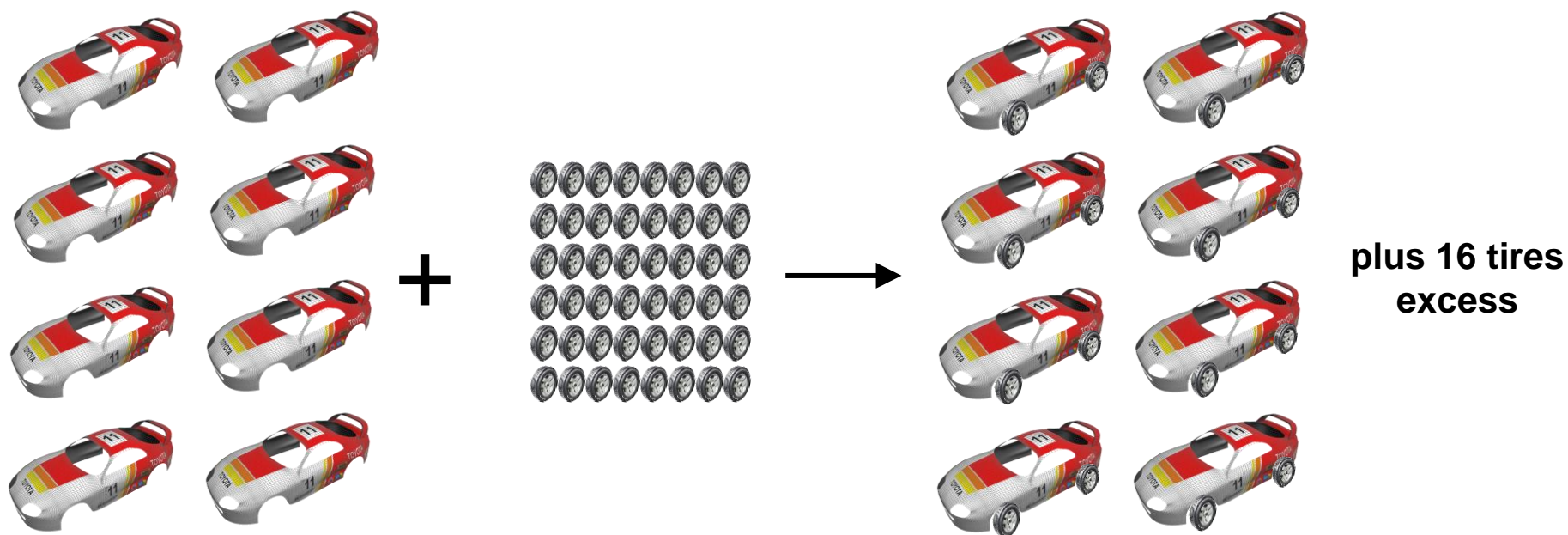


Limiting Reactants



8 car bodies

48 tires

8 cars

plus 16 tires
excess

CB

+

4 T

→

CT₄



Grilled Cheese Sandwich



Bread + Cheese → 'Cheese Melt'

2 B + C → B₂C

100 bread 30 slices 30 sandwiches

What ingredient runs out first? Cheese

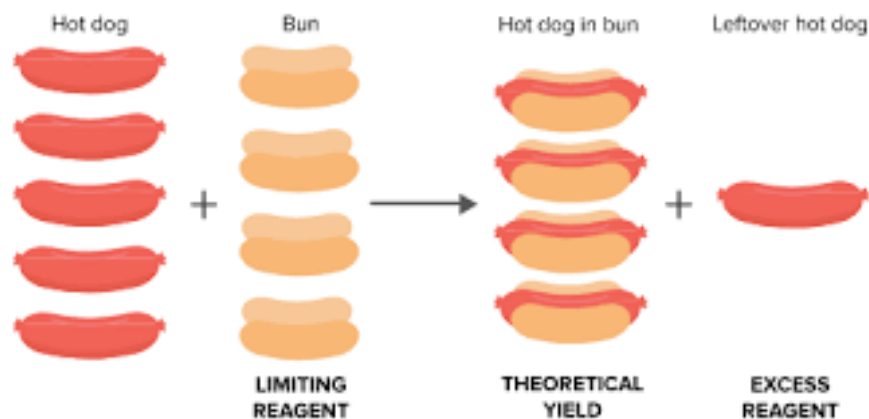
What ingredient is leftover? Bread

How much of the leftover ingredient is there? 40 pieces

***The amount of cheese available LIMITS
the number of sandwiches***

Limiting vs. Excess

- Limiting reagent
 - The first reactant used up in a reaction
 - Determines the amount of product formed
 - After it's gone, no more product formed
- Excess reagent
 - Not used up in a reaction, extra left over



The amount of buns determines how many hot dogs in buns can be formed.

After the buns run out there is one excess hot dog that cannot make a hot dog in a bun

Steps to Find Limiting Reactants

1. Write a balanced equation.

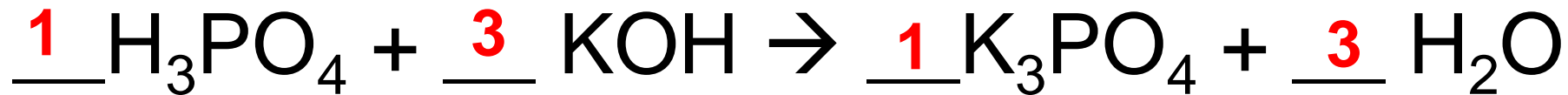
2. For each reactant

- calculate the amount of product formed (in moles or grams)
- Pick one product to use for comparison

3. Smaller answer indicates:

- limiting reactant

Example 1



Balance the equation

Given 5.0 moles of KOH and 2.0 moles of H_3PO_4 , how many moles of K_3PO_4 can be prepared?

Use givens to find products:

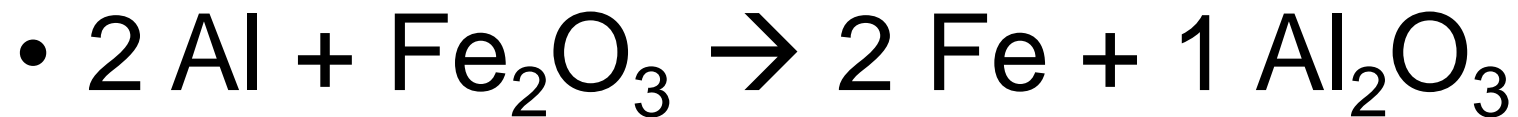
$$5 \text{ mol } \cancel{\text{KOH}} \times \frac{1 \text{ mol } \text{K}_3\text{PO}_4}{3 \text{ mol } \cancel{\text{KOH}}} = 1.67 \text{ mol } \text{K}_3\text{PO}_4$$

$$2 \text{ mol } \cancel{\text{H}_3\text{PO}_4} \times \frac{1 \text{ mol } \text{K}_3\text{PO}_4}{1 \text{ mol } \cancel{\text{H}_3\text{PO}_4}} = 2 \text{ mol } \text{K}_3\text{PO}_4$$

Example 1

- 1.67 is less than 2 so KOH makes less product and is the limiting reactant
- H_3PO_4 is the excess reactant

Example 2



If you reacted 24 grams of aluminum with 190 grams of Fe_2O_3 calculate amount of Fe produced in grams to find the limiting reagent?

Find excess reagent.

Example 2

- $2 \text{ Al} + \text{Fe}_2\text{O}_3 \rightarrow 2 \text{ Fe} + 1 \text{ Al}_2\text{O}_3$
- Given 24 g Al and 190 g of Fe_2O_3
- Use givens to find amount of Fe produced

Mole ratio Molar mass

$$24 \text{ g Al} \times \frac{1 \text{ mol Al}}{26.98 \text{ g Al}} \times \frac{2 \text{ mol Fe}}{2 \text{ mol Al}} \times \frac{55.85 \text{ g Fe}}{1 \text{ mol Fe}} = 49.68 \text{ g Fe}$$

Molar mass

Mole ratio

Molar mass

$$190 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol Fe}_2\text{O}_3}{159.7 \text{ g Fe}_2\text{O}_3} \times \frac{2 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{55.85 \text{ g Fe}}{1 \text{ mol Fe}} = 132.89 \text{ g Fe}$$

Molar mass

Al is limiting and Fe_2O_3 is excess