

**Part I Matching: Write the letter of the description that best matches each term.**

- |   |  |
|---|--|
| _____ 1. Hydronium ion ( $\text{H}_3\text{O}^+$ ) | a. solution in which $[\text{H}^+]$ is greater than $[\text{OH}^-]$ .      |
| _____ 2. Hydroxide ion ( $\text{OH}^-$ )          | b. aqueous solution in which $[\text{H}^+]$ and $[\text{OH}^-]$ are equal. |
| _____ 3. self-ionization                          | c. water molecule that loses a hydrogen ion.                               |
| _____ 4. neutral solution                         | d. solution in which $[\text{H}^+]$ is less than $[\text{OH}^-]$ .         |
| _____ 5. ion-product constant for water ( $K_w$ ) | e. water molecule that gains a hydrogen ion.                               |
| _____ 6. acidic solution                          | f. reaction in which two water molecules produce ions.                     |
| _____ 7. basic solution                           | g. product of hydrogen ion and hydroxide ion concentrations for water.     |

**Part II Fill in the Blank**

Water molecules can self-ionize to form hydrogen ions ( $\text{H}^+$ )

and \_\_\_\_8\_\_\_\_. The concentrations of each ion in pure water at  $25^\circ\text{C}$  is equal to \_\_\_\_9\_\_\_\_ mol/L.

The pH scale, which has a range from 0 to \_\_\_\_10\_\_\_\_ is used to denote the \_\_\_\_11\_\_\_\_ ion concentration of a solution. On this scale, 0-1 is strongly \_\_\_\_12\_\_\_\_, '14' is strongly \_\_\_\_13\_\_\_\_, and '7' is \_\_\_\_14\_\_\_\_. Pure water at  $25^\circ\text{C}$  has a pH of \_\_\_\_15\_\_\_\_.

The ion-product constant,  $K_w$ , for water has a value of \_\_\_\_16\_\_\_\_

Thus, the product of the concentrations of hydronium ions and \_\_\_\_17\_\_\_\_ ions in aqueous solution will always equal  $1.0 \times 10^{-14} \text{M}^2$ .

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

11. \_\_\_\_\_

12. \_\_\_\_\_

13. \_\_\_\_\_

14. \_\_\_\_\_

15. \_\_\_\_\_

16. \_\_\_\_\_

17. \_\_\_\_\_

**Part III - Are the following statements always true (AT), sometimes true (ST), or never true (NT)?**

\_\_\_\_\_ 18. The definition of pH is the negative logarithm of the hydrogen-ion concentration.

\_\_\_\_\_ 19. The pH of a solution that is 1.0 M HCl is one.

\_\_\_\_\_ 20. If the  $[H^+]$  in an aqueous solution decreases, the  $[OH^-]$  must increase.

\_\_\_\_\_ 21. In an acidic solution,  $[H^+]$  is less than  $[OH^-]$ .

\_\_\_\_\_ 22. The  $[OH^-]$  is less than  $10^{-7}$  M in a basic solution.

**Part IV Problems- Show all of your work or no credit!**

23. Determine the **hydrogen** ion concentrations for an aqueous solutions with a pH of 3.

24. Determine the **hydroxide** ion concentrations for an aqueous solutions with a pH of 8.

25. Calculate the hydrogen-ion concentration,  $[H^+]$ , for an aqueous solution in which  $[OH^-]$  is  $1 \times 10^{-9}$  mol/L. Is this solution acidic, basic, or neutral?