

# AP CHEMISTRY

## TOPIC 7: ACIDS & BASES, PART A

Day 75:

- Nature of Acids and Bases
  - Acid Strength
  - Water as an acid and a base
- 

1. Define the following using the Arrhenius model.

- Strong acid : *An Acid that dissociates 100% in water*
- Strong base : *A Base that dissociates 100% in water*
- Weak acid : *An Acid that dissociates very little in water ( typically around 1 – 20% )*
- Weak base : *A Base that dissociates very little in water ( typically around 1 – 20% )*

2. Write the balanced equation that describes the following reactions.

- The dissociation of perchloric acid in water.  $\text{HClO}_4(aq) + \text{H}_2\text{O}(l) \rightarrow \text{ClO}_4^{-1}(aq) + \text{H}_3\text{O}^{+1}(aq)$

OR



- The dissociation of ammonium ion in water.  $\text{NH}_4^{+1}(aq) + \text{H}_2\text{O}(l) \leftrightarrow \text{NH}_3(aq) + \text{H}_3\text{O}^{+1}(aq)$

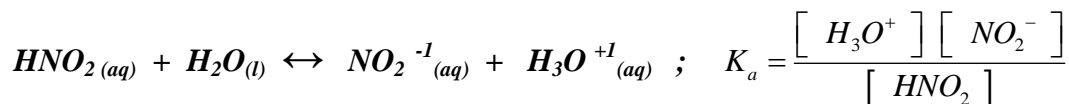
OR



3. Write the dissociation reaction and the corresponding  $K_a$  equilibrium expression for each of the following acids in water.

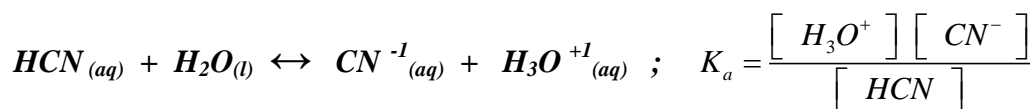
- $\text{HNO}_2$  :  $\text{HNO}_2(aq) \leftrightarrow \text{NO}_2^{-1}(aq) + \text{H}^{+1}(aq)$  ;  $K_a = \frac{[\text{H}^+][\text{NO}_2^-]}{[\text{HNO}_2]}$

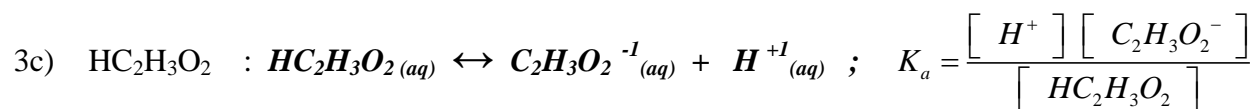
OR



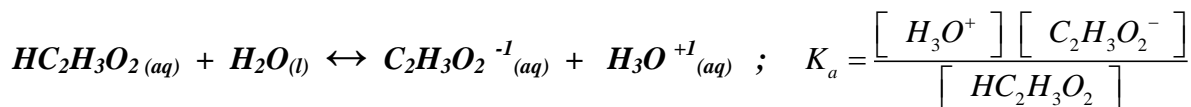
- $\text{HCN}$  :  $\text{HCN}(aq) \leftrightarrow \text{CN}^{-1}(aq) + \text{H}^{+1}(aq)$  ;  $K_a = \frac{[\text{H}^+][\text{CN}^-]}{[\text{HCN}]}$

OR

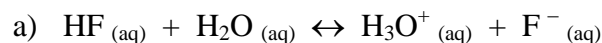




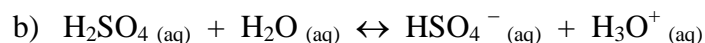
OR



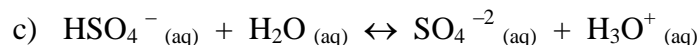
4. For each of the following reactions, identify the acid, the base, the conjugate base, and the conjugate acid.



$\text{HF} (aq)$	+	$\text{H}_2\text{O} (aq)$	$\leftrightarrow$	$\text{H}_3\text{O}^+ (aq)$	+	$\text{F}^- (aq)$
A		B		CA		CB



$\text{H}_2\text{SO}_4 (aq)$	+	$\text{H}_2\text{O} (aq)$	$\leftrightarrow$	$\text{HSO}_4^- (aq)$	+	$\text{H}_3\text{O}^+ (aq)$
A		B		CB		CA



$\text{HSO}_4^- (aq)$	+	$\text{H}_2\text{O} (aq)$	$\leftrightarrow$	$\text{SO}_4^{-2} (aq)$	+	$\text{H}_3\text{O}^+ (aq)$
A		B		CB		CA

5. Calculate  $[\text{H}^+]$  or  $[\text{OH}^-]$  as required for each of the following solutions at 25 °C, and state whether the solution is neutral, acidic, or basic.

$$K_w = 1.00 \times 10^{-14} = [\text{H}^+][\text{OH}^-]$$

a)  $1.4 \times 10^{-3} M [\text{OH}^-] : [\text{H}^+] = \frac{1.00 \times 10^{-14}}{1.4 \times 10^{-3}} = 7.14 \times 10^{-12} \quad \text{Basic}$

b)  $4.3 \times 10^{-7} M [\text{OH}^-] : [\text{H}^+] = \frac{1.00 \times 10^{-14}}{4.3 \times 10^{-7}} = 2.33 \times 10^{-8} \quad \text{Basic}$

c)  $9.7 \times 10^{-11} M [\text{H}^+] : [\text{OH}^-] = \frac{1.00 \times 10^{-14}}{9.7 \times 10^{-11}} = 1.03 \times 10^{-4} \quad \text{Basic}$

d)  $2.4 \times 10^{-6} M [\text{H}^+] : [\text{OH}^-] = \frac{1.00 \times 10^{-14}}{2.4 \times 10^{-6}} = 4.17 \times 10^{-9} \quad \text{Acidic}$

e)  $3.9 \times 10^{-3} M [\text{OH}^-] : [\text{H}^+] = \frac{1.00 \times 10^{-14}}{3.9 \times 10^{-3}} = 2.56 \times 10^{-12} \quad \text{Basic}$