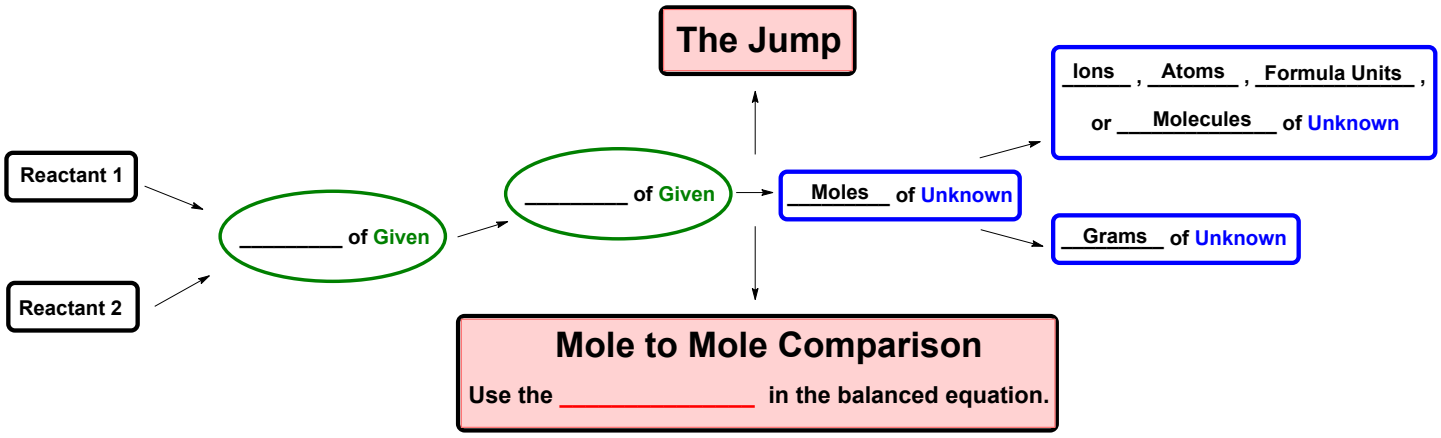
CONCEPT: LIMITING REAGENT

- **Limiting Reagent:** The reactant that is completely consumed in a reaction and determines the max amount of product.
  - □ _____ Yield: The maximum amount of product that can form from a chemical reaction.
    - Also referred to as the _____ yield or _____ yield.
  - □ _____ Reagent: The reactant that remains after the completion of the chemical reaction.
    - In order to determine which reactant is which we must work out the amounts of product each can make.



EXAMPLE: Chromium (III) oxide reacts with hydrogen sulfide (H_2S) gas to form chromium (III) sulfide and water:

$$Cr_2O_3\ (s) + 3\ H_2S\ (g) \longrightarrow Cr_2S_3\ (s) + 3\ H_2O\ (l)$$

What is the mass of chromium (III) sulfide formed when 14.20 g Cr_2O_3 reacts with 12.80 g H_2S?

STEP 1: Convert the **Given** quantities into moles of **Given**.

- □ If any compound(s) is said to be in excess, then just _____.

STEP 2: Do a **Mole to Mole comparison** to convert moles of **Given** of each reactant into moles of **Unknown**.

STEP 3: If necessary, convert the moles of **Unknown** into the final desired units.

STEP 4: Compare the final amounts of the **Unknown** to determine the theoretical yield.

- □ The _____ amount is for the limiting reagent, while the _____ amount is for the excess reagent.

CONCEPT: LIMITING REAGENT

PRACTICE: Acrylonitrile (C_3H_3N) is the starting material for many synthetic carpets and fabrics. It is produced by the following reaction:

$$2\ C_3H_6\ (g) + 2\ NH_3\ (g) + 3\ O_2\ (g) \longrightarrow 2\ C_3H_3N\ (g) + 6\ H_2O\ (g)$$

If 12.0 g C_3H_6, 10.0 g NH_3, and 5.0 g O_2 react, what mass of acrylonitrile can be produced, assuming 100% yield?

PRACTICE: The reaction between solid aluminum and iron (III) chloride can generate temperatures reaching 3000 ºC and is used in welding metals.

$$2\ Al + Fe_2O_3 \longrightarrow Al_2O_3 + 2\ Fe$$

If 150 g of Al are reacted with 432 g of Fe_2O_3, what is the mass of the excess reactant remaining?