Name:_____
Blk:_____Date:_____

Chemistry 12
ACID BASE PART II Lesson # 18
PRACTICAL ASPECTS OF TITRATIONS

To carry out a titration you must have a solution of Known concentration. This is also referred to as a standardized or a standard solution.

A Primary Standard is a substance that is used to determine the concentration of a standard solution. A primary standard is one that can be obtained in a pure and stable form (does not absorb or react with atmospheric gases) and has a "set" molar mass (known to 2 decimal places).

There are TWO WAYS to prepare a **STANDARD SOLUTION**:

1. To prepare a standard solution of a base eg. NaOH

a. use: Potassium hydrogen pthalate ($KHC_8H_4O_4 = 204.22$ g/mol)

$KHC_8H_4O_4 + NaOH \rightarrow KNaC_8H_4O_4 + H_2O(\ell)$

(WA/SB ... use phenolphtalein)

b. use: oxalic acid dihydrate ($H_2C_2O_4 \cdot 2H_2O = 126.07$ g/mol)

$H_2C_2O_4 \cdot 2H_2O + 2NaOH \rightarrow Na_2C_2O_4 + 4H_2O(\ell)$

(WA/SB ... use phenolpthalein)

2. To prepare a standard solution of an acid eg. HCl

use: sodium carbonate ($Na_2CO_3 = 105.99$ g/mol)

$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O(\ell) + CO_2(g)$

(SA/WB ... use methyl orange)

SEATWORK: Do Exercises 121-123 pg 165 in HEBDEN
PLO's: P1 (PRIMARY STANDARDS AND STANDARDIZED SOLUTIONS)

TYPES OF NEUTRALIZATION REACTIONS

Recall from earlier in this unit that we investigated the Formula, Complete and Net Ionic equations for a STRONG ACID and STRONG BASE neutralization reaction:
Ex. When NaOH reacts with HCl

i. $NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l)$

ii. $Na^+(aq) + OH^-(aq) + H^+(aq) + Cl^-(aq) \longrightarrow Na^+(aq) + Cl^-(aq) + H_2O(l)$

iii. $OH^-(aq) + H^+(aq) \rightleftharpoons H_2O(l)$

$\therefore 2H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-$

When the $[H_3O^+] = [OH^-]$ the solution is NEUTRAL, but if one is in excess it is either basic or acidic (depending on which ion is in excess)

When a WEAK ACID is reacted with a STRONG BASE:
eg. HF + NaOH

i. $HF(aq) + NaOH(aq) \longrightarrow NaF(aq) + H_2O(l)$

ii. $HF(aq) + Na^+(aq) + OH^-(aq) \longrightarrow Na^+(aq) + F^-(aq) + H_2O(l)$

iii. $HF(aq) + OH^-(aq) \rightleftharpoons F^-(aq) + H_2O(l)$

$\therefore F^-(aq) + H_2O(l) \rightleftharpoons HF(aq) + OH^-$

When a WEAK BASE is reacted with a a STRONG ACID:
Ex. NH_3 + HCl

i. $NH_3(aq) + HCl(aq) \longrightarrow NH_4^+(aq) + Cl^-(aq)$

ii. $NH_3(aq) + H^+(aq) + Cl^-(aq) \longrightarrow NH_4^+(aq) + Cl^-(aq)$

iii. $NH_3(aq) + H^+(aq) \rightleftharpoons NH_4^+$

$\therefore NH_4^+ + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+$

SEATWORK/HOMEWORK: Worksheet
PLO's: P4

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Chemistry 12
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PRACTICAL ASPECTS OF TITRATIONS WORKSHEET

Write out the FORMULA, COMPLETE and NET IONIC Equations for the following neutralization reactions: (specialized double replacement rxns!)

1 $Sr(OH)_2 + 2HBr \longrightarrow SrBr_2 + 2H_2O(\ell)$

$Sr^{2+} + 2OH^- + 2H^+ + 2Br^- \longrightarrow Sr^{2+} + 2Br^- + 2H_2O(\ell)$

neutral $2OH^- + 2H^+ \longrightarrow 2H_2O(\ell)$

$OH^- + H^+ \rightleftharpoons H_2O(\ell)$ $\therefore 2H_2O(\ell) \rightleftharpoons H_3O^+ + OH^-$

2. $NaCN + HCl \longrightarrow NaCl + HCN$

$Na^+ + CN^- + H^+ + Cl^- \longrightarrow Na^+ + Cl^- + HCN$

$CN^- + H^+ \rightleftharpoons HCN$

acidic $\therefore HCN + H_2O(\ell) \rightleftharpoons CN^- + H_3O^+$

3. $C_6H_5COOH + LiOH \longrightarrow C_6H_5COOLi + H_2O(\ell)$

$C_6H_5COOH + Li^+ + OH^- \longrightarrow C_6H_5COO^- + Li^+ + H_2O(\ell)$

$C_6H_5COOH + OH^- \rightleftharpoons C_6H_5COO^- + H_2O(\ell)$

basic $\therefore C_6H_5COO^- + H_2O(\ell) \rightleftharpoons C_6H_5COOH + OH^-$

4. $HCl + KOH \longrightarrow KCl + H_2O(\ell)$

$H^+ + Cl^- + K^+ + OH^- \longrightarrow K^+ + Cl^- + H_2O(\ell)$

neutral $H^+ + OH^- \rightleftharpoons H_2O(\ell)$ $\therefore 2H_2O(\ell) \rightleftharpoons H_3O^+ + OH^-$

5. $Na_2SO_3 + 2HNO_3 \longrightarrow 2NaNO_3 + H_2SO_3$

$2Na^+ + SO_3^{2-} + 2H^+ + 2NO_3^- \longrightarrow 2Na^+ + 2NO_3^- + H_2SO_3$

acidic $SO_3^{2-} + 2H^+ \rightleftharpoons H_2SO_3$ $\therefore H_2SO_3 + H_2O(\ell) \rightleftharpoons SO_3^{2-} + H_3O^+$

6. $CH_3COOH + RbOH \longrightarrow CH_3COORb + H_2O$

$CH_3COOH + Rb^+ + OH^- \longrightarrow CH_3COO^- + Rb^+ + H_2O(\ell)$

$CH_3COOH + OH^- \rightleftharpoons CH_3COO^- + H_2O(\ell)$

basic $\therefore CH_3COO^- + H_2O(\ell) \rightleftharpoons CH_3COOH + OH^-$