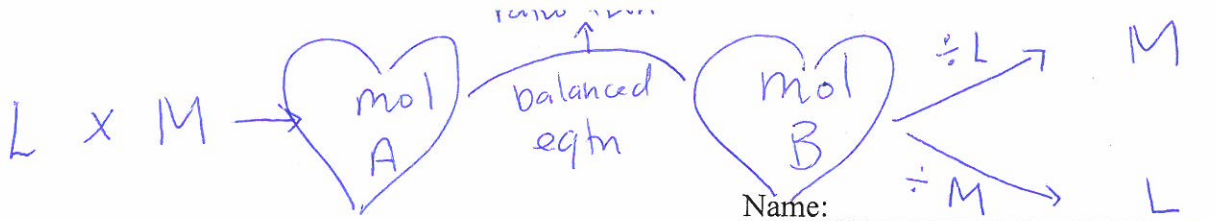

Name:_____

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REVIEW OF CHEMISTRY 11 FOR CHEMISTRY 12

DAY 2: STOICHIOMETRY AND TITRATIONS

A TITRATION is a process in which a measured amount of a solution is reacted with a solution of known concentration and volume until a desired equivalence point is reached.

THE EQUIVALENCE POINT is when moles of unknown is EQUAL to moles of known in a titration (usually coincides with a colour change)

Example A:
A 25.0 mL sample of Sodium hydroxide of unknown concentration is neutralized with 23.5 mL of 0.100 M Sulfuric acid. What is the concentration of the Sodium hydroxide?
Step1. Write out the **balanced equation**:

$2\ NaOH(aq) + 1\ H_2SO_4(aq) \rightarrow 1\ Na_2SO_4(aq) + 2\ H_2O(l)$

Step 2. Calculate **moles** of "known" (recall: mol = M x L)

$$0.0235\ L \times \frac{0.100\ mol\ H_2SO_4}{1\ L} = \text{mol } H_2SO_4$$

Step 3. Cross over to **moles** of "unknown"

$$\times \frac{2\ mol\ NaOH}{1\ mol\ H_2SO_4} = \text{mol NaOH}$$

Step 4. Determine the **concentration** of "unknown" (recall: M = mol ÷ L)

$$\times \frac{1}{0.0250\ L} \text{ (or } \div 0.0250\ L) = 0.188\ M\ NaOH$$

OR----> do steps 2-4 in one single set up:

$$0.0235\ \cancel{L} \times \frac{0.100\ mol\ \cancel{H_2SO_4}}{1\ \cancel{L}} \times \frac{2\ mol\ NaOH}{1\ mol\ \cancel{H_2SO_4}} \times \frac{1}{0.0250\ L} = 0.188\ M\ NaOH$$

Example B:
What volume of 0.200 M Potassium hydroxide is required to react with 25 mL of 0.250M Phosphoric acid in order to produce Potassium phosphate and water?
Step1. Write out the **balanced equation**:

$$1\ H_3PO_4(aq) + 3\ KOH(aq) \longrightarrow 1\ K_3PO_4(aq) + 3\ H_2O(\ell)$$

Step 2. Calculate **moles** of "known"

$$0.025\ L \times \frac{0.250\ mol\ H_3PO_4}{1\ L} = \quad mol\ H_3PO_4$$

Step 3. Cross over to **moles** of "unknown"

$$\times \frac{3\ mol\ KOH}{1\ mol\ H_3PO_4} = \quad mol\ KOH$$

Step 4. Determine the **volume** of "unknown"

$$\times \frac{1\ L}{0.200\ mol\ KOH} \Rightarrow \boxed{0.094\ L\ KOH}$$

OR----> do steps 2-4 in one single set up:

$$0.025\ \cancel{L} \times \frac{0.250\ mol\ \cancel{H_3PO_4}}{1\ \cancel{L}} \times \frac{3\ mol\ \cancel{KOH}}{1\ mol\ \cancel{H_3PO_4}} \times \frac{1\ L}{0.200\ mol\ \cancel{KOH}} = \boxed{0.094\ L\ KOH}$$

Please note an alternate way to present data:

Volume of Potassium hydroxide	?
Final volume of Phosphoric acid	47.50 mL
Initial volume of Phosphoric acid	22.50
Concentration of Potassium hydroxide	0.200 M
Concentration of H_3PO_4	0.250 M

Volume used = Final − Initial
∴ 47.50 − 22.50 = 25.00 mL H_3PO_4

$$1\ H_3PO_4(aq) + 3\ KOH(aq) \longrightarrow 1\ K_3PO_4(aq) + 3\ H_2O(\ell)$$

$$0.02500\ L \times \frac{0.250\ mol\ H_3PO_4}{1\ L} \times \frac{3\ mol\ KOH}{1\ mol\ H_3PO_4} \times \frac{1\ L}{0.200\ mol\ KOH}$$

$$= \boxed{0.0938\ L\ KOH}$$

Work on Examples 17-24