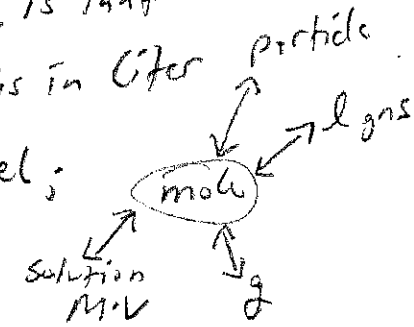
Neutralization Calculations

- These Neutralization (strong Acid - strong Base) calculation are the same as any reaction stoichiometry problem. So follow stoichiometry directions.

- As we talked about in solution section, only thing special about solution in mole concept/stoichiometry is that

$$mole_{solute} = M_{solute} \cdot V_{solute}$$ where V is in liters

So you have a new spoke on your mole wheel;



SO YOU DO THESE CALCULATIONS the same as any other reaction stoichiometry problem.

Neutralization Calculations (by Equation)

Example: How many liters of a 0.45 M sulfuric acid solution do I need to add to 455 mL of a 0.65M sodium hydroxide solution to completely neutralize the solutions (stoichiometric amounts).

step 1: Balanced rxn $1\,H_2SO_{4(aq)} + 2\,NaOH_{(aq)} \rightarrow 2\,H_2O_{(l)} + 1\,Na_2SO_{4(aq)}$

step 2: Convert known info to mole:

$mole = M \cdot V$

$V = (455\,mL)\left(\frac{1\,L}{1000\,mL}\right) = 0.455\,L$

0.65M NaOH

$= \left(\frac{0.65\,mole\,NaOH}{1\,L}\right)(0.455\,L) = 0.295\,mole\,NaOH$

step 3: mole known to mole unknown

$(0.295\,mole\,NaOH)\left(\frac{1\,mole\,H_2SO_4}{2\,mole\,NaOH}\right) = 0.147\,mole\,H_2SO_4$

step 4: mole unknown to unit unknown

$mole = M \cdot V \Rightarrow V = \frac{mole}{M}$

$$V = \frac{0.147\,mole\,H_2SO_4}{\left(\frac{0.45\,mole\,H_2SO_4}{1\,L\,H_2SO_4\,solution}\right)} = 0.326\,L = \boxed{0.33\,L\ H_2SO_4\ solution}$$

Neutralization Calculations (by Dimensional Analysis)

Example: How many liters of a 0.45 M sulfuric acid solution do I need to add to 455ml of a 0.65M sodium hydroxide solution to completely neutralize the solutions.

Step 1: Balanced reaction: $1\ H_2SO_{4(aq)} + 2\ NaOH_{(aq)} \rightarrow 2\ H_2O_{(l)} + 1\ Na_2(SO_4)_{(aq)}$

(Net ionic rxn: $1\ H^+ + 1\ OH^{1-} \rightarrow 1\ H_2O_{(l)}$)

0.45M — 0.65M

? V — 455ml

$$\left(\frac{0.65\text{mole NaOH}}{1\ \ell\ \text{NaOH solution}}\right)\left(\frac{455\text{ml}}{\text{NaOH solution}}\right)\left(\frac{1\ \ell}{1000\text{ml}}\right)\left(\frac{1\text{mole } H_2SO_4}{2\text{mole NaOH}}\right)\left(\frac{1\ \ell\ H_2SO_4\text{ solution}}{0.45\text{mole } H_2SO_4}\right) =$$

step 2 — step 3 — step 4

$= 0.328\ \ell$

$= \boxed{0.33\ \ell}$