

4.7  $K_w$   
4.8 & 4.9  $K_a$  &  $K_b$

Name: \_\_\_\_\_

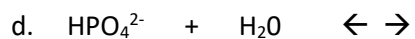
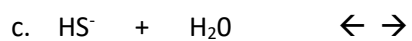
1. What is the  $[H_3O^+]$  in neutral water? What is  $[OH^-]$ ?
2. The ionization of water has a  $\Delta H = +59\text{kJ}$ . Write the equation for the ionization of water with the heat term on the appropriate side.
  - a. Use your equation and Le Chatelier's principle to explain what happens when water is cooled to less than 25 C?
  - b. Does water become less acidic when cooled? Explain why or why not.
3. Determine the  $[H_3O^+]$  and  $[OH^-]$  in each of the following. Use  $K_w$  equation and solve for your unknown.

	$[H_3O^+]$	$[OH^-]$
a. 2.5 M $HNO_3$		
b. $6.00 \times 10^{-3}\text{M}$ $Ca(OH)_2$		
c. 0.25M $H_2SO_4$		

4. Human urine has  $[H_3O^+] = 6.3 \times 10^{-7}\text{M}$ , at 25 C. Is urine acidic, basic or neutral? Support your answer with calculations.
5. Why do weak acids and bases have a  $K_a$  or  $K_b$ , while strong acids and bases do not?
6. What is  $K_a$  a measure of? What does a larger  $K_a$  mean? (2 things to mention)

7. Write the acid or base ionization for each of the following. (Ionization equation is the reaction for each with water.)

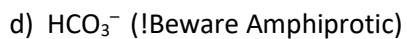
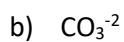
HINT: a and b, act as acids....form  $\text{H}_3\text{O}^+$  on product side  
c and d, act as bases....form  $\text{OH}^-$  on product side



8. Write  $K_a$  expression for a above:

9. Write  $K_b$  expression for c above:

10. Determine the  $K_b$  of the following bases.



11. Given that  $K_b = 1.7 \times 10^{-6}$  for  $\text{N}_2\text{H}_4$ . What is the  $K_a$  for  $\text{N}_2\text{H}_5^+$ ? Is  $\text{N}_2\text{H}_4$  a weak base or a weak acid?