PAL Worksheet – Chem 6A

Logarithms and pH

I. Logarithm calculations

1. Find the **Logarithm (log)** key on your calculator. Describe what it looks like and where it is located.

   Logarithm (log):

2. Write the key combination to enter the following on your calculator and then calculate the log. Note: you may need to include parenthesis around certain values when entering in your calculator and/or use different orders of operation.

   Key combination:

   log 723

   log 2.671×10^{-4}

   log 1.8×10^{-5}

3. Find the **Inverse logarithm (10^x)** key on your calculator. Describe what it looks like and where it is located.

   Inverse logarithm (10^x):

4. Write the key combination to enter the following on your calculator and then answer the following. Note: you may need to include parenthesis around certain values when entering in your calculator and/or use different orders of operation.

   Key combination:

   $10^{3.91}$

   $10^{-7.84}$

II. pH calculations

1. Which of the following measurements corresponds with an *acidic* pH? (circle your answer)

   7.0 11.4 3.1

2. Which of the following measurements corresponds with a *basic* pH? (circle your answer)

   1.0 10.7 5.8

A. *Calculating pH from a known H+ concentration*

The pH of a solution depends on the concentration of hydrogen/hydronium ions present. Use the following equation to calculate the pH of each solution. Show your work.

$$\mathbf{pH = - \log [H^+]}$$

where $[H^+]$ is the concentration of the acid, in units of M, molarity

0.0012 M nitric acid solution

0.00053 M hydrochloric acid solution

3. Based on your answers above, which is more acidic, the nitric acid solution or the hydrochloric acid solution? Why?

4. What is the pH of a solution with a hydrogen ion concentration of 2.4×10^{-10} ? Show your work. Is this solution acidic or basic?

5. What can you conclude about the relationship between hydrogen ion concentration, $[H^+]$, and pH?

B. *Calculating H+ concentration from a known pH*

When the pH of a solution is known, the hydrogen ion concentration, $[H^+]$, can be calculated using this formula:

$$\mathbf{[H^+] = 10^{(-pH)}}$$

Use the formula to calculate [H+] for the following solutions. Show your work.

pH = 5.9

pH of 0.4

6. Based on your answers, which of the solutions is more acidic, that with a pH of 5.9 or the one with a pH of 0.4? Based on your answers, how does hydrogen ion concentration, $[H^+]$, relate to pH?

7. What is the hydrogen ion concentration of a solution with a pH of 9.2 ?

8. Does your answer here agree with your response regarding hydrogen ion concentration in question #6?

C. *Conceptualizing pH and H+*.

Draw two beakers, one containing a solution at pH 4.5 and one containing a solution at pH 10.6. How can you represent the difference between these two solutions in your drawing? Think of the ionization of water and the different species, and their relative amounts, in the two solutions.