Worksheet: pH Calculations **Name**_____*KEY*_____

The letters "pH" represent the French words "pouvoir hydrogene" which means "hydrogen power".

- The definition of pH is *pH is equal to the negative log (logarithm) of the* _____*hydrogen*_____ *ion concentration of a solution.*
- The logarithm of a number is the ***power*** to which 10 must be raised to equal that number.

A pH value of less than 7 indicates a(n) _____*acidic*_____ solution. A pH value of ___*7*___ indicates a neutral solution. A pH value of more than 7 indicates a(n) _____*basic*_____ solution.

PROBLEMS: Show all work and circle the final answer.

1. Determine the pH of a 0.010 M HNO_3 solution.

$$pH = -\log\left[H^+\right] = -\log\left[1.0\times10^{-2}\right] = -\left(-2.0\right) \qquad \boxed{pH = 2.0}$$

2. What is the pH of a 2.5 x 10^{-6} M solution of HCl?

$$pH = -\log\left[2.5\times10^{-6}\right] = -\left(-5.6\right) \qquad \boxed{pH = 5.6}$$

3. Calculate the pH of a solution of 0.0025M H_2SO_4.

$$pH = -\log\left[2(2.5\times10^{-3})\right] = -\left(-2.3\right) \qquad \boxed{pH = 2.3}$$

4. Calculate the pH of a 0.0010 M NaOH solution.

$$\left[H^+\right]\left[OH^-\right] = 1.0\times10^{-14} \qquad \left[H^+\right]\left[1.0\times10^{-3}\right] = 1.0\times10^{-14} \qquad \left[H^+\right] = 1.0\times10^{-11}$$
$$pH = -\log\left[1.0\times10^{-11}\,M)\right] = -\left[-11\right] \qquad \boxed{pH = 11}$$

5. What is the pH of a 0.020M $Sr(OH)_2$ solution?

$$\left[H^+\right]\left[OH^-\right] = 1.0\times10^{-14} \qquad \left[H^+\right]\left[(2)(2.0\times10^{-2})\right] = 1.0\times10^{-14} \qquad \left[H^+\right] = 2.5\times10^{-13}$$
$$pH = -\log\left[2.5\times10^{-13})\right] = -\left(-12.6\right) \qquad \boxed{pH = 13}$$

6. a) What is the hydrogen ion concentration of an aqueous HCl solution that has a pH of 3.0?

$pH = -\log\left[H^+\right]$ $\quad 3.0 = -\log\left[H^+\right]$ $\quad \boxed{\left[H^+\right] = 1.0 \times 10^{-3}\ M}$

b) What is the hydroxide ion concentration of this same solution?

$\left[H^+\right]\left[OH^-\right] = 1.0 \times 10^{-14}$ $\quad \left[1.0 \times 10^{-3}\right]\left[OH^-\right] = 1.0 \times 10^{-14}$ $\quad \boxed{\left[OH^-\right] = 1.0 \times 10^{-11}\ M}$

c) Which ion, H^+ or OH^-, is in greater concentration? H^+ $(1.0 \times 10^{-3} > 1.0 \times 10^{-11})$

d) Is this solution acidic or basic? *acidic*

7. Find the $[H^+]$ and the $[OH^-]$ of a solution with a pH of 3.494.

$pH = -\log\left[H^+\right]$ $\quad 3.494 = -\log\left[H^+\right]$ $\quad \boxed{\left[H^+\right] = 3.206 \times 10^{-4}\ M}$

$\left[H^+\right]\left[OH^-\right] = 1.0 \times 10^{-14}$ $\quad \left[3.206 \times 10^{-4}\right]\left[OH^-\right] = 1.0 \times 10^{-14}$ $\quad \boxed{\left[OH^-\right] = 3.1 \times 10^{-11}\ M}$

Is this solution acidic or basic? *acidic*