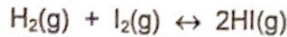


Eq Asmt
[44 marks]

42
44

Communication [3 marks]

1. The equilibrium constant for the reaction,

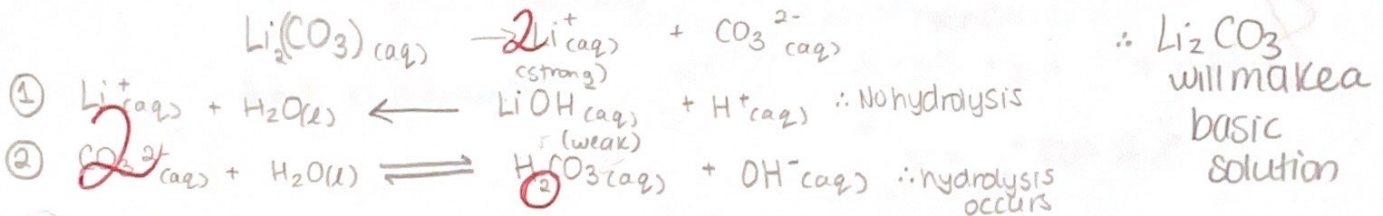


varies with temperature in the following way: $K_c=794$ at 298 K and $K_c=54$ at 700 K. Is the formation of HI favoured more at the higher or lower temperature? Explain. [3 marks]

It is favoured at a lower temp, because K_c is larger (794) at a lower temp (298 K). And the ratio of products to reactants $\rightarrow K_c = \frac{[P]}{[R]}$ is larger at a lower temp.

Making Connections [8 marks]

2. Will lithium carbonate form an acidic, basic or neutral solution? Show your work. [3 marks]



3. For the reaction, $\text{PBr}_5(\text{g}) \leftrightarrow \text{PBr}_3(\text{g}) + \text{Br}_2(\text{g})$, in what direction will the equilibrium shift when the following actions are taken on the system at equilibrium? [5 marks]

- (a) $\text{PBr}_3(\text{g})$ is added \leftarrow
- (b) the temperature is decreased \leftarrow
- (c) the volume of the reaction system is increased \leftarrow
- (d) a catalyst is added \rightleftarrows
- (e) $\text{PBr}_5(\text{g})$ is removed \leftarrow

Inquiry [19 marks]

4. Calculate the pH of a buffer that is 0.25 M in lactic acid, $\text{HC}_3\text{H}_5\text{O}_3$ ($K_a=1.4 \times 10^{-4}$) and 0.10 M in sodium lactate, $\text{NaC}_3\text{H}_5\text{O}_3$. [3 marks]

pH = ?

$K_a = 1.4 \times 10^{-4}$

$\text{pH} = \text{p}K_a + \log \left[\frac{[\text{NaC}_3\text{H}_5\text{O}_3]}{[\text{HC}_3\text{H}_5\text{O}_3]} \right]$

$\text{pH} = 3.85 + \log \left(\frac{0.10 \text{ M}}{0.25 \text{ M}} \right)$

$\text{pH} = 3.46$

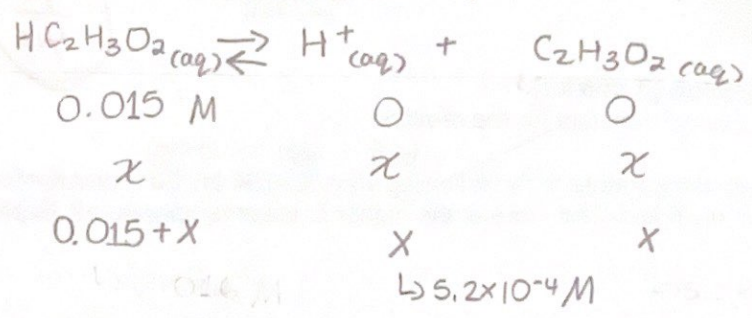
$\text{p}K_a = -\log K_a$
 $= -\log (1.4 \times 10^{-4})$
 $= 3.85$

\therefore pH would be 3.46

5. Calculate the pH of a 0.015 M solution of acetic acid. [8 marks]

pH = ?

Ac = 0.015 M



$K_a = 1.8 \times 10^{-5}$

$$K_a = \frac{[\text{H}^+][\text{C}_2\text{H}_3\text{O}_2^-]}{[\text{HC}_2\text{H}_3\text{O}_2]}$$

$$1.8 \times 10^{-5} = \frac{x^2}{0.015 + x}$$

8 $2.7 \times 10^{-7} = x^2$

$5.2 \times 10^{-4} \text{ M} = x$

$\text{pH} = -\log [\text{H}^+]$

$\text{pH} = -\log (5.2 \times 10^{-4})$

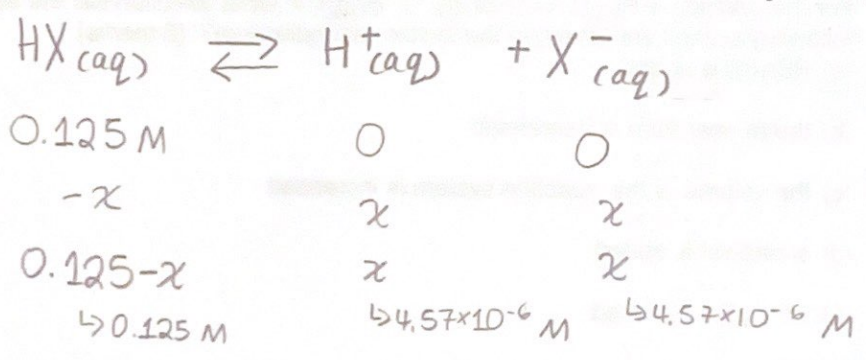
$\text{pH} = 3.28$

\therefore pH would be 3.28

6. A 0.125 M solution of an unknown acid has a pH of 5.34. What is the K_a of the acid? [8 marks]

$K_a = ?$

pH = 5.34



$\text{pH} = -\log [\text{H}^+]$

$5.34 = -\log [\text{H}^+]$

8 $4.57 \times 10^{-6} = [\text{H}^+]$

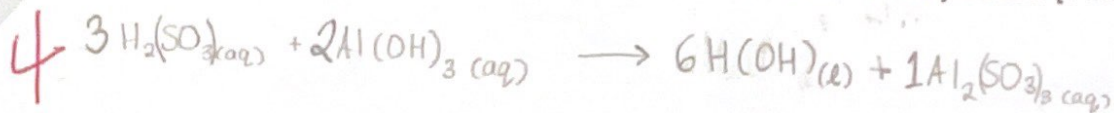
$\therefore K_a$ would be 1.67×10^{-10}

$$\begin{aligned}
 K_a &= \frac{[\text{H}^+][\text{X}^-]}{[\text{HX}]} \\
 &= \frac{(4.57 \times 10^{-6})^2}{(0.125)}
 \end{aligned}$$

$= 1.67 \times 10^{-10}$

Knowledge & Understanding [14 marks]

Show the neutralization reaction between sulfurous acid and aluminum hydroxide. [4 marks]

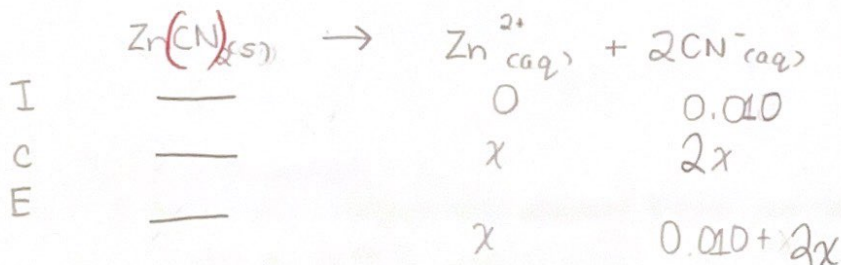


8. Show the dissociation of barium chlorate in water. [2 marks]



9. Calculate the molar solubility of zinc cyanide, at 25°C, in the presence of 0.010 M potassium cyanide. The K_{sp} for zinc cyanide at 25°C is 8.0×10^{-12} . [8 marks]

$$K_{sp} = 8.0 \times 10^{-12}$$



$$K_{sp} = [\text{CN}^{-}]^2 [\text{Zn}^{2+}]$$

$$8.0 \times 10^{-12} = (0.010 + 2x)^2 (x)$$

$$8.0 \times 10^{-12} = 0.0001x$$

$$8.0 \times 10^{-8} \text{ M} = x$$

7

\therefore the molar solubility of zinc cyanide is $8.0 \times 10^{-8} \text{ M}$