Worksheet 15 - Acids and Bases Worksheet

1. Determine whether the substance on the left is an acid or a base.
   a) Mg(OH)$_2$(aq) $\rightarrow$ Mg$^{2+}$(aq) + OH$^-$ (aq)
   b) H$_2$SO$_4$(aq) $\rightarrow$ H$^+$(aq) + SO$_4^{2-}$(aq)
   c) HCl(aq) $\rightarrow$ H$^+$(aq) + Cl$^-$ (aq)
   d) NaOH(aq) $\rightarrow$ Na$^+$(aq) + OH$^-$ (aq)
   e) Ca(OH)$_2$(aq) $\rightarrow$ Ca$^{2+}$(aq) + OH$^-$ (aq)
   f) HF(aq) $\rightarrow$ H$^+$(aq) + F$^-$ (aq)
   g) Be(OH)$_2$(aq) $\rightarrow$ Be$^{2+}$(aq) + OH$^-$ (aq)
   h) HI(aq) $\rightarrow$ H$^+$(aq) + I$^-$ (aq)
   i) LiOH(aq) $\rightarrow$ Li$^+$(aq) + OH$^-$ (aq)

2. Give an example of the pH for each of the following:
   a) a very concentrated base
   b) a dilute basic solution
   c) a very concentrated acid
   d) a dilute acid solution
   e) pure water

3. How much more acidic is a solution with a pH of 4.5 than a solution with a pH of:
   a) 5.5
   b) 6.5
   c) 9.5

4. How much more basic is a solution with a pH of 12.5 than a solution with a pH of:
   a) 10.5
   b) 8.5
   c) 1.5

pH formulas \[ [H^+] = 10^{-pH}, \quad pH = -\log [H^+] \]

5. Use the pH formula to calculate the pH of solutions in which the hydrogen ion concentration (in mol/L) is:
   a) 0.1
   b) 0.01
   c) 0.001
   d) 1 x 10$^{-5}$
   e) 1 x 10$^{-4}$

6. Calculate the concentrations of hydrogen ions for the following pH values:
   a) 1.0
   b) 3.0
   c) 5.0
   d) 9.0
   e) 12.0

7. What is the percent ionization in each solution below?
   a) 10 out of 100 molecules of acid ionize
   b) 100 out of 1000 molecules ionize
   c) 3 out of 1000 molecules ionize
   d) 500 out of 1000 molecules ionize

8. If all solutions have the same concentration from question 7 which solution has
   a) the lowest pH
   b) the highest pH

9. Define each of the following terms: concentration of an acid or base, percent ionization of an acid or base, weak acid, strong acid, weak base, strong base.