_3$

Ans. (1)



Hence nature of solution is basic

2. Which of the following compounds will be suitable for Kjeldahl's method for nitrogen estimation ?



Ans. (1)

Sol. Kjeldahl's is suitable for Aniline. This method is used for quantitative analysis of N compound in organic substance ($\text{NH}_3 / \text{NH}_4^+$).

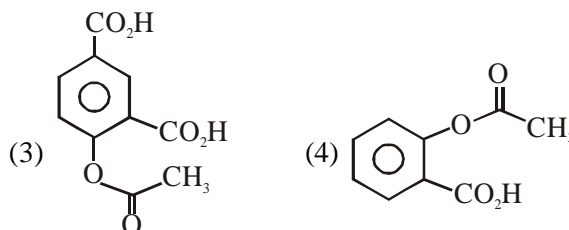
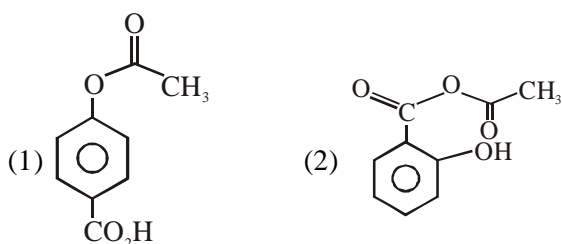
3. Which of the following are Lewis acids ?

- (1) AlCl_3 and SiCl_4
(2) PH_3 and SiCl_4
(3) BCl_3 and AlCl_3
(4) PH_3 and BCl_3

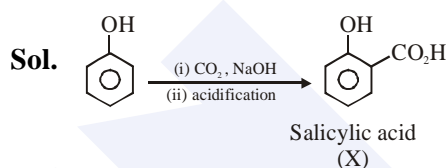
Ans. (3)

Sol. BCl_3 & AlCl_3 both have vacant p-orbital & incomplete octet. So they act as Lewis acid.

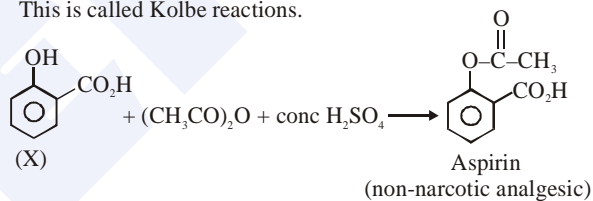
4. Phenol on treatment with CO_2 in the presence of NaOH followed by acidification produces compound X as the major product. X on treatment with $(\text{CH}_3\text{CO})_2\text{O}$ in the presence of catalytic amount of H_2SO_4 produces :



Ans. (4)



This is called Kolbe reactions.



This step is called acylation reaction.

5. An alkali is titrated against an acid with methyl orange as indicator, which of the following is a correct combination ?

| Base | Acid | End point |
|------------|--------|-----------------------|
| (1) Strong | Strong | Pinkish red to yellow |
| (2) Weak | Strong | Yellow to pinkish red |
| (3) Strong | Strong | Pink to colourless |
| (4) Weak | Strong | Colourless to pink |

Ans. (2)

Sol. Methyl orange shows Red(pinkish) color in Acidic medium & yellow color in basic medium since original solution is basic so initial color \Rightarrow yellow & Titrated with acid so Final color \Rightarrow pinkish (red)

6. An aqueous solution contains 0.10 M H_2S and 0.20 M HCl . If the equilibrium constants for the formation of HS^- from H_2S is 1.0×10^{-7} and that of S^{2-} from HS^- ions is 1.2×10^{-13} then the concentration of S^{2-} ions in aqueous solution is :

- (1) 3×10^{-20} (2) 6×10^{-21}
 (3) 5×10^{-19} (4) 5×10^{-8}

Ans. (1)

Sol. $[H_2S] = 0.10$ M

$[HCl] = 0.20$ M $\Rightarrow [H^+] = 0.2$ M

(1) $H_2S \rightleftharpoons HS^- + H^+$ $K_1 = 1.0 \times 10^{-7}$

(2) $HS^- \rightleftharpoons S^{2-} + H^+$ $K_2 = 1.2 \times 10^{-13}$

So ,

$H_2S \rightleftharpoons S^{2-} + 2H^+$ $= K_1 \times K_2$
 $= 1.2 \times 10^{-20}$

So,

$$[S^{2-}] = \frac{1.2 \times 10^{-20} \times [H_2S]}{[H^+]^2}$$

$$= \frac{1.2 \times 10^{-20} \times 10^{-1}}{4 \times 10^{-2}}$$

$$= 3 \times 10^{-20} \text{ M}$$

* All the $[H^+]$ will come from strong acid $[HCl]$ only.

7. The combustion of benzene (l) gives $CO_2(g)$ and $H_2O(l)$. Given that heat of combustion of benzene at constant volume is -3263.9 kJ mol $^{-1}$ at $25^\circ C$; heat of combustion (in kJ mol $^{-1}$) of benzene at constant pressure will be - ($R = 8.314$ JK $^{-1}$ mol $^{-1}$)

- (1) -452.46 (2) 3260
 (3) -3267.6 (4) 4152.6

Ans. (3)

Sol. $C_6H_6(l) + \frac{15}{2} O_2(g) \rightarrow 6CO_2(g) + 3H_2O(l)$

$\Delta n_g = 6 - 7.5 = -1.5$ (change in gaseous mole)

ΔU or $\Delta E = -3263.9$ kJ

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

$\Delta n_g = -1.5$

$R = 8.314$ JK $^{-1}$ mol $^{-1}$

$T = 298$ K

So $\Delta H = -3263.9 + (-1.5) 8.314 \times 10^{-3} \times 298$
 $= -3267.6$ kJ

ΔH = Heat at constant pressure

$\Delta U / \Delta E$ = Heat at constant volume

R = gas constant

8. The compound that does not produce nitrogen gas by the thermal decomposition is

- (1) $(NH_4)_2Cr_2O_7$ (2) NH_4NO_2
 (3) $(NH_4)_2SO_4$ (4) $Ba(N_3)_2$

Ans. (3)

Sol. 1. $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} Cr_2O_3 + N_2 + 4H_2O$

2. $NH_4NO_2 \xrightarrow{\Delta} N_2 + 2H_2O$

3. $(NH_4)_2SO_4 \xrightarrow{\Delta} 2NH_3 + H_2SO_4$

4. $Ba(N_3)_2 \xrightarrow{\Delta} Ba + 3N_2$

In reaction (3) NH_3 is evolved where as in reaction 1, 2 and 4 N_2 is evolved.

9. How long (approximate) should water be electrolysed by passing through 100 amperes current so that the oxygen released can completely burn 27.66 g of diborane ?

(Atomic weight of B = 10.8 u)

- (1) 0.8 hours (2) 3.2 hours
 (3) 1.6 hours (4) 6.4 hours

Ans. (2)

Sol. $B_2H_6 + 3O_2 \rightarrow B_2O_3 + 3H_2O$

moles of O_2 required = 3x moles of B_2H_6

$$= 3 \times \frac{27.6}{27.6} = 3$$

$$\frac{I \times t}{96500} = \text{moles of } O_2 \times 4$$

$$\frac{100 \times t}{96500} = 3 \times 4$$

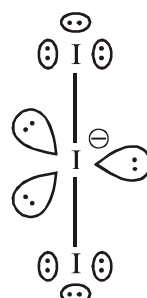
$$t = \frac{3 \times 4 \times 96500}{100} \text{ sec.}$$

$$= 3.2 \text{ hours.}$$

10. Total number of lone pair of electrons in I_3^- ion is

- (1) 6 (2) 9
 (3) 12 (4) 3

Ans. (2)



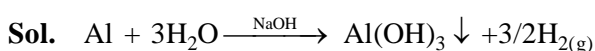
Sol.

Total number of lone pair in I_3^- is 9.

11. When metal 'M' is treated with NaOH, a white gelatinous precipitate 'X' is obtained, which is soluble in excess of NaOH. Compound 'X' when heated strongly gives an oxide which is used in chromatography as an adsorbent. The metal 'M' is

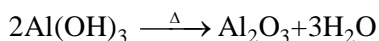
- (1) Ca (2) Al
(3) Fe (4) Zn

Ans. (2)



(x)
white gelatinous ppt.

↓
soluble in excess of NaOH
and form $\text{Na}[\text{Al}(\text{OH})_4]$



used as
adsorbent in chromatography

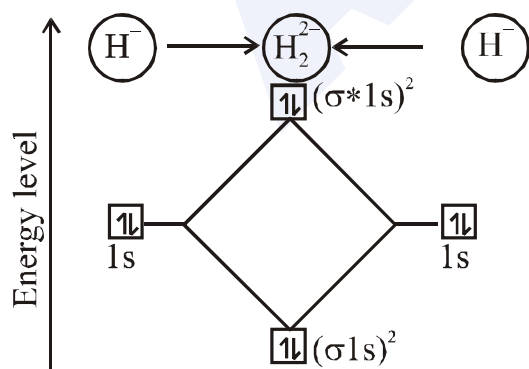
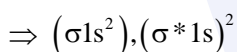
So metal is Al.

12. According to molecular orbital theory, which of the following will not be a viable molecule ?

- (1) He_2^+ (2) H_2^-
(3) H_2^{2-} (4) He_2^{2+}

Ans. (3)

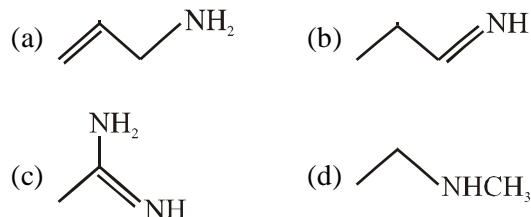
Sol. The electronic configuration of $\text{H}_2^{2\ominus}$ is



Bond order of $\text{H}_2^{2\ominus} = \frac{N_b - N_a}{2} = \frac{2 - 2}{2} = 0$.

Hence $\text{H}_2^{2\ominus}$ does not exist, due to zero bond order.

13. The increasing order of basicity of the following compounds is :



- (1) (b) < (a) < (c) < (d)
(2) (b) < (a) < (d) < (c)
(3) (d) < (b) < (a) < (c)
(4) (a) < (b) < (c) < (d)

Ans. (2)

Sol. Order of base nature depends on electron donation tendency.

In compound nitrogen is sp^2 hybridized so least basic among all given compound.

compound is very strong

nitrogenous organic base as lone pair of one nitrogen delocalize in resonance and make another nitrogen negatively charged and conjugate acid have two equivalent resonating structure.

Thus it is most basic in given compounds.

(secondary amine) more basic than (primary amine)

14. Which type of 'defect' has the presence of cations in the interstitial sites ?

- (1) Vacancy defect
(2) Frenkel defect
(3) Metal deficiency defect
(4) Schottky defect

Ans. (2)

Sol. In Frenkel defect, some of ion (usually cation due to their small size) missing from their correct position and occupies position in interstitial.

15. Which of the following compounds contain(s) no covalent bond(s) ?

KCl, PH₃, O₂, B₂H₆, H₂SO₄

- (1) KCl, H₂SO₄
- (2) KCl
- (3) KCl, B₂H₆
- (4) KCl, B₂H₆, PH₃

Ans. (2)

Sol. $\left. \begin{array}{l} \text{PH}_3 \\ \text{O}_2 \\ \text{B}_2\text{H}_6 \\ \text{H}_2\text{SO}_4 \end{array} \right\}$ All are covalent compounds

KCl is ionic compound.

16. The oxidation states of Cr in [Cr(H₂O)₆]Cl₃, [Cr(C₆H₆)₂], and K₂[Cr(CN)₂(O)₂(O₂)(NH₃)] respectively are :

- (1) +3, +2, and +4
- (2) +3, 0, and +6
- (3) +3, 0, and +4
- (4) +3, +4, and +6

Ans. (2)

Sol. (i) [Cr(H₂O)₆]Cl₃: Hexaaquachromium(III) chloride

$$x + 6 \times 0 + (-1) \times 3 = 0$$

$$\boxed{x = +3}$$

(ii) [Cr(C₆H₆)₂] : bis(η⁶-benzene)chromium(0)

$$y + 2 \times 0 = 0$$

$$\boxed{y = 0}$$

(iii) K₂[Cr(CN)₂(O)₂(O₂)(NH₃)] :

Potassium amminedicyanidodioxidoperoxidochromate(VI)

$$2 \times 1 + z + 2 \times (-1) + 2 \times (-2) + (-2) + 0 = 0$$

$$\boxed{z = +6}$$

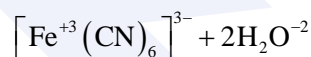
The oxidation states of Cr in [Cr(H₂O)₆]Cl₃, [Cr(C₆H₆)₂], and K₂[Cr(CN)₂(O)₂(O₂)(NH₃)] respectively are +3, 0 and +6.

17. Hydrogen peroxide oxidises [Fe(CN)₆]⁴⁻ to [Fe(CN)₆]³⁻ in acidic medium but reduces [Fe(CN)₆]³⁻ to [Fe(CN)₆]⁴⁻ in alkaline medium. The other products formed are, respectively :

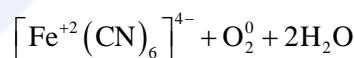
- (1) (H₂O + O₂) and (H₂O + OH⁻)
- (2) H₂O and (H₂O + O₂)
- (3) H₂O and (H₂O + OH⁻)
- (4) (H₂O + O₂) and H₂O

Ans. (2)

Sol. (i) $[\text{Fe}^{+2}(\text{CN})_6]^{4-} + \text{H}_2\text{O}_2^{-1} + 2\text{H}^+$



(ii) $[\text{Fe}^{+3}(\text{CN})_6]^{3-} + \text{H}_2\text{O}_2^{-1} + 2\text{OH}^-$

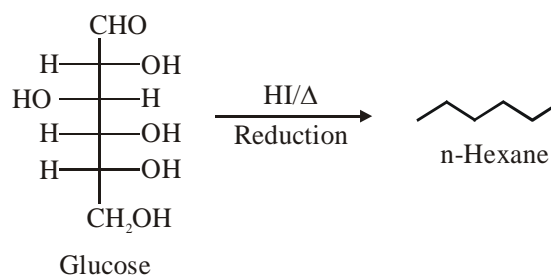


18. Glucose on prolonged heating with HI gives :

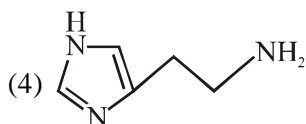
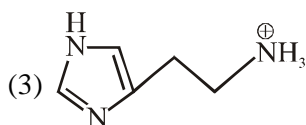
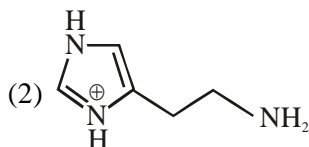
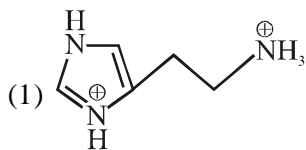
- (1) 1-Hexene
- (2) Hexanoic acid
- (3) 6-iodohexanal
- (4) n-Hexane

Ans. (4)

Sol.

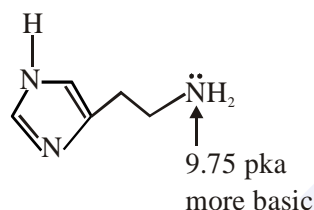


19. The predominant form of histamine present in human blood is (pK_a , Histidine = 6.0)



Ans. (3)

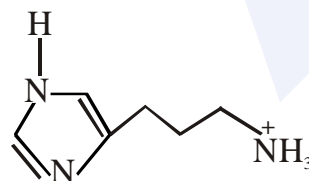
Sol. Structure of Histamine



Blood is slightly basic in nature (7.35 pH) approx.

At this pH terminal NH_2 will get protonated due to more basic nature.

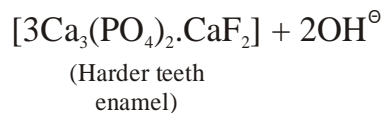
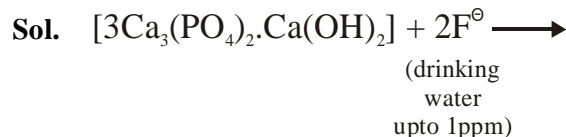
\therefore Predominant structure of Histamine is



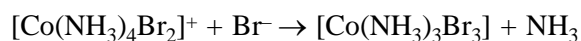
20. The recommended concentration of fluoride ion in drinking water is up to 1 ppm as fluoride ion is required to make teeth enamel harder by converting $[3Ca_3(PO_4)_2 \cdot Ca(OH)_2]$ to :

- (1) $[3(CaF_2) \cdot Ca(OH)_2]$
- (2) $[3Ca_3(PO_4)_2 \cdot CaF_2]$
- (3) $[3(Ca(OH)_2) \cdot CaF_2]$
- (4) $[CaF_2]$

Ans. (2)



21. Consider the following reaction and statements :



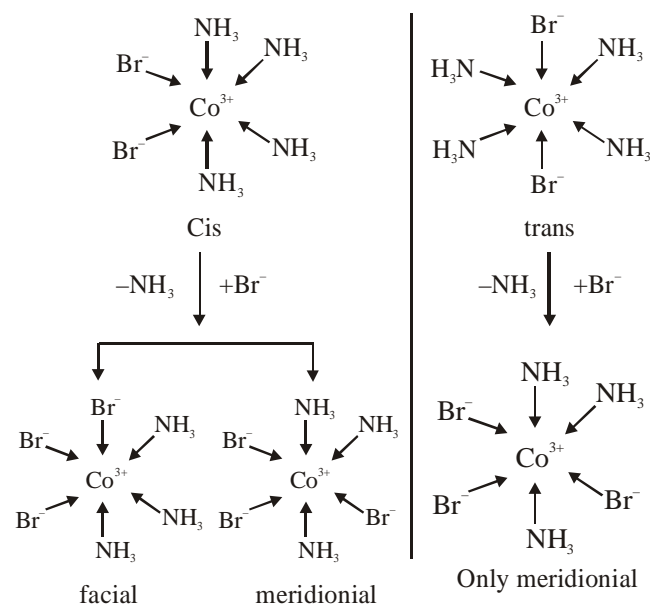
- (I) Two isomers are produced if the reactant complex ion is a *cis*-isomer.
- (II) Two isomers are produced if the reactant complex ion is a *trans*-isomer.
- (III) Only one isomer is produced if the reactant complex ion is a *trans*-isomer.
- (IV) Only one isomer is produced if the reactant complex ion is a *cis*-isomer.

The correct statements are :

- (1) (I) and (III)
- (2) (III) and (IV)
- (3) (II) and (IV)
- (4) (I) and (II)

Ans. (1)

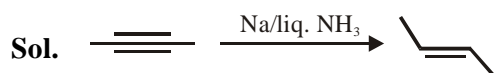
Sol.



22. The *trans*-alkenes are formed by the reduction of alkynes with :

- (1) NaBH_4 (2) Na/liq. NH_3
 (3) Sn-HCl (4) $\text{H}_2\text{-Pd/C, BaSO}_4$

Ans. (2)

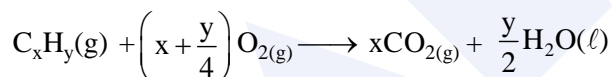
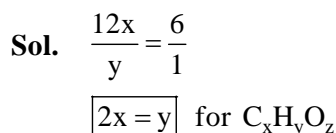


Birch reduction is anti addition. So *trans* alkene will be produced.

23. The ratio of mass percent of C and H of an organic compound ($\text{C}_x\text{H}_y\text{O}_z$) is 6 : 1. If one molecule of the above compound ($\text{C}_x\text{H}_y\text{O}_z$) contains half as much oxygen as required to burn one molecule of compound C_xH_y completely to CO_2 and H_2O . The empirical formula of compound $\text{C}_x\text{H}_y\text{O}_z$ is :

- (1) $\text{C}_2\text{H}_4\text{O}$ (2) $\text{C}_3\text{H}_4\text{O}_2$
 (3) $\text{C}_2\text{H}_4\text{O}_3$ (4) $\text{C}_3\text{H}_6\text{O}_3$

Ans. (3)



no. of oxygen atom in $\text{C}_x\text{H}_y\text{O}_z = z$

no. of oxygen atom required for C_xH_y

combustion is $\left(x + \frac{y}{4}\right) \times 2 = \left(2x + \frac{y}{2}\right)$.

So $z = \frac{1}{2} \left(2x + \frac{y}{2}\right)$

$$z = x + \frac{y}{4}$$

$$z = x + \frac{2x}{4} = \frac{3x}{2}$$

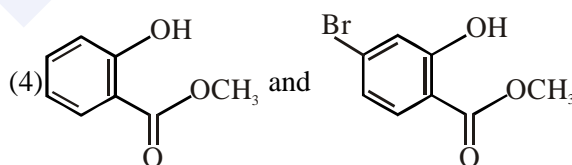
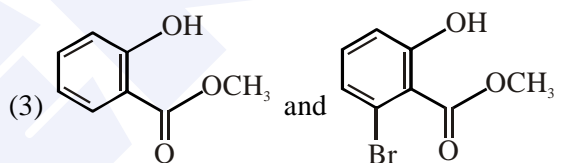
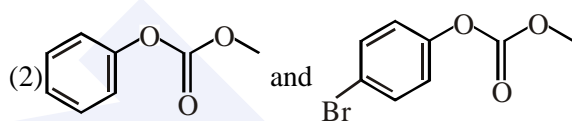
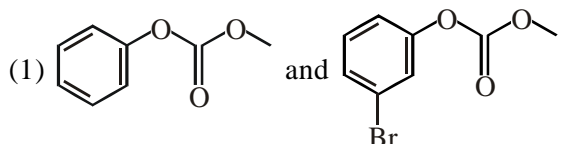
$$x : 2x : \frac{3x}{2}$$

$$2x : 4x : 3x$$

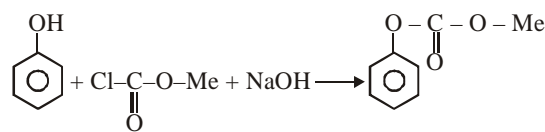
$$2 : 4 : 3$$

Hence $\text{C}_2\text{H}_4\text{O}_3$

24. Phenol reacts with methyl chloroformate in the presence of NaOH to form product A. A reacts with Br_2 to form product B. A and B are respectively :



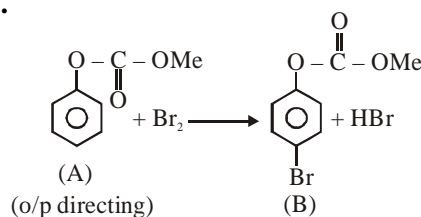
Ans. (2)



Methylchloroformate

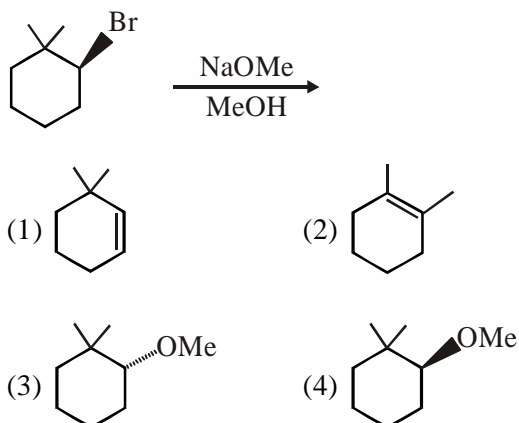
This step involves acid base reaction at first followed by $\text{S}_{\text{N}}\text{AE}$ reactions.

Sol.

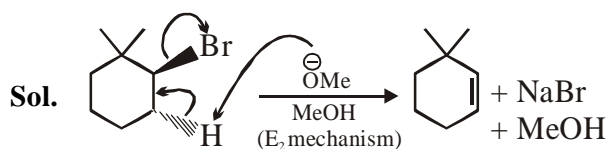


This step is called bromination.

25. The major product of the following reaction is :

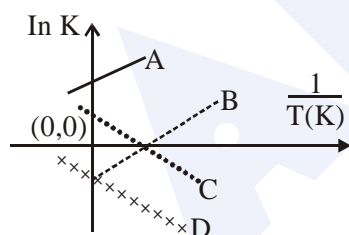


Ans. (1)



Reaction is dehydrohalogenation E_2 -elimination reaction. Elimination takes place in single step and proceed by formation of transition state from anti position.

26. Which of the following lines correctly show the temperature dependence of equilibrium constant, K , for an exothermic reaction ?



- (1) B and C (2) C and D
(3) A and D (4) A and B

Ans. (4)

Sol. From thermodynamics

$$\ln k = \frac{-\Delta H^\circ}{RT} + \frac{\Delta S^\circ}{R}$$

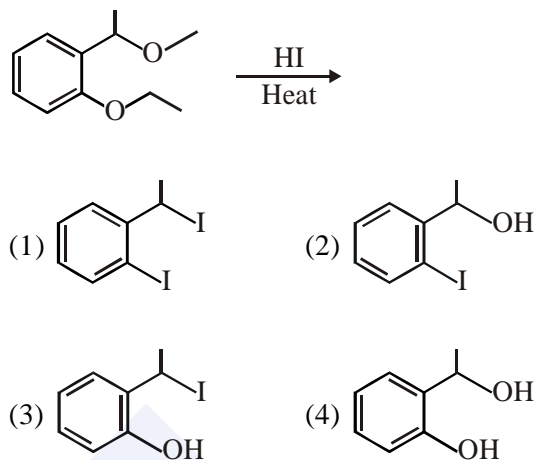
for exothermic reaction,

$$\Delta H = -ve$$

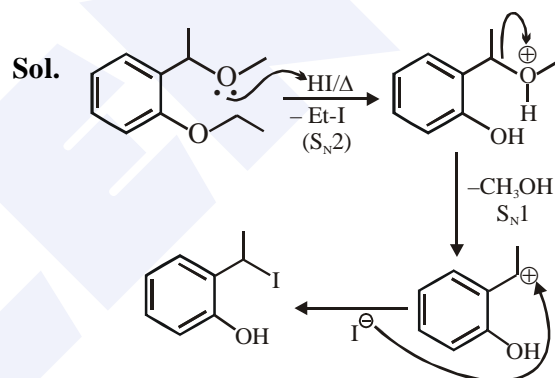
$$\text{slope} = \frac{-\Delta H^\circ}{R} = +ve$$

So from graph, line should be A & B.

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



Ans. (3)

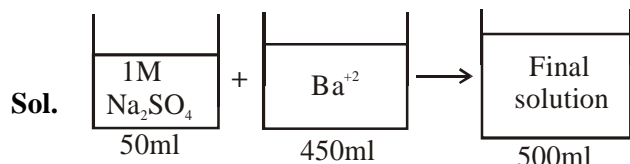


It is nucleophilic substitution reaction.

28. A aqueous solution contains an unknown concentration of Ba^{2+} . When 50 mL of a 1 M solution of Na_2SO_4 is added, $BaSO_4$ just begins to precipitate. The final volume is 500 mL. The solubility product of $BaSO_4$ is 1×10^{-10} . What is the original concentration of Ba^{2+} ?

- (1) 2×10^{-9} M
(2) 1.1×10^{-9} M
(3) 1.0×10^{-10} M
(4) 5×10^{-9} M

Ans. (2)



Concentration of SO₄⁻² in Ba⁺² solution

$$M_1V_1 = M_2V_2$$

$$1 \times 50 = M_2 \times 500$$

$$M_2 = \frac{1}{10}$$

for just precipitation

$$I.P = K_{sp}$$

$$[Ba^{+2}][SO_4^{-2}] = K_{sp} (BaSO_4)$$

$$[Ba^{+2}] \times \frac{1}{10} = 10^{-10}$$

$$[Ba^{+2}] = 10^{-9} \text{ M in 500 ml solution}$$

For calculation of [Ba⁺²] in original solution (450 ml)

$$M_1 \times 450 = 10^{-9} \times 500$$

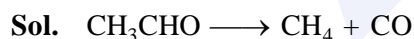
$$M_1 = \frac{500}{450} \times 10^{-9} = 1.11 \times 10^{-9} \text{ M}$$

[M₁ = molarity of Ba⁺² in original solution (450ml)]

29. At 518° C, the rate of decomposition of a sample of gaseous acetaldehyde, initially at a pressure of 363 Torr, was 1.00 Torr s⁻¹ when 5% had reacted and 0.5 Torr s⁻¹ when 33% had reacted. The order of the reaction is :

- (1) 3 (2) 1 (3) 0 (4) 2

Ans. (4)



r₁ = 1 torr sec⁻¹, when 5% reacted (95% unreacted)

r₂ = 0.5 torr sec⁻¹, when 33% reacted (67% unreacted)

$$r \propto (a - x)^m \quad m = \text{order of reaction}$$

$$a - x = \text{unreacted}$$

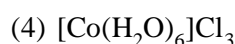
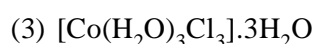
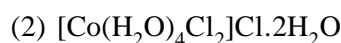
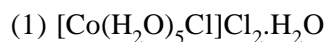
$$\frac{r_1}{r_2} = \left[\frac{(a - x_1)}{(a - x_2)} \right]^m$$

$$\frac{1}{0.5} = \left(\frac{0.95}{0.67} \right)^m$$

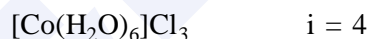
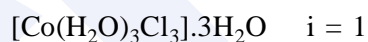
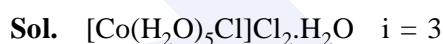
$$2 = (1.41)^m \Rightarrow 2 = (\sqrt{2})^m$$

$$\Rightarrow m = 2$$

30. For 1 molal aqueous solution of the following compounds, which one will show the highest freezing point ?



Ans. (3)



$$\Delta T_f \propto i \quad \text{where } \Delta T_f = (T_f - T_f')$$

$$T_f' = \text{F.P. of solution}$$

Freezing point of solution ↑ as i ↓.