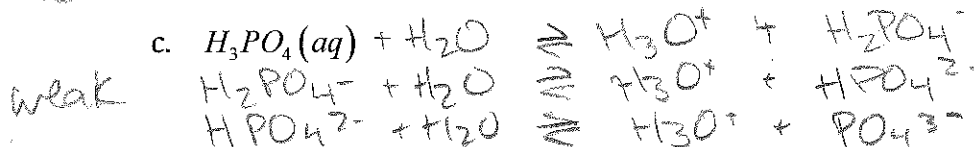


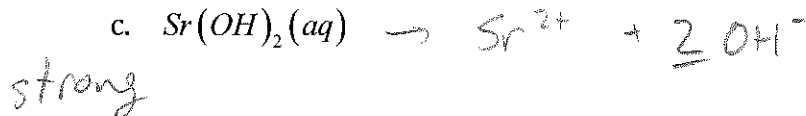
NO_3^-
 I^-
 Br^-
 SO_4^{2-}
 ClO_4^-
 Cl^-

Part B

1. Use the modified Arrhenius theory to suggest a chemical equation to explain the acid properties of each of the following solutions. (write the ionization formula)



2. Use the modified Arrhenius theory to suggest a chemical equation to explain the basic properties of each of the following solutions. (write the dissociation formula)



3. Explain, using chemical reactions, to explain the observations listed below.

a. A solution containing the ammonium ion turns blue litmus paper to red.



b. A solution containing $HNO_3(aq)$ has a pH = 5.50.



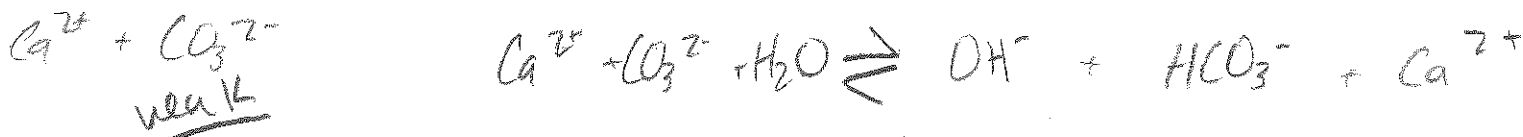
c. A solution containing sodium hydrogen carbonate ($NaHCO_3(aq)$) turns blue litmus to red.



d. A solution containing $Al(OH)_3(aq)$ has a pH=14.23.



e. A solution of calcium carbonate turns red litmus paper blue.



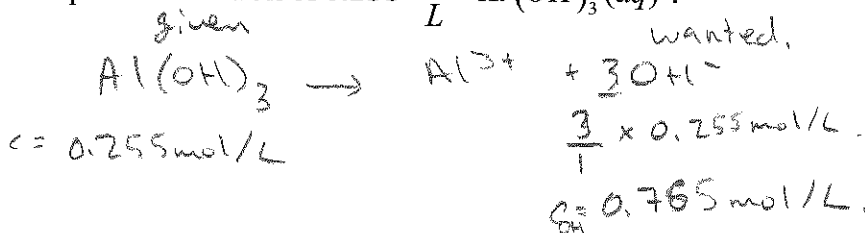
4. Determine the pH and pOH of a solution with a $[H_3O^+(aq)] = 1.65 \times 10^{-4} \frac{mol}{L}$.

$pH = -\log [1.65 \times 10^{-4}]$ $pH = 3.783$

$pH + pOH = 14$

$pOH = 10.217$

5. Determine the pOH and pH of a solution of $0.255 \frac{mol}{L} Al(OH)_3(aq)$.



$pOH = -\log [OH] = 0.116338$

$pH = 13.884$

6. Express the following pH values as the concentration of the hydronium ion

a. Household ammonia: pH = 11.3

$[H_3O^+] = 5 \times 10^{-12} mol/L$

b. Soda pop: pH = 4.20

$[H_3O^+] = 6.3 \times 10^{-5} mol/L$

c. Oven cleaner: pH = 13.755

$[H_3O^+] = 1.76 \times 10^{-14} mol/L$

d. Salad dressing: pH = 2.55

$[H_3O^+] = 2.8 \times 10^{-3} mol/L$

7. An 11.8 mol/L solution of hydrochloric acid (a strong acid) is prepared.
a. Determine the concentration of the hydronium ion in the solution.



- b. Determine the pH of the solution.

$$\text{pH} = -\log [11.8] \quad \boxed{\text{pH} = -1.072}$$

- c. Determine the pOH of the solution

$$\text{pH} + \text{pOH} = 14$$

$$\boxed{\text{pOH} = 15.072}$$

- d. Determine the concentration of the hydroxide ion in the solution.

$$[\text{OH}^-] = 10^{-\text{pOH}}$$

$$\boxed{[\text{OH}^-] = 8.47 \times 10^{-16} \text{ mol/L}}$$

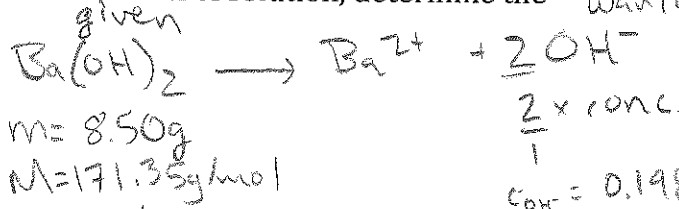
8. An 11.8 mol/L solution of acetic acid is prepared. What do you expect the pH of this solution to be in comparison to the pH of the solution from the above question? Explain your answer.

different: HCl is strong acid (fully ionized)
CH₃COOH is weak acid (not fully ionized)

9. If 8.50 g of barium hydroxide is dissolved to make 500 mL of solution, determine the

- a. Concentration of the solution

$$\boxed{9.92 \times 10^{-2} \text{ mol/L}}$$



- b. Concentration of the hydroxide ion

$$\boxed{0.198 \text{ mol/L}}$$

$$n = m/M$$

$$n = 0.0496 \text{ mol}$$

- c. pOH of the solution

$$-\log [0.198] = \boxed{0.702 = \text{pOH}}$$

$$c = n/v \quad c = 0.099212 \text{ mol/L}$$

10. Determine the mass of aluminum hydroxide required to make a solution with a pH of 10.35. (hint: 1st determine the concentration of the hydroxide ion) $v = 1.0 \text{ L}$.

$$M = 78.01 \text{ g/mol}$$

$$\text{pH} = 10.35$$

$$m = M \times n$$

$$\text{pOH} = 3.63$$

$$m = 0.0058$$

$$[\text{OH}^-] = 10^{-3.63} = \underline{2.2387 \times 10^{-4} \text{ mol/L}}$$

$$\boxed{m = 5.8 \times 10^{-3} \text{ g}}$$



$$c = 7.762 \times 10^{-5} \text{ mol/L}$$

$$c = 2.2387 \times 10^{-4} \text{ mol/L}$$

$$v = 1.0 \text{ L}$$

$$n = 7.462 \times 10^{-5} \text{ mol}$$