

AP CHEMISTRY

TOPIC 2: STOICHIOMETRY, PART B

EXAMPLES

Day 14:

Stoichiometry

- Limiting Reactants

- 1) Determine the limiting reactant when 55.0 grams of methane, CH₄, reacts with 22.0 grams of oxygen gas in a combustion reaction. Hint: we are NOT trying to calculate "how much" product was formed. This technique, which is about to be demonstrated, **MUST be mastered** for the AP exam.

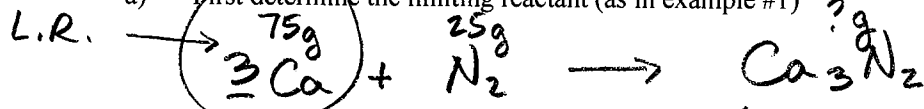


L.R. STEP:
$$\frac{55g \text{ CH}_4}{12.01g + 4(1.008g)} \times \frac{2 \text{ mol O}_2}{1 \text{ mol CH}_4} \times \frac{2(16g)}{1 \text{ mol O}_2} = 219g \text{ O}_2$$

IF 55g OF CH₄ COMPLETELY REACTED, YOU WOULD NEED A MINIMUM OF 219g OF O₂. YOU DON'T HAVE 219g OF O₂. THEREFORE O₂ IS L.R.

- 2) Calcium metal and nitrogen gas will react to produce calcium nitride. Calculate the mass of calcium nitride that can be produced from the reaction of 75.0 grams of Ca with 25.0 grams of nitrogen gas?

- a) First determine the limiting reactant (as in example #1)



Ca is L.R., IF ALL 75g OF Ca REACTED, YOU WOULD NEED AT LEAST 17.5g N₂

L.R. STEP:
$$\frac{75g \text{ Ca}}{40.08g} \times \frac{1 \text{ mol N}_2}{3 \text{ mol Ca}} \times \frac{2(14.01g)}{1 \text{ mol N}_2} = 17.48g \text{ N}_2$$

YOU HAVE MORE!

- b) Next, calculate the mass of the product produced in the reaction (from your limiting reactant amount).

$$\frac{75g \text{ Ca}}{40.08g} \times \frac{1 \text{ mol Ca}_3\text{N}_2}{3 \text{ mol Ca}} \times \frac{3(40.08g) + 2(14.01g)}{1 \text{ mol Ca}_3\text{N}_2} = \boxed{92.5g \text{ Ca}_3\text{N}_2}$$

- c) Finally, calculate the mass of the Un-reacted reactant.

USED: 17.48g N₂ (SEE L.R. STEP)

$$25.0g - 17.48g = 7.52g$$

L.R.

NOTE: THIS STEP WAS "EASY" BECAUSE WE "ACCIDENTLY" PICKED THE L.R. BACK IN a). THIS STEP WOULD REQUIRE YOU TO "START" w/ THE