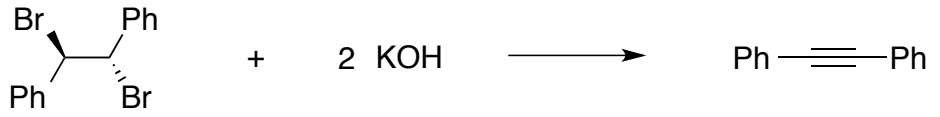
# Calculating Theoretical and Percent Yield

**General Procedure**

1) Balance the chemical equation
2) Convert the grams or milligrams of reactants to moles or millimoles.
3) Find the limiting reagent (the reactant that limits the reaction to produce the least amount of product)
4) Calculate the moles of product expected if the reaction goes to 100%.
5) Calculate the grams of product from the moles of product. This is the theoretical yield in grams.
6) Calculate the percent yield: $\% \text{ Yield} = \frac{\text{Actual yield}}{\text{Theoretical Yield}} \times 100\%$

**Example**




MW: 340 g/mol MW: 56 g/mol MW: 178 g/mol

*Suppose the above reaction uses 300. mg of dibromide and 247 mg of KOH. The reaction yielded 115 mg of diphenylacetylene.*

1) The equation written above is already balanced.
2) Calculate the of mmol of each reactant:

   **Dibromide:** $300.\text{ mg} \times \frac{1\text{ mmol}}{340\text{ mg}} = 0.882\text{ mmol}$

   **Potassium Hydroxide:** $247\text{ mg} \times \frac{1\text{ mmol}}{56\text{ mg}} = 4.41\text{ mmol}$
3) Determine the limiting reagent:

   **Dibromide:** $0.882\text{ mmol} \times \frac{1\text{ mmol product}}{1\text{ mmol dibromide}} = 0.882\text{ mmol product}$ (limiting reagent)

   **Potassium Hydroxide:** $4.41\text{ mmol} \times \frac{1\text{ mmol product}}{2\text{ mmol KOH}} = 2.21\text{ mmol product}$ (excess reagent)
4) Based on the limiting reagent calculation, if the reaction goes to 100% completion, the maximum amount of product that can be formed is 0.882 mmol.
5) **Theoretical Yield:** $0.882\text{ mmol} \times \frac{178\text{ mg}}{1\text{ mmol}} = 157\text{ mg}$
6) **Percent Yield:** $\frac{115\text{ mg}}{157\text{ mg}} \times 100\% = 73.2\ \%\text{ yield}$