BR: May 1st

In this reaction:

CO_2 (g) + H_2 (g) + heat <--> CO (g) + H_2O (g)

a. Is heat absorbed or released by the forward reaction?

endo

b. In which direction will the equilibrium shift if these changes are made?

CO is added L

CO_2 is added R

H_2 is removed L

catalyst is added N/C

temperature is increased R

system is cooled L

pressure is increased N/C

Wednesday, May 1st

Objective: Students will be able to write neutralization reactions.

1. Bellringer
2. Notes: Neutralization Reaction/Titration
3. Worktime

HW: Neutralization Reactions Practice
DUE: Naming, Writing, and Predicting Products Practice

May 2-8:40 AM

Neutralization Reactions

Remember double replacement reactions?

HCl + NaOH → ???

HCl + NaOH → NaCl + HOH

acid base salt water

* Acid + Base --> Salt + water

I.C.

May 10-7:53 AM

Neutralization Reactions

HCl + NaOH → NaCl + HOH

- *Acids and bases are opposite each other*
  - *acids donate H^+, bases accept H^+*
- *When they combine they NEUTRALIZE each other -- neither acidic nor basic anymore*

(pH) = 7

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Neutralization Reactions

Practice #1

Complete and balance the neutralization reaction below, label the acid and the base:

1 H_2SO_4 + 2 NaOH → 2 H(OH) + 1 Na_2SO_4

acid base

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Neutralization Reactions

Practice #2

Complete and balance the neutralization reaction below, label the acid and the base:

2 HCl + 1 $Ca(OH)_2$ → 2 H(OH) + 1 $CaCl_2$

A B

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Neutralization Reactions

Practice #3

Complete and balance the neutralization reaction below, label the acid and the base:

$1\,H_2SO_3 + 2\,NH_4OH \rightarrow 2\,H(OH) + 1\,(NH_4)_2SO_3$

A B

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Titrations

Titration: adding a ***known*** *amount of solution of* ***known concentration*** to a *solution with an* ***unknown concentration***

Goal: **To determine the unknown concentration**

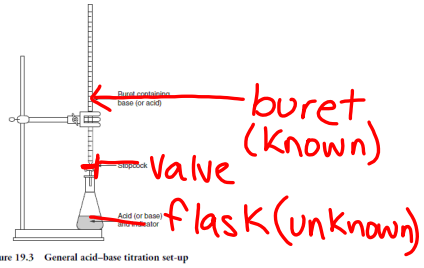

Figure 19.3 General acid–base titration set-up

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Equivalence Point

- **Endpoint**: the point of neutralization in a titration

pH = 7

- **Equivalence point**: the point where the moles of H^+ and OH^- are equal -- usually close to the endpoint

(not always at pH = 7)

> ***strong*** *acid and* ***strong*** *base, equivalence point pH around* ***7***

> ***strong*** *acid and* ***weak*** *base, equivalence point pH* ***less than 7***

> ***weak*** *acid and* ***strong*** *base, equivalence point pH* ***greater than 7***

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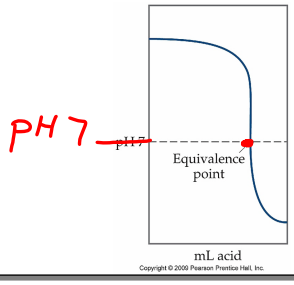
Equivalence Point

How do we know we reached the endpoint in a titration?

We can **use an indicator and look for a color change!**

OR

We **use a graph.**



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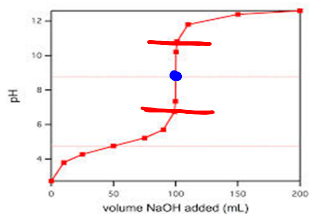
Equivalence Point and Ions

HCl and NaOH

- Look at the vertical part of the graph.
- Draw a line at the top of the vertical part.
- Draw a line at the bottom of the vertical part.
- Half-way between the two lines is your equivalence point.



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Equivalence Point and Ions

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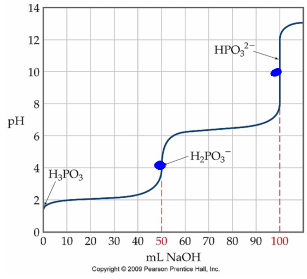

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Titration Calculations

After we do the experiment, how do we determine the concentration of the known???

--- **STOICH!!**

Steps:

1. Write and balance the equation.
2. List what you know (vol of acid, vol of base, conc of standard, mole ratio)
3. Begin with the volume (L) of the standard solution (known)
4. Set up dimensional analysis to determine the number of moles of the unknown (Use the known molarity and the mole to mole ratio as conversion factors)
5. Divide by the volume (L) of the unknown to find molarity of the unknown

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Titration Calculations

Practice #1

20.0 mL of 0.100 M HCl are titrated with 19.5 mL of an NaOH solution. What is the molarity of the NaOH solution?

1. Write and balance the equation. List what you know and don't know.

$1HCl + 1NaOH \rightarrow 1H(OH) + 1NaCl$

20.0 mL, 19.5 mL

0.1 mol/L, ? M

2. Set up dimensional analysis to find moles for the substance of unknown concentration. (NaOH)

$0.02\,L \times \frac{.1\,mol\,HCl}{1\,L\,HCl} \times \frac{1\,mol\,NaOH}{1\,mol\,HCl}$ mols NaOH

3. Divide the number of moles of NaOH by the volume of NaOH to find molarity.

$\frac{0.002\,mols}{0.0195\,L} = 0.1\,M$

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Titration Calculations

Practice #2

In a titration, 33.21 mL of 0.3020 M strontium hydroxide ($Sr(OH)_2$) solution is required to exactly neutralize 20.00 mL of hydrofluoric acid solution (HF). What is the molarity of the hydrofluoric acid solution?

1. Write and balance the equation. List what you know and don't know.

$1Sr(OH)_2 + 2HF \rightarrow 2H(OH) + 1SrF_2$

33.21 mL, 20.00 mL

0.302 M, ? M

2. Set up dimensional analysis to find moles for the substance of unknown concentration. (NaOH)

$.03321\,L \times \frac{.302\,mol\,Sr}{1\,L} \times \frac{2\,mols\,HF}{1\,mol\,Sr}$

3. Divide the number of moles of NaOH by the volume of NaOH to find molarity.

$\frac{0.02\,mols}{0.02\,L} = 1\,M$

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Worktime: Titration and Neutralization Practice

C

$2NaNO_3 + 1PbO \rightarrow$

$1Pb(NO_3)_2 + 1Na_2O$

$2AgI + 1Fe_2(CO_3)_3 \rightarrow 2FeI_3 + 3Ag_2CO_3$

$1Fe + 2AgNO_3 \rightarrow 1Fe(NO_3)_2 + 2Ag$

3D

$1PbSO_4 + 2AgNO_3 \rightarrow 1Ag_2SO_4 +$

$1Pb(NO_3)_2$

May 2-9:04 AM