Ka Expressions

l. Write Ka expressions for the following acids.

a) $HC_2H_3O_2$

b) HNO_3

c) H_2CO_3

d) H_3PO_4

Equilibrium in Weak Acids

1. If Ka for HNO_2, = 4.5 x 10^{-4}, find the $[H^+]$ a 0.9 M HNO_2 solution.
2. Find the $[H^+]$ of a 0.153 M HOCl solution with a Ka = 3.2 x 10^{-8}.
3. A certain acid (HA) has an ionization constant (Ka) of 5.0 x 10^{-6}. Find the $[H^+]$ in a 1.0 M solution.
4. Find the value of Ka of an acid if a 2.00 M solution has a hydrogen ion concentration $[H^+]$of 0.14 M.
5. Find the Ka in a 0.31 M HOCl solution which has a $[H^+]$ = 1.0 x 10^{-4} M.

Ka and pH

1. Nicotinic acid ($HC_2H_4NO_2$) is a B vitamin. It is also a weak acid with a Ka=l.4 x 10^{-5}. What is the $[H^+]$ and pH of a 0.010 M solution?
2. Chloroacetic acid ($HC_2H_2ClO_2$), is a weak acid. Calculate Ka of a 0.10 M solution if the pH is 1.96.
3. Ka for HNO_2 = 4.5 x 10^{-4}. Find the pH of a 0.9 M solution.
4. Find the Ka of a 2.00 M $HClO_2$ solution if $[H^+]$ = 0.14 M.
5. Find the Ka of a 0.11 M HNO_2 solution if $[H^+]$ = 6.8 x 10^{-3} M.
6. If a 0.25 M solution of acetic acid has a Ka=1.8 x 10^{-5}, fmd pH and $[H^+]$
7. A 0.20 M solution of a weak acid (HA) has a pH of 3.6. Calculate Ka.
8. In a 0.50 M solution of a weak acid HX, the $[H^+]$ is 8.0 x 10^{-2} M. Find Ka.
9. For the acid HCN Ka= 4.0 x 10^{-10} What is the $[H^+]$ and pH of a 0.010 M solution?

Ka, pH, pOH, % ionization

l. Calculate the Ka of a 0.750 M solution of the weak acid $HC_2H_3O_2$ which has a pH of 3.92.

2. Calculate Ka of the weak acid HF if a 0.267 M soltuion has a pH of 5.62.

3. Calculate the $[H^+]$, $[OH^-]$, pH and pOH for each of the following:

a) 0.367 M HNO_2; Ka=7.1 x 10^{-4}

b) 1.32 M HOCl; Ka=3.0 x 10^{-8}

c) 2.92 M HCN; Ka=6.2 x 10^{-10}

4. Calculate the percent ionization for each of these acids:

a) 0.100 M $HC_2H_3O_2$ Ka=1.8 x 10^{-5}

b) 0.00100 M HCN; Ka = 6.2 x 10^{-10}

5. A 1.50 x 10^{-2} M solution of a weak acid has a pH of 3.92. Calculate percent ionization.
6. A 4.5 x 10^{-3} M soltuion of the weak acid HA is 4.72% ionized. Calculate $[H^+]$, $[OH^-]$, pH, pOH and Ka.
7. A solution contains 8.35 g of $Ba(OH)_2$ in 1600 ml of solution. Calculate $[OH^-]$, $[H^+]$, pH and pOH.
8. Calculate the pH and pOH of a solution containing 7.30 g of HCl in 1.0 L of solution.

Ka Expressions - Answers

a) $K_a = \frac{[H^+]\,[C_2H_3O_2^-]}{[HC_2H_3O_2]}$

b) $K_a = \frac{[H^+]\,[NO_3^-]}{[HNO_3]}$

c) $K_a = \frac{[H^+]\,[HCO_3^-]}{[H_2CO_3]}$

d) $K_a = \frac{[H^+]\,[H_2PO_4^-]}{[H_3PO_4]}$

Equilibrium in Weak Acids - Answers

1. $[H^+] = 0.02$ M
2. $[H^+] = 7.0 \times 10^{-5}$ M
3. $[H^+] = 0.002$ M
4. $K_a = 1.1 \times 10^{-2}$
5. $K_a = 3.2 \times 10^{-8}$

Ka and pH - Answers

1. $[H^+] = 3.74 \times 10^{-4}$ M ; pH = 3.4
2. 1.4×10^{-3}
3. 1.7
4. 1.05×10^{-2}
5. 4.5×10^{-4}
6. $[H^+] = 2.1 \times 10^{-3}$ M ; pH = 2.7
7. 3.2×10^{-7}
8. 1.52×10^{-2}
9. $[H^+] = 2.0 \times 10^{-6}$ M ; pH = 5.7

Ka, pH, pOH, % ionization - Answers

1. 1.93×10^{-8}
2. 2.16×10^{-11}
3. a) 1.61×10^{-2} ; 6.21×10^{-13} ; 1.8 ; 12.2
   b) 1.99×10^{-4} ; 5.03×10^{-11} ; 3.7 ; 10.3
   c) 4.25×10^{-5} ; 2.35×10^{-10} ; 4.37 ; 9.63
4. a) 1.34% b) 0.079%
5. 0.800%
6. 2.12×10^{-4} ; 4.72×10^{-11} ; $K_a = 1.0 \times 10^{-5}$; 3.67 ; 10.33
7. $[OH^-] = 0.06$ M ; $[H^+] = 1.7 \times 10^{-13}$; pH = 12.8 ; pOH = 1.2
8. pH = 0.7 ; pOH = 13.3