73 K_w, pH, AND pOH CALCULATIONS

1. $[OH^-_{(aq)}] = \frac{K_w}{[H^+_{(aq)}]} = \frac{1.0 \times 10^{-14}\ (mol/L)^2}{1.3 \times 10^{-2}\ mol/L} = 7.7 \times 10^{-13}\ mol/L$

2. $[H^+_{(aq)}] = \frac{K_w}{[OH^-_{(aq)}]} = \frac{1.0 \times 10^{-14}\ (mol/L)^2}{2.0 \times 10^{-12}\ mol/L} = 5.0 \times 10^{-3}\ mol/L$

3. $n_{NaOH} = 2.50\ g \times \frac{1\ mol}{40.00\ g} = 6.25 \times 10^{-2}\ mol$

   $[NaOH_{(aq)}] = \frac{6.25 \times 10^{-2}\ mol}{2.00\ L} = 3.13 \times 10^{-2}\ mol/L$

   $[OH^-_{(aq)}] = [NaOH_{(aq)}] = 3.13 \times 10^{-2}\ mol/L$

   $[H^+_{(aq)}] = \frac{K_w}{[OH^-_{(aq)}]} = \frac{1.0 \times 10^{-14}\ (mol/L)^2}{3.13 \times 10^{-2}\ mol/L} = 3.2 \times 10^{-13}\ mol/L$

4. $n_{HCl} = 0.728\ g \times \frac{1\ mol}{36.46\ g} = 2.00 \times 10^{-2}\ mol$

   $[HCl_{(aq)}] = \frac{2.00 \times 10^{-2}\ mol/L}{0.200\ L} = 9.98 \times 10^{-2}\ mol/L$

   $[H^+_{(aq)}] = [HCl_{(aq)}] = 9.98 \times 10^{-2}\ mol/L$

   $[OH^-_{(aq)}] = \frac{K_w}{[H^+_{(aq)}]} = \frac{1.0 \times 10^{-14}\ (mol/L)^2}{9.98 \times 10^{-2}\ mol/L} = 1.0 \times 10^{-13}\ mol/L$

5. $pH = -\log[H^+_{(aq)}] = -\log(1.5 \times 10^{-3}) = 2.82$

6. $[OH^-_{(aq)}] = 10^{-pOH} = 10^{-2.92}\ mol/L = 1.2 \times 10^{-3}\ mol/L$

7. $n_{Sr(OH)_2} = 7.50\ g \times \frac{1\ mol}{121.64\ g} = 0.0617\ mol$

   $[Sr(OH)_{2(aq)}] = \frac{0.0617\ mol}{0.500\ L} = 0.123\ mol/L$

   $[OH^-_{(aq)}] = 2\,[Sr(OH)_{2(aq)}] = 2 \times 0.123\ mol/L = 0.247\ mol/L$
   $pOH = -\log[OH^-_{(aq)}] = -\log(0.247) = 0.608$
   $pH = 14.00 - 0.608 = 13.39$

	Substance	$[H^+_{(aq)}]$ (mol/L)	pH	$[OH^-_{(aq)}]$ (mol/L)	pOH	Acidic, Basic, or Neutral
8.	milk	3.1×10^{-7}	6.51	3.2×10^{-8}	7.49	acidic
9.	pure water	1×10^{-7}	7.0	1×10^{-7}	7.0	neutral
10.	blood	4.0×10^{-8}	7.40	2.5×10^{-7}	6.60	basic
11.	cleaner	1.6×10^{-11}	10.80	6.3×10^{-4}	3.20	basic