HONORS CHEMISTRY UNIT 13 NOTE PACKET

ACIDS AND BASES:

Arrhenius Model

Bronsted-Lowry Model

Conjugate acids and Conjugate bases

HA(aq) + H2O(l) → H3O+(aq) + A-(aq)

HCO3-(aq) + HNO3(aq) → H2CO3(aq) + NO3-(aq)

HCl(aq) + NH3(aq) → NH4+(aq) + Cl-(aq)

Conjugate acid-base pair, Conjugate base-acid pair

Hydronium ion:

ACID STRENGTH

BASE STRENGTH

WATER AS AN ACID AND A BASE

Amphoteric substance

Ionization of water

Kw

A neutral solution

An acidic solution

A basic solution

Sample problem 1: Calculate the [H+] or [OH-] for each of the following solutions at 25oC, and state whether the solution is neutral, acidic, or basic.

1. 1.0 x 10-5 M OH-
2. 1.0 x 10-7 M OH-
3. 10.0 M H+

THE pH SCALE ( A LOGARITHMIC SCALE)

pH = -log [H+]

What does the calculator do?

Sample problem 2: Calculate the pH of the following solutions

1. [H+] = 4.5 x 10-9 M
2. [H+] = 1.2 x 10-3 M
3. [HNO3] = 0.0100 M

pOH = -log[OH-]

Sample problem 3: Calculate the pOH of the following solutions

1. [OH-] = 2.5 x 10-4 M
2. [OH-] = 1.5 x 10-9
3. [NaOH] = 0.0100 M

Relating pH and pOH

1. x 10-14 = [H+][OH-]

Sample problem 4: Calculate the pH and pOH of the following solutions. Also, indicate whether they are acidic or basic.

1. [H+] = 4.2 x 10-5 M
2. [OH-] = 3.6 x 10-4 M
3. [H+] = 8.7 x 10-10 M
4. [OH-]= 7.2 x 10-11 M

Reversing the process: Calculating [H+] or [OH-] from the pH or pOH

Sampler problem 5: Calculate the [H+] from the following

1. pH = 5.2
2. pOH = 4.2
3. pH = 9.8
4. [OH-] = 2.5 x 10-6 M

Sample problem 6: Calculate the [OH-] from the following

1. pOH = 7.5
2. pH = 1.5
3. pOH = 3.7
4. [H+] = 5.6 x 10-10 M

MEASURING pH

ACID-BASE TITRATIONS

Neutralization reaction

Titration

Standard solution

Equivalence point

End point

Sample problem 7: Determine the volume of 0.100 M NaOH needed to titrate 50.0 mL of 0.200 M HNO3

Sample problem 8: Calculate the concentration of H2SO4 if it takes 25.0 mL of a 0.200 M NaOH solution to neutralize 35.0 mL of the H2SO4

Sample problem 9: Calculate the concentration of NaOH if it takes 17.0 mL of a 0.100 M HCl to neutralize 27.0 mL of the NaOH.

Sample problem 10: Determine the volume of 0.100 M Ba(OH)2 needed to neutralize 45.0 mL of 0.250 M HCl