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_2SO_3 sulfous acid

c) H_3P hydrophosphic acid

d) $Cu(OH)_2$ copper (II) hydroxide

e) $H_2Cr_2O_7$ dichromic acid

f) HIO_3 iodic acid

g) NH_3 nitrogen trihydride

h) HC_6H_5COO benzoic acid

3) How is acid rain formed from pollution?

acid rain forms when pollution (SO_2, CO_2) react with water vapor to form an acid in the clouds. Ex. $SO_2 + H_2O \rightarrow H_2SO_3$

4) If the concentration of H_3O^+ ions is 7×10^{-5} M, what is the concentration of OH^- ions? Is the solution acidic or basic? Show your work!

$K_w = [H^+][OH^-]$

$1\times10^{-14} = (7\times10^{-5})\,x$ $x = [OH^-] = 1.4\times10^{-10}$ 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.

HCO_3^- (aq) + H_2O (l) <====> OH^- (aq) + H_2CO_3 (aq)

base acid c. base c. acid

H_3O^+ (aq) + H_2NNH_2 (aq) <====> $H_2NNH_3^+$ (aq) + H_2O (l)

acid base c. acid c. base

$H_2PO_4^-$ (aq) + H_2O (l) <====> H_3O^+ (aq) + HPO_4^{-2} (aq)

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

$\overset{+1}{H_2}\overset{-2}{CO_3} + 2\overset{+1}{Na}\overset{-1}{OH} \rightarrow 2\overset{+1}{H}\overset{-1}{OH} + \overset{+1}{Na_2}\overset{-2}{CO_3}$

b) Ammonium hydroxide and hydrosulfuric acid

$2\overset{+1}{NH_4}\overset{-1}{OH} + \overset{+1}{H_2}\overset{-2}{S} \rightarrow \overset{+1}{(NH_4)_2}\overset{-2}{S} + 2\overset{+1}{H}\overset{-1}{OH}$

c) Magnesium hydroxide and arsenic acid

$3\overset{+2}{Mg}\overset{-1}{(OH)_2} + 2\overset{+1}{H_3}\overset{-3}{AsO_4} \rightarrow 6\overset{+1}{H}\overset{-1}{OH} + \overset{+2}{Mg_3}\overset{-3}{(AsO_4)_2}$

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

a) saliva - $[OH^-] = 1.5 \times 10^{-9}$ M pOH = $-\log(1.5\times10^{-9})$ = 8.8 14 − 8.8 = 5.2 acid

b) borax cleaner - $[OH^-] = 2.2 \times 10^{-6}$ M pOH = $-\log(2.2\times10^{-6})$ = 5.7 14 − 5.7 = 8.3 base

c) bleach - $[H_3O^+] = 8.3 \times 10^{-13}$ M pH = $-\log(8.3\times10^{-13})$ = 12.1 base

d) bananas - $[H_3O^+] = 7.7 \times 10^{-4}$ M pH = $-\log(7.7\times10^{-4})$ = 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.

$M_A V_A = M_B V_B$ $M_A(35\,mL) = 0.100M(45\,mL)$ $M_A = 0.13\,M$

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 ~~sto~~ 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 $CaCl_2$ is dissolved in 250 ml of water.

$M = \frac{mol}{L}$ M = ?

mol = $60g\,CaCl_2\left(\frac{1\,mol}{111.1g}\right) = 0.54\,mol$ $M = \frac{0.54\,mol}{.250\,L} = 2.16\,M$

L = 250 mL = .250 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 = 0.90M

mol = $1.5g\,HCl\left(\frac{1\,mol}{36.5g}\right) = 0.041\,mol$

L = ?

$\frac{0.90}{1} = \frac{0.041}{L}$

L = 0.0456 L or 45.6 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 = ?

mol = 0.041 mol

L = 2.0 L

$M = \frac{0.041\,mol}{2.0L} = 0.0205\,M$

pH = $-\log(0.0205)$ 1.7

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

$1\times10^{-14} = [H^+]\,2.5\times10^{-11}$

$[H^+] = 0.0004\,M$ $-\log(0.0004) = 3.4$

Answers to selected problems:

4a) 2×10^{-9} 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