Unit 12

Look up vocab.

Objective 1:

1) HNO_2 nitrous acid

H_2SO_3 sulfurous acid

HCl hydrochloric acid

HIO_2 iodous acid

H_2S hydrosulfuric acid

$HBrO$ hypobromous acid

H_3PO_3 phosphorous acid

HNO_3 nitric acid

$HC_2H_3O_2$ acetic acid

$HClO_4$ perchloric acid

2) hydrocyanic acid HCN

sulfuric acid H_2SO_4

hypofluorous acid HFO

chloric acid ~~H_2CrO_4~~ $HClO_3$

hydroarsenic acid H_3As

chromic acid H_2CrO_4

3) Bases are named like ionic compounds.

4.) Arrhenius acids are hydrogen-containing compounds that ionize to yield (H^+)(or H_3O^+) in solution. Arrhenius bases are compounds that ionize to yield (OH^-) in water (solution). This is a narrower view than Bronsted-Lowry. In Arrhenius, one of the reactants is water, but water is not considered an acid or a base. The Brønsted-Lowry theory defines an acid as a proton (hydrogen-ion) donor and a base as a proton acceptor. If water is a reactant, it would be labeled as an acid or base. All of the acids and bases under Arrhenius are included within the Bronsted-Lowry theory.

5. a. $HSO_4^- + C_2O_4^{2-} \rightleftharpoons SO_4^{2-} + HC_2O_4^-$

A B CB CA

b. $H_2PO_4^- + HCO_3^- \rightleftharpoons HPO_4^{2-} + H_2CO_3$

A B CB CA

c. $H_2O + S^{2-} \rightleftharpoons HS^- + OH^-$

A B CA CB

d. $CN^- + HC_2H_3O_2 \rightleftharpoons HCN + C_2H_3O_2^-$

B A CA CB

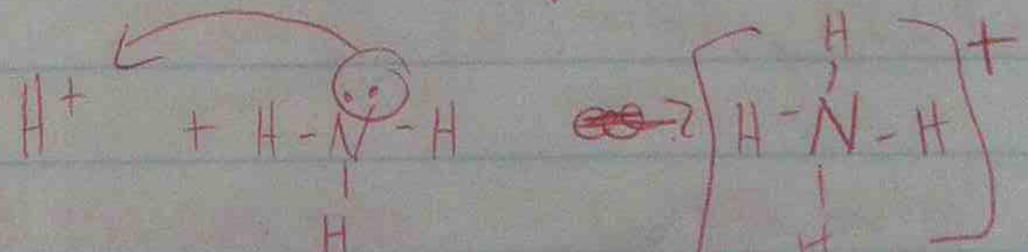
e. $HNO_2 + H_2O \rightleftharpoons H_3O^+ + NO_2^-$

A B CA CB

6. $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^+$

Arrhenius - ammonia is a base because in water it increases the $[OH^-]$.

Brønsted-Lowry - ammonia is a base because it accepts an H^+.



Lewis- ammonia is a base because it is an electron-pair donor.

Unit 12

Objective 2:

1. In notes

2. a. $HCl \rightarrow H^+ + Cl^-$

$.40M\ H^+$ $pH = -\log[H^+] = -\log(.40M)$

pH = .4

b. $K_w = [OH^-] \times [H^+]$

$[H^+] = \frac{K_w}{[OH^-]} = \frac{1.0 \times 10^{-14}}{1.2 \times 10^{-8}} = 8.33 \times 10^{-7} M$

$pH = -\log[H^+] = -\log(8.33 \times 10^{-7}) =$ **6.08**

c. $\frac{25.6g\ CsOH}{4520mL} \times \frac{1000mL}{1L} \times \frac{1mol\ CsOH}{149.91g} \times \frac{1mol\ OH^-}{1mol\ CsOH}$

$= .0378\ M\ OH^-$

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

$[H^+] = \frac{K_w}{[OH^-]} = \frac{1.0 \times 10^{-14}}{.0378} = 2.65 \times 10^{-13}\ M\ H^+$

$pH = -\log[H^+] = -\log(2.65 \times 10^{-13}) =$ **12.6**

d. $\frac{100g\ HNO_3}{780mL} \times \frac{1000mL}{1L} \times \frac{1mol\ HNO_3}{63g} \times \frac{1mol\ H^+}{1mol\ HNO_3} = 2.03 M\ H^+$ $pH = -\log[H^+]$

which is 0 → **pH = -.308**

3. $\frac{2.5g}{1.6L} \times \frac{1 mol\ KOH}{56.1g} \times \frac{1 mol\ OH^-}{1 mol\ KOH} =$ **.0278 M OH^-**

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

$[H^+] = \frac{K_w}{[OH^-]} = \frac{1.0 \times 10^{-14}}{.0278} =$ **3.59×10^{-13} M H^+**

c. $pH = -\log[H^+] =$ **12.44**

d. $pH + pOH = 14$ $\quad pOH =$ **1.55**

4. It is 1000 times more acidic.

Objective 3

$LiOH + HNO_3 \rightarrow H_2O + LiNO_3$

a. $\frac{25.00 mL}{1} \times \frac{1L}{1000mL} \times \frac{.678 mol\ HNO_3}{1L} =$ **.0170 mol HNO_3**

b. $\frac{.0170 mol\ HNO_3}{1} \times \frac{1 mol\ LiOH}{1 mol\ HNO_3} =$ **.0170 mol LiOH**

c. $\frac{.0170 mol\ LiOH}{.03215 L} =$ **.527 M LiOH**

d. In notes

Objective 3

2. $2\,KHP + Sr(OH)_2 \rightarrow 2\,H_2O + Sr(KP)_2$

$\frac{.6875\,g}{1} \times \frac{1\,mol\,KHP}{204\,g} = .00337\,mol\,KHP$

$\frac{.00337\,mol\,KHP}{.200\,L} = .0169\,M\,KHP$

$24.32 - 1.32\,mL = 23.00\,mL$

$\frac{.00337\,mol\,KHP}{1} \times \frac{1\,mol\,Sr(OH)_2}{2\,mol\,KHP} = .00169\,mol\,Sr(OH)_2$

$\frac{.00169\,mol}{.023} = \boxed{.073\,M\,Sr(OH)_2}$

6. Look up properties of primary standard.

3. $HCl + KOH \rightarrow H_2O + HCl$

$\frac{110.0 mL}{1} \times \frac{1 L}{1000 mL} \times \frac{.325 mol\ HCl}{1 L} \times \frac{1 mol\ H^+}{1 mol\ HCl} = .036 mol\ H^+$

$365.0 mL \times \frac{1 L}{1000 mL} \times \frac{.221 mol\ KOH}{1 L} \times \frac{1 mol\ OH^-}{1 mol\ KOH} = .081 mol\ OH^-$

$.081 mol\ OH^- - .036 mol\ H^+ = .045 mol\ OH^-$ left

$110 mL + 365 mL = 475 mL$

$\frac{.045 mol\ OH^-}{.475 L} = .095 M\ OH^-$ $pOH = -\log(.095)$

$pOH = 1.02$ $14 - 1.02 =$ **$12.97 = pH$**

4. $255.0 mL \times \frac{1 L}{1000 mL} \times \frac{1.25 mol\ Ba(OH)_2}{1 L} \times \frac{2 mol\ OH^-}{1 mol\ Ba(OH)_2} = .638 mol\ OH^-$

$120.0 mL \times \frac{1 L}{1000 mL} \times \frac{4.0 mol\ HNO_3}{1 L} \times \frac{1 mol\ H^+}{1 mol\ HNO_3} = .48 mol\ H^+$

$.638 mol - .48 = \frac{.158 mol\ OH^-}{(.255 L + .120 L)} =$ **$.421 M\ OH^-$** $= [OH^-]$

$pOH = .38$

$pH = 13.62$ $[H^+] =$ **$2.40 \times 10^{-14} M$**