Homework - Worksheet

2. a) $HClO_4 \Rightarrow ClO_4^-$

b) $NH_4^+ \Rightarrow NH_3$

c) $H_2O \Rightarrow OH^-$

d) $HCO_3^- \Rightarrow CO_3^{2-}$

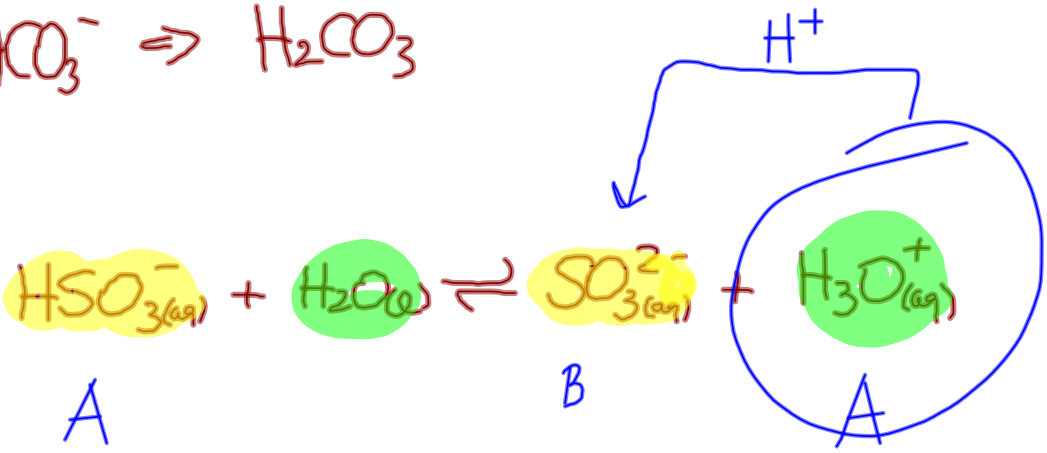
3. a) $CN^- \Rightarrow HCN$

b) $SO_4^{2-} \Rightarrow HSO_4^-$

c) $H_2O \Rightarrow H_3O^+$

d) $HCO_3^- \Rightarrow H_2CO_3$

4. a) $HSO_{3(aq)}^- + H_2O_{(l)} \rightleftharpoons SO_{3(aq)}^{2-} + H_3O_{(aq)}^+$

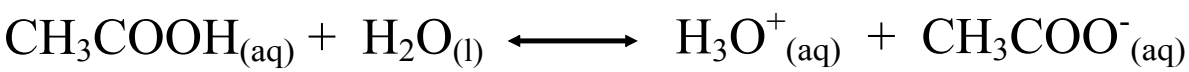


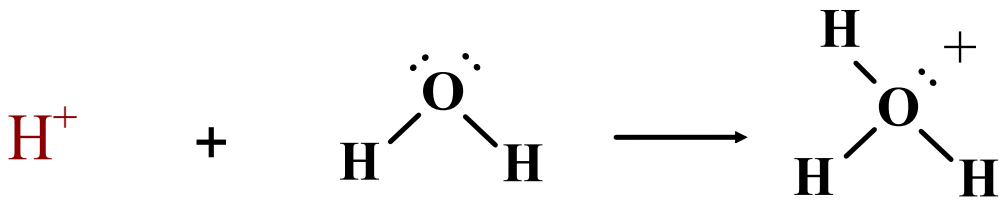
Ionization Constants for Acids

Strong acids - ionizes quantitatively in water to form hydronium ions

Weak acids - ionizes partially in water to form hydronium ions

To describe the equilibrium of acids in water, the equilibrium law is used to calculate the acid ionization constant, K_a.




H+
+
O
H
H
H
O
+
H
H

Ex. Predict the hydronium ion concentration, and pH of a 1.0 mol/L nitrous acid solution at equilibrium.

WEAK

Ex. What is the pH of a 0.150 mol/L hypochlorous acid solution?

$$HClO_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + ClO^-_{(aq)}$$

0.150 mol/L

$$K_a = \frac{[H_3O^+_{(aq)}][ClO^-_{(aq)}]}{[HClO_{(aq)}]}, \quad [H_3O^+_{(aq)}] = [ClO^-_{(aq)}]$$

$$K_a = \frac{[H_3O^+_{(aq)}]^2}{[HClO_{(aq)}]}$$

$$2.9 \times 10^{-8} = \frac{[H_3O^+_{(aq)}]^2}{[0.150\ mol/L]}$$

$$[H_3O^+_{(aq)}] = \sqrt{(2.9 \times 10^{-8})[0.150]}$$

$$[H_3O^+_{(aq)}] = 6.60 \times 10^{-5}\ M$$

$$pH = -\log[H_3O^+_{(aq)}]$$

$$pH = -\log[6.60 \times 10^{-5}]$$

$$pH = 4.180$$

ACIDIC (pH < 7)

STRONG

What is the pH of a 0.150 mol/L hydrochloric acid solution?

$$HCl_{(aq)} + H_2O_{(l)} \longrightarrow H_3O^+_{(aq)} + Cl^-_{(aq)}$$

$0.150\ mol/L$ $\qquad$ $0.150\ mol/L$ $\qquad$ $0.150\ mol/L$

$$pH = -\log[H_3O^+_{(aq)}]$$
$$= -\log[0.150]$$
$$=$$

Ex. The pH of a 0.25 mol/L carbonic acid solution at equilibrium is found to be 3.48. Calculate the K_a.

Worksheet

#22, 23 p. 610