6. Barium Hydroxide is a strong base. Find the [OH-], [H+], and the pH. If 0.17g of $Ba(OH)_{2(s)}$ were dissolved in 500 ml of solution.

$\frac{1 mol}{x} = \frac{171.35}{0.17g}$

$x = 9.921 \times 10^{-4} mol$

$\frac{9.921 \times 10^{-4} mol}{0.500 L} = 1.984 \times 10^{-3} M$

$Ba(OH)_2 \rightarrow Ba^{2+} + 2OH^-$

$[OH^-] = 1.984 \times 10^{-3} \times 2 = 3.968 \times 10^{-3} M$

$[H^+] = \frac{k_w}{[OH^-]} = \frac{1 \times 10^{-14}}{3.968 \times 10^{-3}} = 2.520 \times 10^{-12}$

$pH = -\log[H^+] = -\log 2.520 \times 10^{-12} = 11.6$

$[OH^-] = 4.0 \times 10^{-3}$

$[H^+] = 2.5 \times 10^{-12}$

pH = 12.

7. It takes 5.50 ml of a 0.100M HCl solution to neutralize 40.00 ml of a $Ca(OH)_2$ solution. What was the $[Ca(OH)_2]$ in the original solution? $Ca(OH)_2$ is a strong base!

$\frac{M_A V_A}{n_A} = \frac{M_B V_B}{n_B}$

$2HCl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O$

$\frac{(0.100M)(5.50mL)}{2} = \frac{M_B(40.00mL)}{1}$

$0.550 = 80.00 M_B$

$M_B = 6.875 \times 10^{-3}$

$\boxed{6.88 \times 10^{-3} M}$

8. Write the acid-base reaction between the hydrogen phosphate ion (HPO_4^{-2}) and the hydrogen sulfite ion. Which reaction (forward or reverse) will be favoured? Why?

$HPO_4^{-2}{}_{(aq)} + HSO_3^- \rightleftharpoons SO_3^{-2} + H_2PO_4^{-1}$

$K_a = 4.4 \times 10^{-13}$ 6.2×10^{-8} 6.3×10^{-8}

stronger

strongest → reverse reaction is the fastest

9. Calculate the solubility, in mol/L, of calcium fluoride if its Ksp is 3.9×10^{-11}.

$CaF_{2(s)} \rightarrow Ca^{+2} + 2F^-$

$K_{sp} = [Ca^{2+}][F^-]^2$

$3.9 \times 10^{-11} = (x)(2x)^2$

$\frac{3.9 \times 10^{-11}}{4} = \frac{4x^3}{4}$

$\sqrt[3]{9.75 \times 10^{-12}} = \sqrt[3]{x^3}$

$2.1 \times 10^{-4} M = x$

The solubility of CaF_2 is $2.1 \times 10^{-4} M$

Acids/Bases/Ksp Review

Name: _____

Test on May, 9th (03) May, 10th (01/02)

1. The $[OH^-]$ in a cleaning solution is 0.0025*M*. Calculate the $[H^+]$.

$K_w = [H^+][OH^-]$ $\quad [H^+] = \frac{K_w}{[OH^-]} = \frac{1\times10^{-14}}{0.0025} = 4.0\times10^{-12} M$

2. The pH of rain, on a particular day was found to be 4.82.

A. Calculate the $[H^+]$.

~~pOH~~. $[H^+] = 10^{-pH}$

$= 10^{-4.82}$

$[H^+] = 1.51\times10^{-5} M$

B. Calculate the $[OH^-]$.

$[OH^-] = \frac{K_w}{[H^+]}$

$= \frac{1\times10^{-14}}{1.51\times10^{-5}}$

$[OH^-] = 6.61\times10^{-10}$

C. Calculate pOH

$pH + pOH = 14$

$pOH = 14 - pH$

$= 14 - 4.82$

$pOH = 9.18$

3. Write the neutralization reaction between sodium hydroxide and sulphuric acid.

$2\,NaOH + 1\,H_2SO_4 \rightarrow 1\,Na_2SO_4 + 2\,H_2O$

4. The initial concentration of an acid, HX, is 2.25*M*. Calculate the Ka for this acid if the pH at equilibrium is found to be 3.4.

	$HX \rightarrow$	H^+	$+ X^-$
I	2.25	0	0
C	$-x$	$+x$	$+x$
E	$2.25-x$	x	x

$x = [H^+] = 10^{-pH} = 10^{-3.4} = 3.981\times10^{-4} M$

$[X^-] = 3.981\times10^{-4} M$

$[HX] = 2.25 - \cancel{3.981\times10^{-4}} = 2.2496 M$ or $2.25 M$

$K_a = \frac{[H^+][X^-]}{[HX]}$

$= \frac{(3.981\times10^{-4})^2}{2.2496 M}$

$K_a = 7.045\overline{2}\times10^{-8} M$

$\boxed{K_a = 7.0\times10^{-8} M}$

5. Find the pH of a solution made by dissolving 0.488 g of benzoic acid in 100 mL distilled water. (see appendix for reaction and Ka)

$C_6H_5COOH \rightarrow C_6H_5COO^- + H^+$

I	0.04	0	0
C	$-x$	$+x$	$+x$
E	$0.04-x$	x	x

$\frac{1\,mol}{x} = \frac{122.13 g}{0.488 g}$

$x = 4.00\times10^{-3} mol$

$\frac{4.00\times10^{-3} mol}{0.100 L} = 0.0400 M$

$K_a = \frac{[C_6H_5COO^-][H^+]}{[C_6H_5COOH]}$

$6.6\times10^{-5} = \frac{x^2}{0.0400 - \cancel{x}}$

$2.64\times10^{-6} = x^2$

$1.62\times10^{-3} = x = [H^+]$

$pH = -\log[H^+]$

$= -\log(1.62\times10^{-3})$

$pH = 2.79$