

## Section 4C Review

Name: Key

- 1) Compare and contrast the taste and the feel of an acid and a base.

acids - taste sour, give sting      bases - taste bitter, feel slippery

- 2) Identify the following as an acid or a base, and name the acid or base:

- |                                                                 |                                                         |
|-----------------------------------------------------------------|---------------------------------------------------------|
| a) LiOH      lithium hydroxide                                  | b) H <sub>2</sub> SO <sub>3</sub> sulfurous acid        |
| c) H <sub>3</sub> P      hypophosphoric acid                    | d) Cu(OH) <sub>2</sub> copper (II) hydroxide            |
| e) H <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> dichromic acid | f) HIO <sub>3</sub> iodic acid                          |
| g) NH <sub>3</sub> nitrogen trihydride                          | h) HC <sub>6</sub> H <sub>5</sub> COO      benzoic acid |

- 3) How is acid rain formed from pollution?

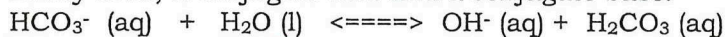
acid rain forms when pollution (SO<sub>2</sub>, CO<sub>2</sub>) react with water vapor to form an acid in the clouds. Ex.  $\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3$

- 4) If the concentration of H<sub>3</sub>O<sup>+</sup> ions is  $7 \times 10^{-5}$  M, what is the concentration of OH<sup>-</sup> ions? Is the solution acidic or basic? Show your work!

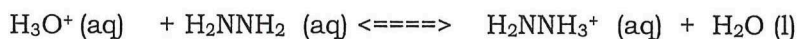
$$K_w = [\text{H}^+][\text{OH}^-]$$

$$1 \times 10^{-14} = (7 \times 10^{-5}) \times x \quad x = [\text{OH}^-] = 1.4 \times 10^{-10} \text{ M}$$

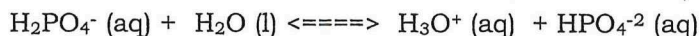
- 5) In the following reactions, identify which substance act as a Bronsted-Lowry acid, a Bronsted-Lowry base, a conjugate acid and a conjugate base.



base      acid      c. base      c. acid

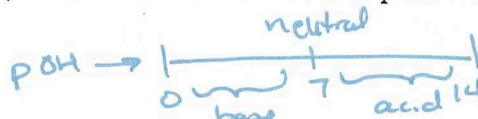
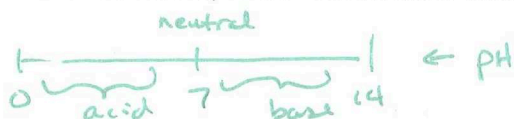


acid      base      c. acid      c. base



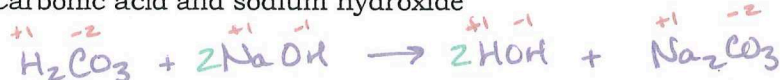
acid      base      c. acid      c. base

- 6) Draw a pH scale below and identify the maximum and minimum values, and the location of the various acidic, basic and neutral solutions. Then, on the same scale label the pOH values.

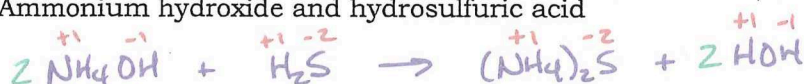


- 7) Write the neutralization reaction for the following acids/base combinations:

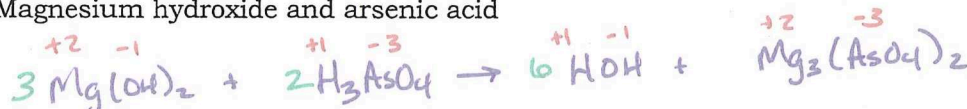
- a) Carbonic acid and sodium hydroxide



- b) Ammonium hydroxide and hydrosulfuric acid



- c) Magnesium hydroxide and arsenic acid



8) Calculate the pH of the following substances. Tell whether the substance is an acid or a base.

a) saliva -  $[\text{OH}^-] = 1.5 \times 10^{-9} \text{ M}$   $\text{pOH} = -\log(1.5 \times 10^{-9}) = 8.8$   $14 - 8.8 = 5.2$  acid

b) borax cleaner -  $[\text{OH}^-] = 2.2 \times 10^{-6} \text{ M}$   $\text{pOH} = -\log(2.2 \times 10^{-6}) = 5.7$   $14 - 5.7 = 8.3$  base

c) bleach -  $[\text{H}_3\text{O}^+] = 8.3 \times 10^{-13} \text{ M}$   $\text{pH} = -\log(8.3 \times 10^{-13}) = 12.1$  base

d) bananas -  $[\text{H}_3\text{O}^+] = 7.7 \times 10^{-4} \text{ M}$   $\text{pH} = -\log(7.7 \times 10^{-4}) = 3.1$  acid

9) In a titration of 35 ml of an acetic acid solution, the end point is reached when 45 ml of 0.100 M barium hydroxide is added. Calculate the concentration of acetic acid.

$$M_A V_A = M_B V_B \quad M_A (35 \text{ mL}) = 0.100 \text{ M} (45 \text{ mL}) \quad \boxed{M_A = 0.13 \text{ M}}$$

10) What is a substance called when it gives off a certain color if immersed in hydronium ions and gives off a different color in the presence of hydroxide ions?

an indicator

11) Explain what a buffer is and how it works.

A buffer is a solution that can neutralize a ~~small~~ small amount of acid or base to keep the pH from changing. It resist pH change.

12) Calculate the molarity of a solution in which 60 g of  $\text{CaCl}_2$  is dissolved in 250 ml of water.

$$M = \frac{\text{mol}}{L} \quad M = ? \quad \text{mol} = 60 \text{ g } \text{CaCl}_2 \left( \frac{1 \text{ mol}}{111.1 \text{ g}} \right) = 0.54 \text{ mol} \quad M = \frac{0.54 \text{ mol}}{0.250 \text{ L}} = \boxed{2.16 \text{ M}}$$

$$L = 250 \text{ mL} = 0.250 \text{ L}$$

13a) How many mL of 0.90 M HCl solution need to be measured out in order for the solution to contain 1.5 g of HCl?

$$M = 0.90 \text{ M} \quad \text{mol} = 1.5 \text{ g HCl} \left( \frac{1 \text{ mol}}{36.5 \text{ g}} \right) = 0.041 \text{ mol} \quad \frac{0.90}{1} = \frac{0.041}{L}$$

$$L = ? \quad L = 0.0456 \text{ L or } 45.6 \text{ mL}$$

b) What would be the pH of the solution in (a) if the solution was diluted to a volume of 2.0 L by adding water?

$$M = ? \quad \text{mol} = 0.041 \text{ mol} \quad M = \frac{0.041 \text{ mol}}{2.0 \text{ L}} = 0.0205 \text{ M}$$

$$L = 2.0 \text{ L} \quad \text{pH} = -\log(0.0205) = \boxed{1.7}$$

14) Calculate the pH of a solution that has an  $[\text{OH}^-]$  concentration of  $2.5 \times 10^{-11} \text{ M}$ .

$$1 \times 10^{-14} = [\text{H}^+] 2.5 \times 10^{-11}$$

$$[\text{H}^+] = 0.0004 \text{ M} \quad -\log(0.0004) = \boxed{3.4}$$

Answers to selected problems:

4a)  $2 \times 10^{-9} \text{ M}$       8a) 5.2      8b) 8.3      8c) 12.1      8d) 3.1      9) 0.13 M  
12) 2.16 M      13a) 45.6 mL      13b) 1.7      14) 3.4