

JEE MAIN PAPER CLASS 11<sup>th</sup>

1.  $K_a$  for HCN is  $5 \times 10^{-10}$  at  $25^\circ\text{C}$ . For maintaining at constant pH of 9, the volume of 5MKCN solution required to be added to 10ml of 2MHCN solution is

(A) 4ml

(B) 7.95ml

(C) 2ml

(D) 9.3ml

$$\text{pH} = \text{p}K_a + \log \frac{\text{Salt}}{\text{acid}}$$

$$9 = 10 - \log 5 + \log \frac{5 \times V}{2 \times 10}$$

2. One mole of  $\text{N}_2\text{H}_4$  loses 10 moles of electrons to form a new compound, y. Assuming that all nitrogen appear in the new compound, what is the oxidation state of nitrogen in y (There is no change in the oxidation state of hydrogen)

(A)  $-1$

(B)  $-3$

(C)  $+3$

(D)  $+5$



3.

The reactions



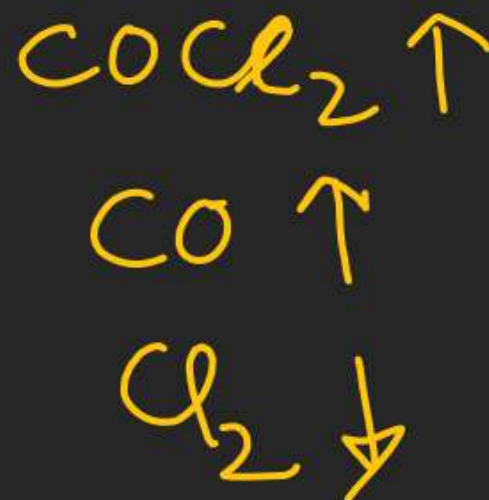
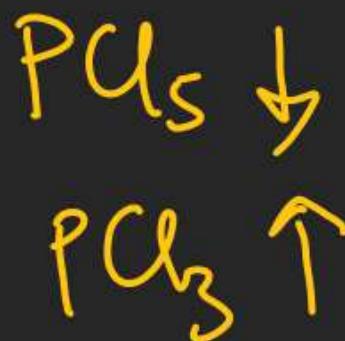
are simultaneously in equilibrium in a vessel at constant volume. If some CO is introduced into the vessel then at the new equilibrium

(A)  $\text{Cl}_2$  is greater ✗

(B)  $\text{PCl}_5$  is less ↓

(C)  $\text{PCl}_3$  remain unchanged ✗

(D)  $\text{PCl}_5$  is greater ✗



4.  $\text{Li}^{3+}$  and a proton are accelerated by the same potential, then de-Broglie wavelengths  $\lambda_{\text{Li}}$  and  $\lambda_{\text{p}}$  have the ratio (assume  $m_{\text{Li}} = 9 m_{\text{p}}$ )
- (A)  $1:3\sqrt{3}$       (B)  $1:1$       (C)  $1:2$       (D)  $1:4$

$$\lambda = \frac{h}{\sqrt{2.m.q.V}}$$



5. A solution of  $NH_4Cl$  and  $NH_3$  has  $pH = 8.0$ . Which of the following hydroxides may be precipitated when this solution is mixed with equal volume of 0.2M of metal ion.

$$[OH^-] = 10^{-6}$$



~~(A)~~ <sup>metal</sup>  $0.1 (10^{-6})^2$

(13)  $0.1 \times (10^{-6})^2$

6.  $\text{SrCO}_3$  ( $K_{\text{sp}} = 10^{-10}$ ) and  $\text{ZnCO}_3$  ( $K_{\text{sp}} = 1.5 \times 10^{-11}$ ) are dissolved together in a solution. The ratio of  $[\text{Sr}^{2+}] / [\text{Zn}^{2+}]$  in the solution is:

(A)  $\frac{10}{3}$

(B)  $\frac{3}{10}$

(C)  $\frac{20}{3}$

(D)  $\frac{3}{20}$



7. pH of a weak monoacidic base is 12. What will be concentration of base ( $K_b = 10^{-5}$ ):—

(A) 10 M

(B) 0.1 M

(C) 0.01 M

(D) 0.001 M

$$[H^+] = 10^{-12}$$

$$[OH^-] = 10^{-2} = x$$

$$10^{-5} = K_b = \frac{x^2}{C - x} = \frac{10^{-4}}{C - 10^{-2}}$$

$$C - 10^{-2} = 10$$

$$\underline{C = 10}$$



8. Find pH of solutions containing 0.02MHA ( $K_a = 10^{-2}M$ )

[Given :  $\log 2 = 0.3$ ]

$$\frac{x^2}{2 \times 10^{-2} - x} = 10^{-2}$$

$$x = 52 \times 10^{-2}$$

$$\frac{x^2}{2 \times 10^{-2} - x} = 10^{-2}$$

$$x^2 + 10^{-2}x - 2 \times 10^{-4} = 0$$

$$x = \frac{-10^{-2} + \sqrt{10^{-4} + 8 \times 10^{-4}}}{2}$$

$$x = 10^{-2}$$

$$pH = 2$$



9. If the critical wavelength for producing photoelectric effect is  $2000\text{\AA}$ . Then what wavelength of light will be required to produce photoelectrons with double the K.E. of those produced by light of wavelength of  $1500\text{\AA}$ .

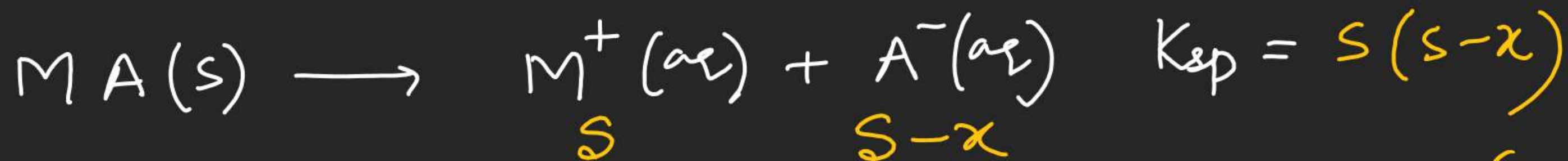
$$KE = \frac{hc}{1500} - \frac{hc}{2000}$$

$$2KE = \frac{hc}{\lambda} - \frac{hc}{2000}$$

10. 3.2 moles of hydrogen iodide were heated in a sealed bulb at  $444^{\circ}\text{C}$  till the equilibrium state was reached. Its degree of dissociation at this temperature was found to be 22% The number of moles of hydrogen iodide present at equilibrium are

$$0.78 \times 3.2$$

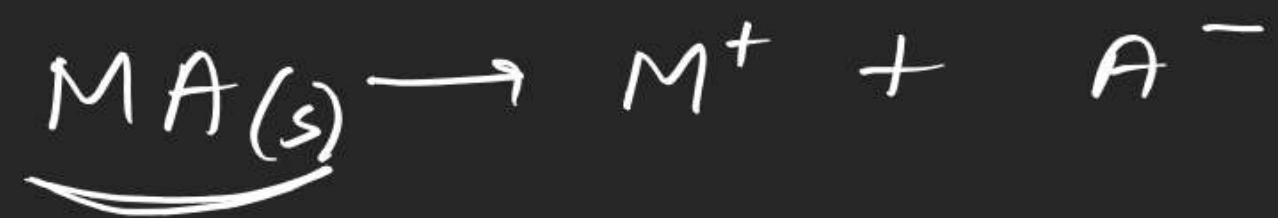
# Effect of hydrolysis on solubility:-



$S-x$   $x$

→ in this question pH of the solution will be given.  
 and given pH will be due to a Buffer.  
 e.g pH=8  $[OH^-] = 10^{-6} \neq x$





$$K_{sp} = [M^+][A^-] \quad \text{--- ①}$$



$$\frac{K_w}{K_a} = \frac{[HA][OH^-]}{[A^-]} \quad \text{--- ②}$$

$$[M^+] = S = [A^-] + [HA] \quad \text{--- ③}$$

by eq ②

$$S = [A^-] \left\{ 1 + \frac{K_w}{K_a [OH^-]} \right\}$$

by eq ①

$$K_{sp} = S \cdot \frac{S}{\left\{ 1 + \frac{K_w}{K_a [OH^-]} \right\}}$$

$$S = \sqrt{K_{sp} \left[ 1 + \frac{[H^+]}{K_a} \right]}$$



Q.30 J-Adv

$$pH=7$$

$$pH=2$$

$$S=10^{-4}$$

$$10^{-3}$$

$$S = \sqrt{K_{sp} \left[ 1 + \frac{[H^+]}{K_a} \right]}$$

$$10^{-2} = \frac{(10^{-4})^2}{(10^{-3})^2} = \frac{\cancel{K_{sp}} \left[ 1 + \frac{10^{-7}}{K_a} \right]}{\cancel{K_{sp}} \left[ 1 + \frac{10^{-2}}{K_a} \right]}$$

$$\frac{10^{-4}}{K_a} = 1 + \frac{10^{-7}}{\cancel{K_a}}$$

$$\underline{K_a = 10^{-4}}$$