67) $HC_2H_2ClO_2$ $K_a = 1.35 \times 10^{-3}$

H_2O $K_w = 1.0 \times 10^{-14}$

	$HC_2H_2ClO_2$	$\rightleftharpoons$	H^+	+	$C_2H_2ClO_2^-$
I	0.10		0		0
C	$-x$		$+x$		$+x$
E	$0.10 - x$		x		x

$$K_a = \frac{[H^+][C_2H_2ClO_2^-]}{[HC_2H_2ClO_2]} = 1.35 \times 10^{-3} = \frac{x^2}{0.10 - x}$$

$x = 1.16 \times 10^{-2}$

so, $\frac{1.16 \times 10^{-2}}{0.10} \times 100 = 11.6\%$

$$1.35 \times 10^{-3} = \frac{x^2}{0.10 - x}$$

$1.35 \times 10^{-4} - 1.35 \times 10^{-3}x = x^2$

$x^2 + 1.35 \times 10^{-3}x - 1.35 \times 10^{-4} = 0$

$x = 1.1 \times 10^{-2}$ M

$pH = -\log(1.1 \times 10^{-2}) = 1.96$

6a) HF $K_c = 7.2 \times 10^{-4}$ *

HOC_6H_5 $K_a = 1.6 \times 10^{-10}$

	HF	⇌	H^+	+	F^-
I	1.0		0		0
C	$-x$		$+x$		$+x$
E	$1.0 - x$		x		x

$$K_c = \frac{[H^+][F^-]}{[HF]} = 7.2 \times 10^{-4} = \frac{x^2}{1.0 - x}$$

$x = [H^+] = 2.7 \times 10^{-2}$ M

$pH = -\log(2.7 \times 10^{-2}) = 1.57$

$\% = \frac{2.7 \times 10^{-2}}{1.0} \times 100 = 2.7\%$

	HOC_6H_5	⇌	H^+	+	$OC_6H_5^-$
I	1.0		2.7×10^{-2}		0
C	$-x$		$+x$		$+x$
E	$1.0 - x$		$2.7 \times 10^{-2} + x$		x

$$K_a = \frac{[H^+][OC_6H_5^-]}{[HOC_6H_5]} = 1.6 \times 10^{-10} = \frac{(2.7 \times 10^{-2})(x)}{1.0}$$

$x = [OC_6H_5^-] = 5.9 \times 10^{-9}$ M

7.) a) $HC_2H_3O_2$ $\quad K_a = 1.8 \times 10^{-5}$

H_2O $\quad K_w = 1.0 \times 10^{-14}$

	$HC_2H_3O_2$	$\rightleftharpoons$	H^+	+	$C_2H_3O_2^-$
I	0.50		0		0
C	$-x$		$+x$		$+x$
E	$0.50 - x$		x		x

$$K_a = \frac{[H^+][C_2H_3O_2^-]}{[HC_2H_3O_2]} = 1.8 \times 10^{-5} = \frac{x^2}{0.50 - x}$$

$x = [H^+] = [C_2H_3O_2^-] = 3.0 \times 10^{-3} M$

$\% \quad \frac{3.0 \times 10^{-3}}{0.50} \times 100 = 0.60\%$

b) $K_a = 1.8 \times 10^{-5} = \frac{x^2}{0.050 - x}$

$x = [H^+] = [C_2H_3O_2^-] = 9.5 \times 10^{-4} M$

$\% \quad \frac{9.5 \times 10^{-4}}{0.050} \times 100 = 1.9\%$ ✓

c) $K_a = 1.8 \times 10^{-5} = \frac{x^2}{0.0050 - x}$

$x = [H^+] = [C_2H_3O_2^-] = 3.0 \times 10^{-4} M$

$\% \quad \frac{3.0 \times 10^{-4}}{0.0050} \times 100 = 6.0\%$ ☹

Quadratic $\quad x = [H^+] = [C_2H_3O_2^-] = 2.5 \times 10^{-4} M$

$\% \quad \frac{2.5 \times 10^{-4}}{0.0050} \times 100 = 5\%$ ✓

d) - as you dilute a solution, all [ ] decrease

- dilution will shift the equilibrium to the side with greater number of particles

Q > K shift to right ↑ % dissociation

e) [ ] ↓ more rapidly % dissociation so [H+] decreases

73)

	HA	⇌	H^+	+	A^-
I	0.15		0		0
C	−x		+x		+x
E	0.15 − x		x		x

3% dissociation

$x = [H^+] = 3.0\%$ of $0.15 = 4.5 \times 10^{-3}$ M

$$K_a = \frac{[H^+][A^-]}{[HA]} = \frac{(4.5 \times 10^{-3})^2}{(0.15 - 4.5 \times 10^{-3})} = 1.4 \times 10^{-4}$$

76) $HOCN \rightleftharpoons H^+ + OCN^-$

	$HOCN$	H^+	OCN^-
I	0.0100	0	0
C	$-x$	$+x$	$+x$
E	$0.0100-x$	x	x

$$K_a = \frac{[H^+][OCN^-]}{[HOCN]} = \frac{x^2}{(0.0100-x)}$$

$pH = 2.77$ $\qquad x = [H^+] = 10^{-2.77} = 1.7\times10^{-3}\,M$

$$K_a = \frac{(1.7\times10^{-3})^2}{(0.0100-1.7\times10^{-3})} = 3.5\times10^{-4}$$

77) $HCOOH$ $\qquad K_a = 1.8\times10^{-4}$

H_2O $\qquad K_w = 1.0\times10^{-14}$

$HCOOH \rightleftharpoons H^+ + HCOO^-$

	$HCOOH$	H^+	$HCOO^-$
I	C	0	0
C	$-x$	$+x$	$+x$
E	$C-x$	x	x

$$K_a = 1.8\times10^{-4} = \frac{[H^+][HCOO^-]}{[HCOOH]} = \frac{x^2}{C-x}$$

$pH = 2.70$ $\qquad [H^+] = 10^{-2.70} = 2.0\times10^{-3}\,M$

$$1.8\times10^{-4} = \frac{(2.0\times10^{-3})^2}{C-2.0\times10^{-3}} \qquad C = 2.4\times10^{-2}\,M$$

7a) $[HA]_0 = \frac{1.0\ mol}{2.0\ L} = 0.50\ M$

	HA	$\rightleftharpoons$	H^+	+	A^-
I	0.50		0		0
C	$-x$		$+x$		$+x$
E	$0.50-x$		x		x

$$K_a = \frac{[H^+][A^-]}{[HA]} = \frac{x^2}{0.50-x}$$

$[HA] = 0.45 = 0.50\ M - x$ $\quad x = 0.05\ M$

$$K_a = \frac{(0.05)^2}{0.45} = 6 \times 10^{-3}$$