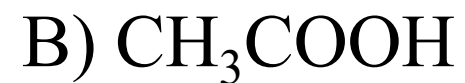


# **Chapter 16**

## **Acid-Base Equilibria**

1. Which one of the following is a Brønsted-Lowry acid? E



E) all of the above

2. Which one of the following statements regarding  $K_w$  is false?

B

A)  $pK_w$  is 14.00 at 25 °C.

B) The value of  $K_w$  is always  $1.0 \times 10^{-14}$ .

C)  $K_w$  changes with temperature.

D)  $K_w$  is known as the ion product of water.

3. Which one of the following is the weakest acid?     D    

A) HF ( $K_a = 6.8 \times 10^{-4}$ )

B) HClO ( $K_a = 3.0 \times 10^{-8}$ )

C) HNO<sub>2</sub> ( $K_a = 4.5 \times 10^{-4}$ )

D) HCN ( $K_a = 4.9 \times 10^{-10}$ )

E) CH<sub>3</sub>COOH ( $K_a = 1.8 \times 10^{-5}$ )

4. Which of the following acids will be the strongest?     A    



5. The  $K_a$  of hypochlorous acid ( $\text{HClO}$ ) is  $3.0 \times 10^{-8}$  at  $25^\circ\text{C}$ . What is the percent ionization (%) of hypochlorous acid in a  $0.015\text{ M}$  aqueous solution of  $\text{HClO}$  at  $25^\circ\text{C}$ ?     D    

A)  $4.5 \times 10^{-8}$

B) 14

C)  $2.1 \times 10^{-5}$

D) 0.14

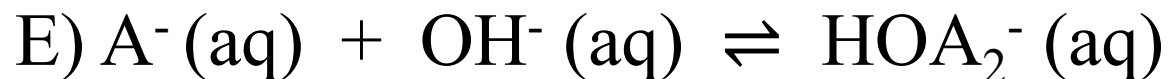
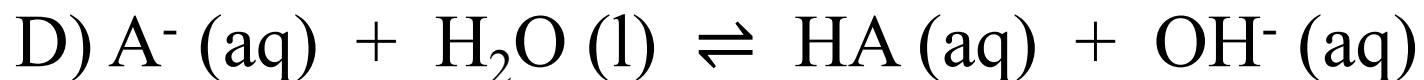
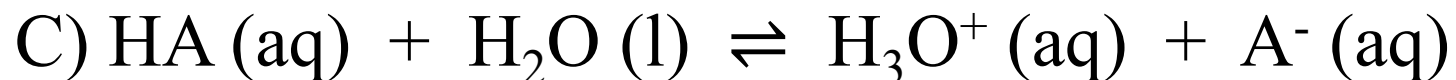
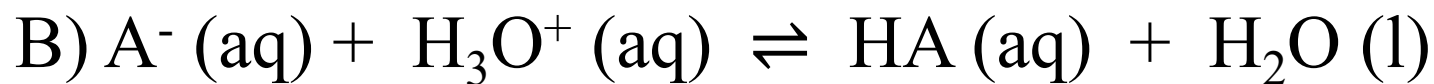
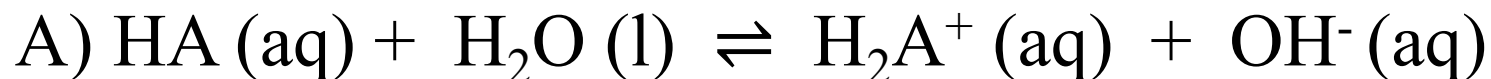
E)  $1.4 \times 10^{-3}$

$$x^2 = 4.5 \times 10^{-10}$$

$$x = 2.1 \times 10^{-5}$$

$$\text{Ionization} = (2.1 \times 10^{-5} / 0.015) \times 100\%$$

6.  $A^-$  is a weak base. Which equilibrium corresponds to the equilibrium constant  $K_a$  for HA?     C    



7. Using the data in the table, which of the conjugate acids below is the strongest acid?     C    

A)  $\text{HClO}$

B)  $\text{HCO}_3^-$

C)  $\text{H}_2\text{S}$

D)  $\text{NH}_3\text{CH}_3^+$

E)  $\text{H}_2\text{S}$  and  $\text{HClO}$

Base	$K_b$
$\text{ClO}^-$	$3.3 \times 10^{-7}$
$\text{CO}_3^{2-}$	$1.8 \times 10^{-4}$
$\text{HS}^-$	$1.8 \times 10^{-7}$
$\text{NH}_2\text{CH}_3$	$4.4 \times 10^{-4}$



8. Which of the following aqueous solutions has the highest  $[\text{OH}^-]$ ?

D

- A) a solution with a pH of 3.0      pH = 3
- B) a  $1 \times 10^{-4}$  M solution of  $\text{HNO}_3$       pH = 4
- C) a solution with a pOH of 12.0      pH = 2
- D) pure water      pH = 7
- E) a  $1 \times 10^{-3}$  M solution of  $\text{NH}_4\text{Cl}$       pH  $\sim$  5.6

9. A 0.0035M aqueous solution of a particular compound has pH = 2.46. The compound is C.

- A) a weak base
- B) a weak acid
- C) a strong acid
- D) a strong base
- E) a salt

10. Of the compounds below, a 0.1 M aqueous solution of A will have the highest pH.

A) KCN,  $K_a$  of HCN =  $4.0 \times 10^{-10}$

$$K_a = 4.0 \times 10^{-10}$$

B)  $\text{NH}_4\text{NO}_3$ ,  $K_b$  of  $\text{NH}_3$  =  $1.8 \times 10^{-5}$

$$K_a = 10^{-14} / 1.8 \times 10^{-5} = 5.6 \times 10^{-10}$$

C) NaOAc,  $K_a$  of HOAc =  $1.8 \times 10^{-5}$

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

D) NaClO,  $K_a$  of HClO =  $3.2 \times 10^{-8}$

$$K_a = 3.2 \times 10^{-8}$$

E) NaHS,  $K_b$  of  $\text{HS}^-$  =  $1.8 \times 10^{-7}$

$$K_a = 10^{-14} / 1.8 \times 10^{-7} = 5.6 \times 10^{-8}$$