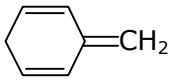
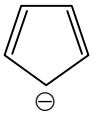
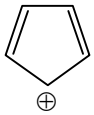
CHEMISTRY
JEE-MAIN (MARCH-Attempt) 16 MARCH
(Shift-1) Paper

Section-A

1. Among the following, the aromatic compounds are:

(A)  (B) 

(C)  (D) 

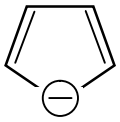
Choose the correct answer from the following options:

(1) (A) and (B) only (2) (A), (B) and (C) only

(3) (B), (C) and (D) only (4) (B) and (C) only

Ans. **(4)**

Sol.

 6 π electron

 6 π electron

2. Given below are two statements:
Statement I: H_2O_2 can act as both oxidising and reducing agent in basic medium.
Statement II: In the hydrogen economy, the energy is transmitted in the form of dihydrogen.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is false but statement II is true
(2) Both Statement I and Statement II are true
(3) Statement I is true but statement II is false
(4) Both Statement I and Statement II are false

Ans. **(2)**

Sol. H_2O_2 can act as oxidising & reducing agent in both acidic & basic medium.

3. Which of the following is Lindlar catalyst?
(1) Zinc chloride and HCl
(2) Partially deactivated palladised charcoal
(3) Sodium and Liquid NH_3
(4) Cold dilute solution of $KMnO_4$

Ans. **(2)**

Sol. Lindlar's catalyst $\Rightarrow$ $Pd/CaCo_3$ + $(CH_3COO)_2$ Pb + quinolene

4. In chromatography technique, the purification of compound is independent of:

(1) Length of the column or TLC plate

(2) Mobility or flow of solvent system

(3) Physical state of the pure compound

(4) Solubility of the compound

Ans. **(3)**

Sol. Based on NCERT

5. Which among the following pairs of Vitamins is stored in our body relatively for longer duration?

(1) Ascorbic acid and Vitamin D

(2) Thiamine and Ascorbic acid

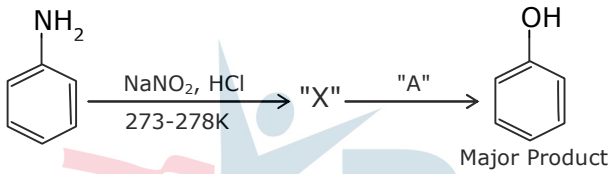
(3) Vitamin A and Vitamin D

(4) Thiamine and Vitamin A

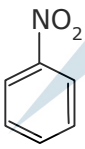
Ans. **(3)**

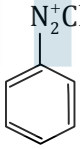
Sol. Based on NCERT

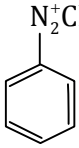
6.

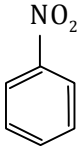


In the above chemical reaction, intermediate "X" and reagent/condition "A" are:

(1) X-  ; A-H_2O/NaOH

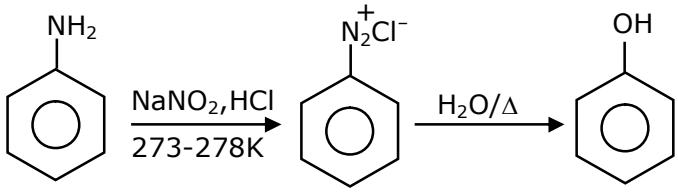
(2) X-  ; A-H_2O/NaOH

(3) X-  ; A-H_2O/Δ

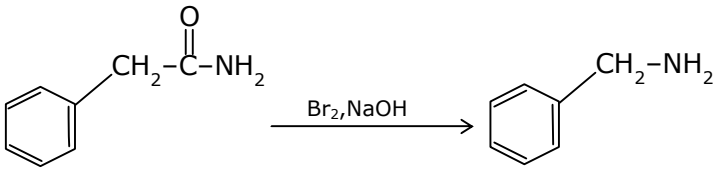
(4) X-  ; A-H_2O/Δ

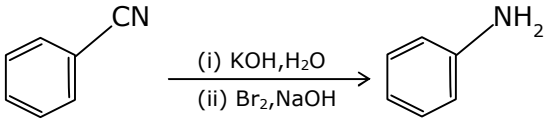
Ans. **(3)**

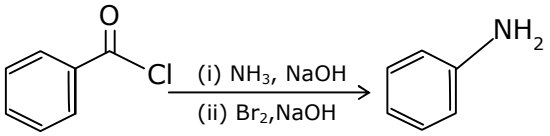
Sol.

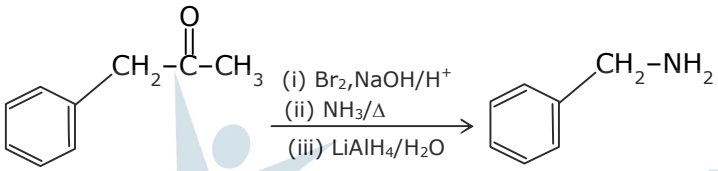


7. Which of the following reaction DOES NOT involve Hoffmann bromamide degradation?

(1) 

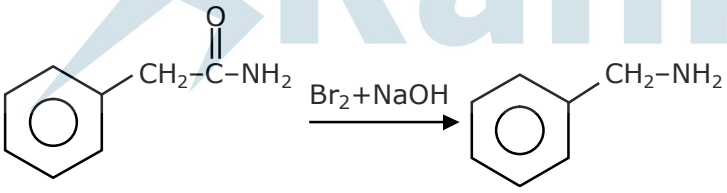
(2) 

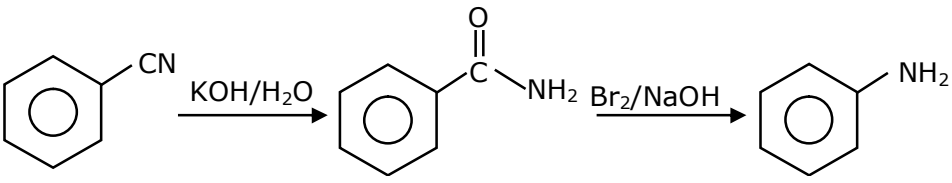
(3) 

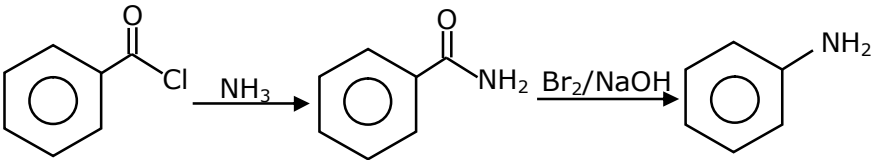
(4) 

Ans. **(4)**

Sol.

(1) 

(2) 

(3) 

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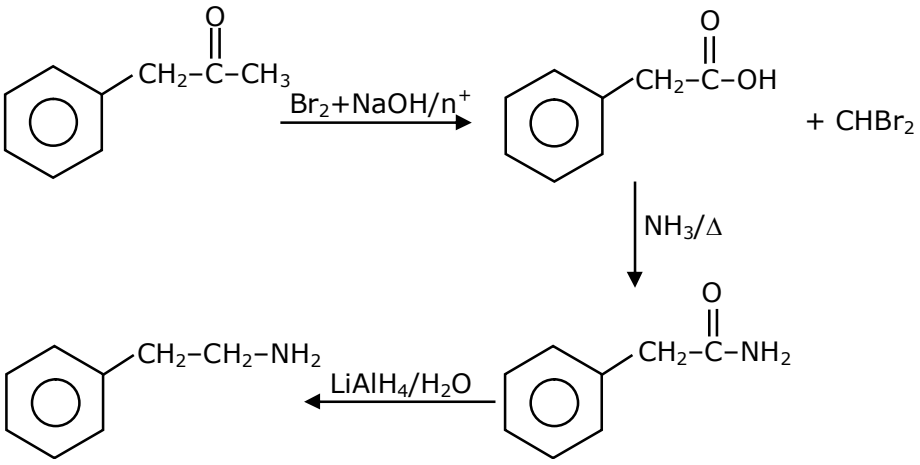


8. A group 15 element, which is a metal and forms a hydride with strongest reducing power among group 15 hydrides. The element is:

(1) Bi (2) As (3) P (4) Sb

Ans. **(1)**

Sol. BiH_3 is strongest reducing agent among the hydrides of 15 group elements as Bi – H bond dissociation energy is very less.

9. Given below are two statement : One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Size of Bk^{3+} ion is less than Np^{3+} ion.

Reason R: The aboveis a consequence of the lanthanoid contraction.

In the light of the above statements, choose the correct answer from the options given below:

(1) A is false but R is true

(2) Both A and R are true but R is not the correct explanation of A

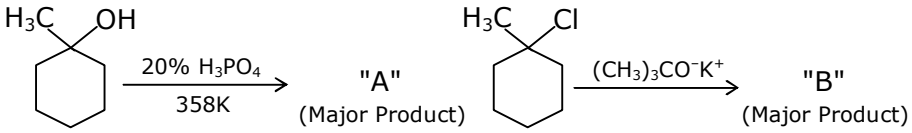
(3) A is true but R is false

(4) Both A and R are true and R is the correct explanation of A

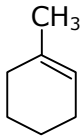
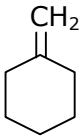
Ans. **(4)**

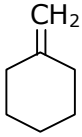
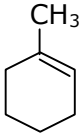
Sol. $_{93}Np^{3+}$ $_{97}BK^{3+}$ as atomic No. increase ionic size dec. (lanthanide/Actinide) contraction.

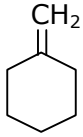
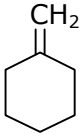
10.

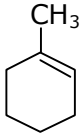
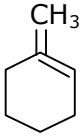


The products "A" and "B" formed in above reactions are:

(1) A–  B– 

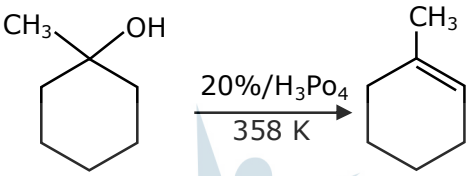
(2) A–  B– 

(3) A–  B– 

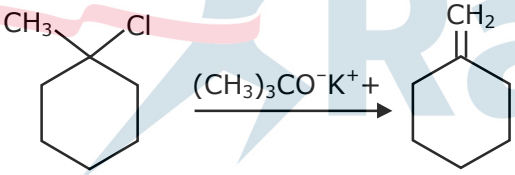
(4) A–  B– 

Ans. **(1)**

Sol.



Saytzeff's alkene(A)



Hoff mann's alkene(B)

11. The type of pollution that gets increased during the day time and in the presence of $O_3$is :

(1) Global warming (2) Reducing smog

(3) Acid rain (4) Oxidising smog

Ans. **(4)**

Sol. $NO + O_2 \longrightarrow NO_2$

$NO + O_3 \longrightarrow NO_2 + O_2$

$NO_2 \xrightarrow{h\nu} NO + [O]$

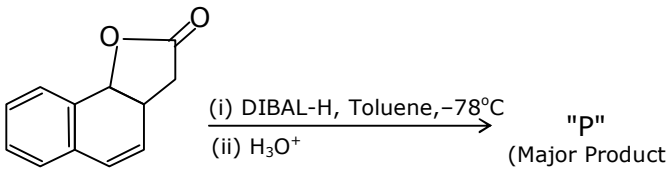
$O + O_2 \rightleftharpoons O_3$

Bad ozone

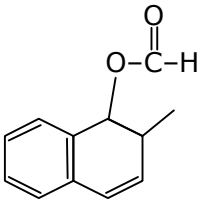
$CH_4 + O_2 \longrightarrow CH_2 = O + H_2O$

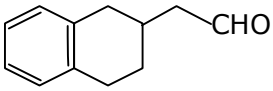
Vehicle

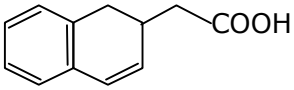
Exhaust

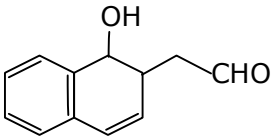
12. 

The product "P" in the above reaction is:

(1) 

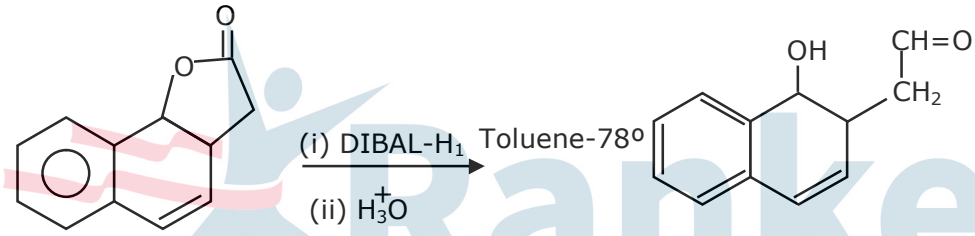
(2) 

(3) 

(4) 

Ans. (4)

Sol.



13. Match List – I with List – II:

	List-I Industrial process		**List-II Application**
(a)	Haber's process	(i)	HNO_3 synthesis
(b)	Ostwald's process	(ii)	Aluminium extraction
(c)	Contact process	(iii)	NH_3 synthesis
(d)	Hall-Heroult process	(iv)	H_2SO_4 synthesis

Choose the correct answer from the options given below:

(1) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

(2) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

(3) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

(4) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

Ans. (4)

Sol. Habber's process is used for NH_3 manufacture

$$N_2 + 3H_2 \underset{}{\overset{Fe/Mo}{\rightleftharpoons}} 2NH_3$$

Ostwald's process is used for perperational HNO_3 by catalytic oxidation of NB

Contact process is used for preperation of H_2SO_4 using N_2O_5 catalyst

Hall herowlt process is used for Al exhactium.

14. Given below are two statements:
Statement I: The E^o value for Ce^{4+}/Ce^{3+} is +1.74 V.
Statement II: Ce is more stable in Ce^{4+} state than Ce^{3+} state.
In the light of the above statements, choose the correct answer from the options given below:
(1) Both Statement I and Statement II are correct
(2) Statement I is incorrect but statement II is correct
(3) Both Statement I and Statement II are incorrect
(4) Statement I is correct but statement II is incorrect

Ans. (4)

Sol. Ce^{4+} is good oxidising agent as Ce^{3+} is more stable
$Ce^{-4} + e^- \rightarrow Ce^{3+}$ $E^\circ = 1.74$ volt

15. Given below are two statements:
Statement I: Both $CaCl_{(2)}6H_2O$ and $MgCl_{(2)}8H_2O$ undergo dehydration on heating.
Statement II: BeO is amphoteric whereas the oxides of other elements in the same group are acidic.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is true but statement II is false
(2) Both Statement I and Statement II are false
(3) Statement I is false but statement II is true
(4) Both Statement I and Statement II are true

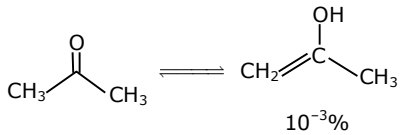
Ans. (2)

Sol. $CaCl_2.6H_2O \xrightarrow{\Delta} CaCl_2 + 6H_2O$
$MgCl_2.6H_2O \longrightarrow MgCl(OH) + H_2O$
Among alkaline earth metal BeO is amphateric & rest are basic oxide

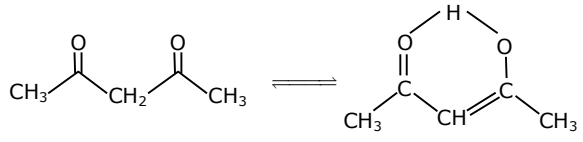
16. **Assertion A :**Enol form acetone $[CH_3COCH_3]$ exists in <0.1% quantity. However, the enol form the acetyl acetone $[CH_3COCH_2OCCH_3]$ exists in approximately 15% quantity.
Reason R: Enol form of acetyl acetone is stabilized by intramolecular hydrogen bonding, which is not possible in enol form of acetone.
Choose the correct statement:
(1) A is true but R is false
(2) Both A and R are true but R is the correct explanation of A
(3) A is false but R is true
(4) Both A and R are true but R is not the correct explanation of A

Ans. (2)

Sol.



$10^{-3}\%$



76%

stable due to intramolecular H-bonding

17. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason

Assertion A: The H–O–H bond angle in water molecule is 104.5°

ReasonR: The lone pair – lone pair repulsion of electrons is higher than the bond pair-bond pair repulsion.

In the light of the above statements, choose the correct answer from the options given below:

(1) A is false but R is true

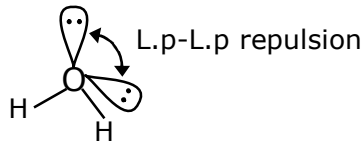
(2) A is true but R is false

(3) Both A and R are true, and R is the correct explanation of A

(4) Both A and R are true, but R is not the correct explanation of A

Ans. (3)

Sol.



2bp & 2-L.P.

in water O atom is sp^3 hybridised with 2 B.P & 2 L.P

18. Match List – I with List – II:

	List-I Name of oxo acid		List-II Oxidation state of 'P'
(a)	Hypophosphorous acid	(i)	+5
(b)	Orthophosphoric acid	(ii)	+4
(c)	Hypophosphoric acid	(iii)	+3
(d)	Orthophosphorous acid	(iv)	+2
		(v)	+1

Choose the correct answer from the options given below:

(1) (a)-(iv), (b)-(v), (c)-(ii), (d)-(iii)

(2) (a)-(v), (b)-(iv), (c)-(ii), (d)-(iii)

(3) (a)-(v), (b)-(i), (c)-(ii), (d)-(iii)

(4) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

Ans. (3)

Sol.

Hypophosphorous acid $\overset{+1}{H_3PO_2}$

Orthophosphoric acid $\overset{+5}{H_3PO_4}$

Hypophosphoric acid $\overset{+4}{H_4P_2O_6}$

Orthophosphorous acid $\overset{+3}{H_3PO_3}$

19. The process that involves the removal of sulphur from the ores is:
(1) Refining (2) Roasting (3) Smelting (4) Leaching

Ans. **(2)**

Sol. Rosting removes S as SO_2

$S + O_2 \longrightarrow SO_2$

20. The functions of antihistamine are :
(1)Antiallergic and Analgesic (2) Antacid and antiallergic
(3)Antiallergic and antidepressant (4) Analgesic and antacid

Ans. **(2)**

Sol. Based on NCERT

Section-B

1. $2MnO_4^- + bC_2O_4^{2-} + cH^+ \rightarrow xMn^{2+} + y\,CO_2 + zH_2O$

If the above equation is balanced with integer coefficients, the value of c is_____.
(Round off to the Nearest Integer).

Ans. **16**

Sol. $16H^+ + 2MnO_4^- + 5C_2O_4^{2-} \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

2. Complete combustion of 750 g of an organic compound provides 420 g of CO_2 and 210 g of H_2O. The percentage composition of carbon and hydrogen in organic compound is 15.3 and _____ respectively. (Round off to the Nearest Integer).

Ans. **3**

Sol. Liebeig method:

$$\% \text{ of H-element} = \frac{2}{18} \times \frac{\text{Mass of } H_2O}{\text{Mass of compound}} \times 100$$

$$= \frac{2}{18} \times \frac{210}{750} \times 100 = 3.11 \simeq 3$$

3. AB_2 is 10% dissociated in water to A^{2+} and B^-. The boiling point of a 10.0 molal aqueous solution of AB_2 is _____ °C. (Round off to the Nearest Integer).
[Given: Molal elevation constant of water K_b = 0.5 K kg mol^{-1} boiling point of pure water = 100°C]

Ans. **106**

Sol. $\Delta T_b = iK_bm$

$$\propto = \frac{i-1}{n-1}$$

$$0.1 = \frac{i-1}{(3-1)} \quad \{AB_2 \rightleftharpoons A^{2+} + 2B^-\}$$

$i = 1.2$

$\Delta T_b = 1.2 \times 0.5 \times 10 = 6$

$(T_b)_{solution} = 106°C$

4. A certain element crystallises in a bcc lattice of unit cell edge length 27Å. If the same element under the same conditions crystallises in the fcc lattice, the edge length of the unit cell in Å will be _____. (Round off to the Nearest Integer).

[Assume each lattice point has a single atom]

[Assume $\sqrt{3}=1.73$, $\sqrt{2}=1.41$]

Ans. 33

Sol. For BCC unit cell, $\sqrt{3}a = 4R$

$a = \frac{4R}{\sqrt{3}} = 27$

$R = \frac{27\sqrt{3}}{4}$

For fcc unit cell

$\sqrt{2}a = 4R$

$a = \frac{4}{\sqrt{2}}\left(\frac{27\sqrt{3}}{4}\right)$

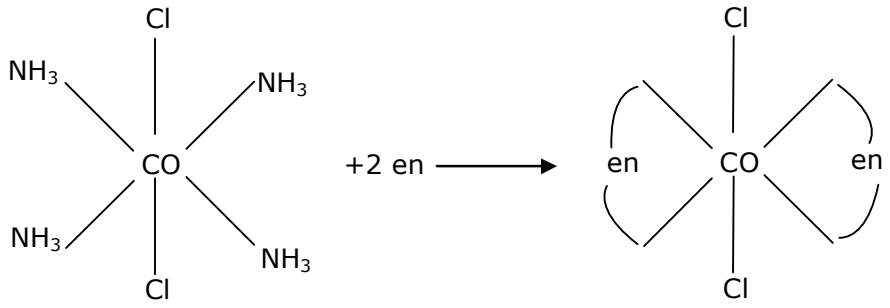
$a = 27\sqrt{\frac{3}{2}}$

$a = 33.12 \approx 33$

5. The equivalents of ethylene diamine required to replace the neutral ligands from the coordination sphere of the trans-complex of $CoCl_{(3)}$ $4NH_3$ is _____. (Round off to the Nearest Integer).

Ans. (2)

Sol. $COCl_3.4NH_3$ or $[CO(NH_3)_4Cl_2]Cl$



Trans-complex

6. For the reaction $A(g) \rightleftharpoons B(g)$ at 495 K, $\Delta_r G^\circ$ = −9.478 kJ mol$^{-(1)}$

If we start the reaction in a closed container at 495 K with 22 millimoles of A, the amount of B in the equilibrium mixture is _____millimoles. (Round off to the Nearest Integer).

[R = 8.314] mol^{-1} K^{-1}; ln 10 = (2)303]

Ans. **20**

Sol. $\Delta G^\circ = -RT \ln K_{eq}$

$-9.478 \times 10^3 = -495 \times 8.314 \ln K_{eq}$

$\ln K_{eq} = 2.303 = \ln 10$

So, $K_{eq} = 10$

Now, $A(g) \rightleftharpoons B(g)$

t = 0 22 0

t = t 22−x x

$K_{eq} = \frac{[B]}{[A]} = \frac{x}{(22-x)} = 10$

x = 20

So, millimoles of B = 20

7. When light of wavelength 248 nm falls on a metal of threshold energy 3.0 eV, the de-Broglie wavelength of emitted electrons is _____Å. (Round off to the Nearest Integer).

[Use : $\sqrt{3} = 1.73$, h = 6.63×10^{-34} Js

$m_e = 9.1 \times 10^{-31}$ kg; c = 3.0×10^8 ms^{-1}; 1eV = 1.6×10^{-19}J]

Ans. **9**

Sol. $\lambda = 248 \times 10^{-9}$m

$w_0 = 3 \times 1.6 \times 10^{-19}$ J

$E = w_0 + K.E.$

$\frac{hc}{\lambda} = W_0 + K.E.$

$K.E = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{248 \times 10^{-19}} - 3 \times 1.6 \times 10^{-19}$

$= 3.2 \times 10^{-19}$J

$P = \sqrt{2mK.E.}$

$P = \sqrt{2 \times 9.1 \times 10^{-31} \times 3.2 \times 10^{-19}}$

$P = 7.63 \times 10^{-25}$

$\therefore \lambda = \frac{h}{p} = \frac{6.626 \times 10^{-34}}{7.63 \times 10^{-25}}$

$\lambda = 8.7 \times 10^{-10} = 8.7Å \approx 9$

8. A 6.50 molal solution of KOH (aq.) has a density of 1.89 g cm^{-3}The molarity of the solution is _____ $moldm^{-3}$ (Round off to the Nearest Integer).
[Atomic masses : K : 39.0 u; O: 16.0 u; H: 1.0 u]

Ans. **9**

Sol. $m = \frac{1000 \times M}{1000xd - M \times M_{solute}}$

$6.5 = \frac{1000 \times M}{1890 - M \times 56}$

$12285 - 364M = 1000M$

$1364\ M = 12285$

$M = 9$

9. Two salts A_2X and MX have the same value of solubility product of 4.0×10^{-12}The ratio of their molar solubilities i.e. $\frac{S(A_2X)}{S(MX)} =$ _____. (Round off to the Nearest Integer).

Ans. **50**

Sol. $AX_2(s) \rightleftharpoons A^{2+}(aq) + 2X^-(aq)$

Solubility: (x) $\frac{mole}{L}$ (x) (x)

$\Rightarrow K_{sp} = 4 \times 10^{-12} = [A^{2+}]\ [x^-]^2 = 4x^3$

$\Rightarrow x = 10^{-4} = S_{AX_2}$

$Bx(s) \rightleftharpoons B^+(aq) + x^-(aq)$

Solubility: (y) $\frac{mole}{L}$ (y) (y)

$\Rightarrow K_{sp} = 4 \times 10^{-12} = [B^-][x^-] = y^2$

$\Rightarrow y = 2 \times 10^{-6} = S_{Bx}$

$\Rightarrow \frac{S_{Ax_2}}{S_{Bx}} = \frac{10^{-4}}{2\times10^{-6}} = 50$

10. The decomposition of formic acid on gold surface follows first order kinetics. If the rate constant at 300 K is $1.0\times10^{-3}\ s^{-1}$ and the activation energy E_a = 11.488 kJ mol^{-1}, the rate constant at 200 K is _____$\times10^{-5}\ s^{-1}$.(Round off to the Nearest Integer).

Ans. **10**

Sol. $\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

$\log\frac{1.0\times10^{-3}s^{-1}}{K_1} = \frac{11.488\times1000}{2.303\times8.314}\left[\frac{1}{200} - \frac{1}{300}\right]$

$\log\frac{10^{-3}}{K_1} = 600\times\frac{3-2}{600}$ $\log\frac{10^{-3}}{K_1} = 1$ $\Rightarrow 10 = \frac{10^{-3}}{K_1}$

$\Rightarrow K_1 = 10^{-4}$ So, $x \times 10^{-5} = 10^{-4} \Rightarrow x = 10$

(Given: R = 8.314J $Mol^{-1}\ K^{-1}$)