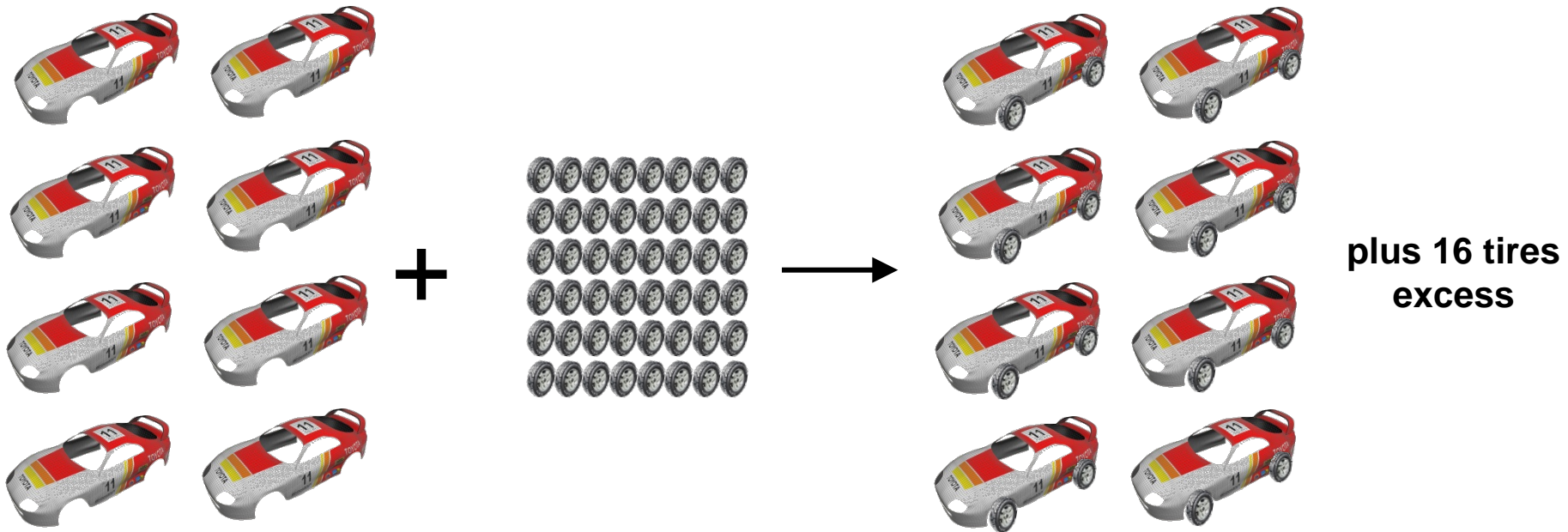


Limiting Reactants



8 car bodies

48 tires

8 cars

plus 16 tires
excess

CB

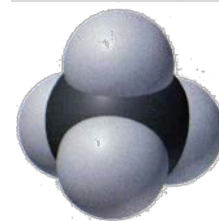
+

4 T

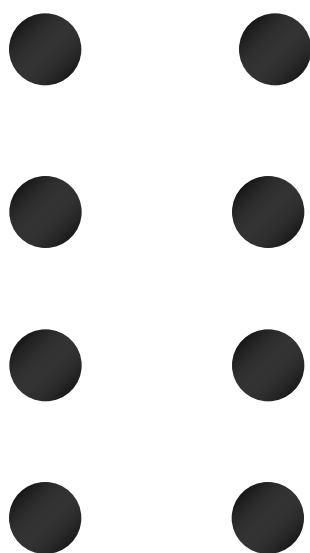
→

CT₄

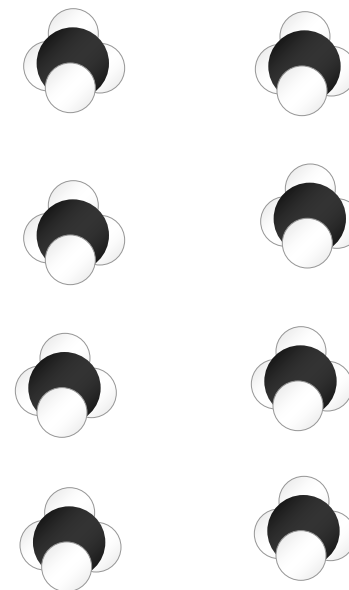
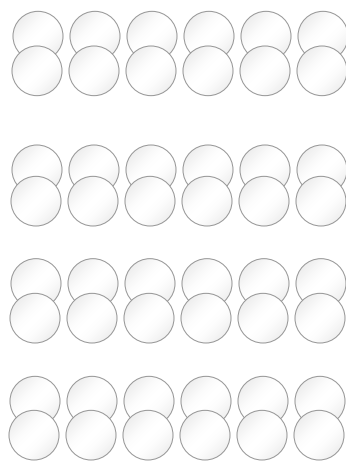
Limiting Reactants



Methane, CH₄



+



~~plus 16~~
plus 16
hydrogen
molecules
excess

8 carbon
atoms

24 hydrogen
molecules

8 methane
molecules

C

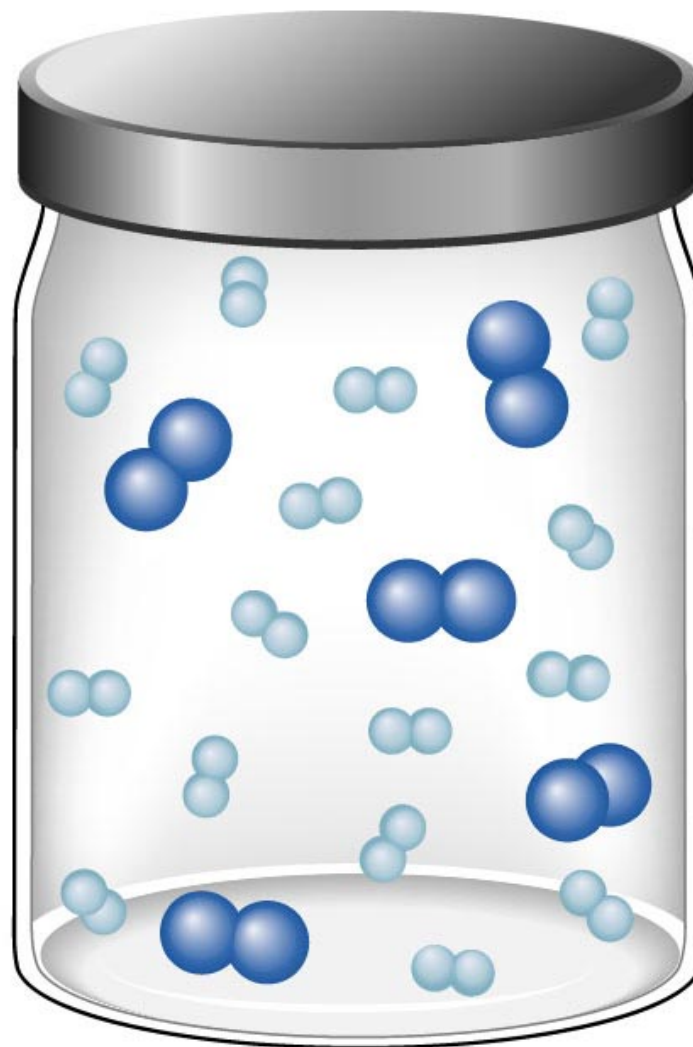
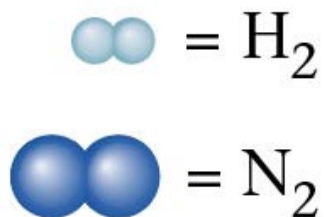
+

2 H₂

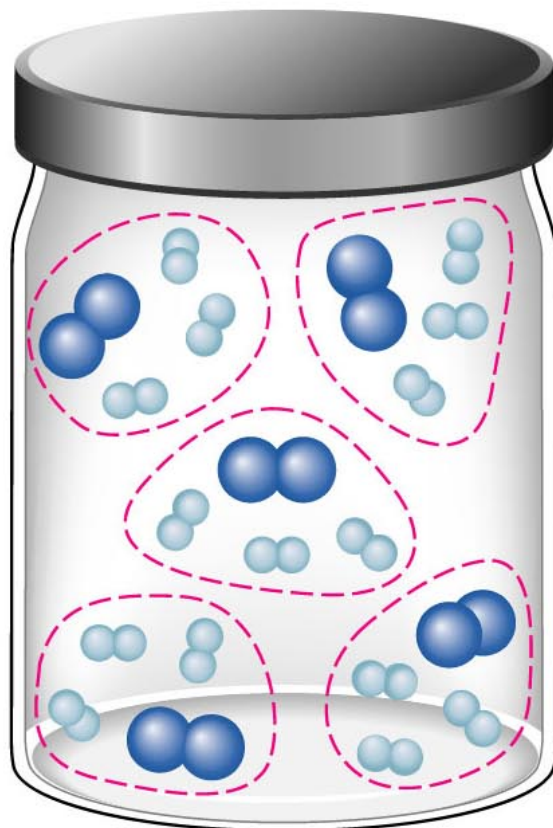
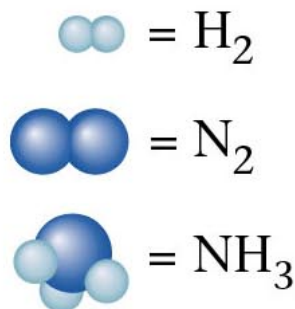
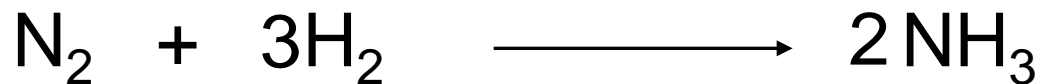


CH₄

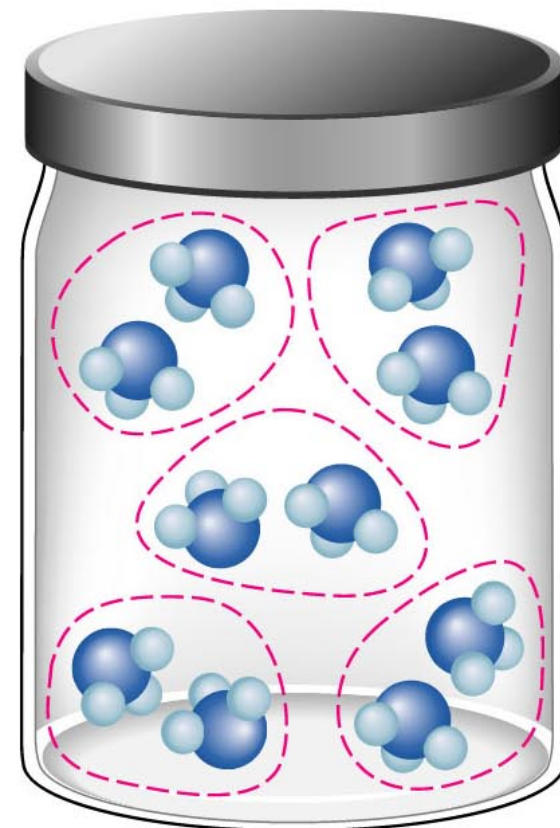
Container 1



Before and After Reaction 1



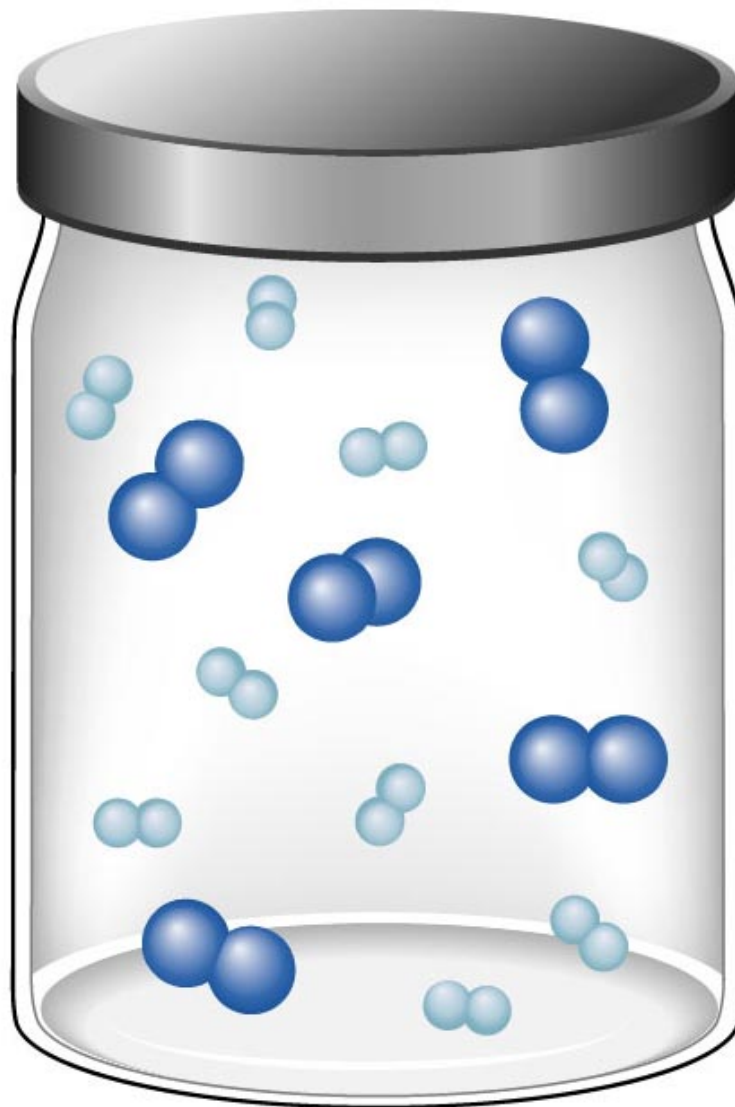
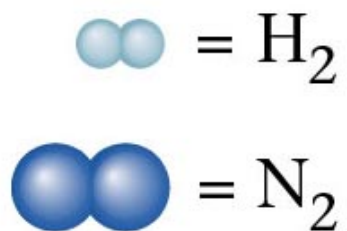
Before the reaction



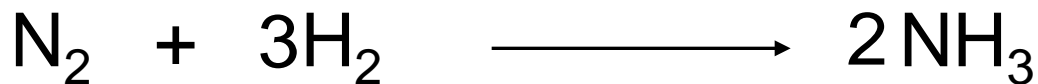
After the reaction

All the hydrogen and nitrogen atoms combine.

Container 2

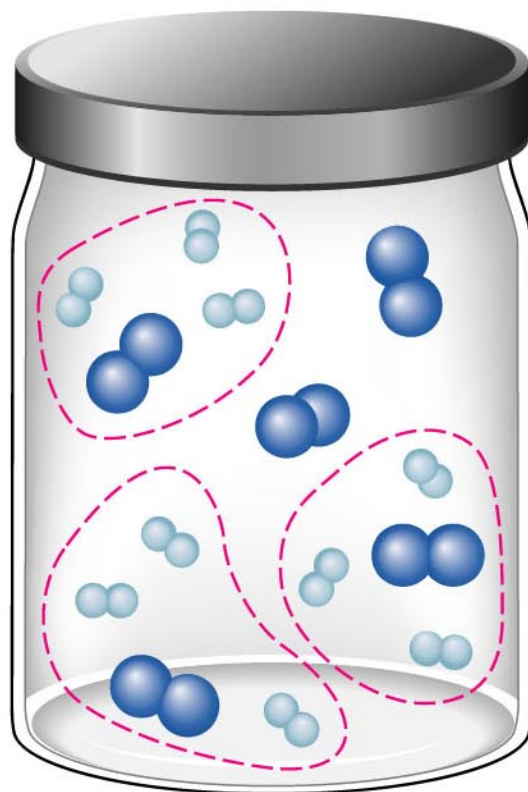
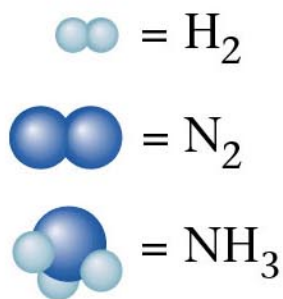


Before and After Reaction 2

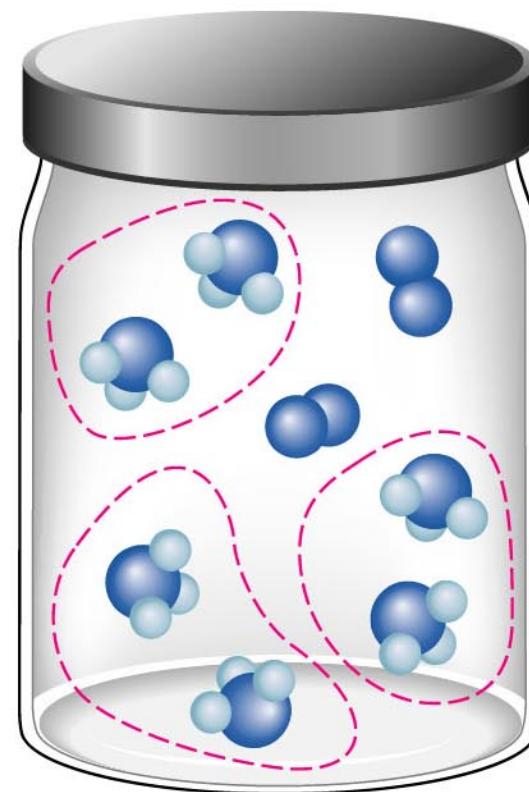


excess

limiting



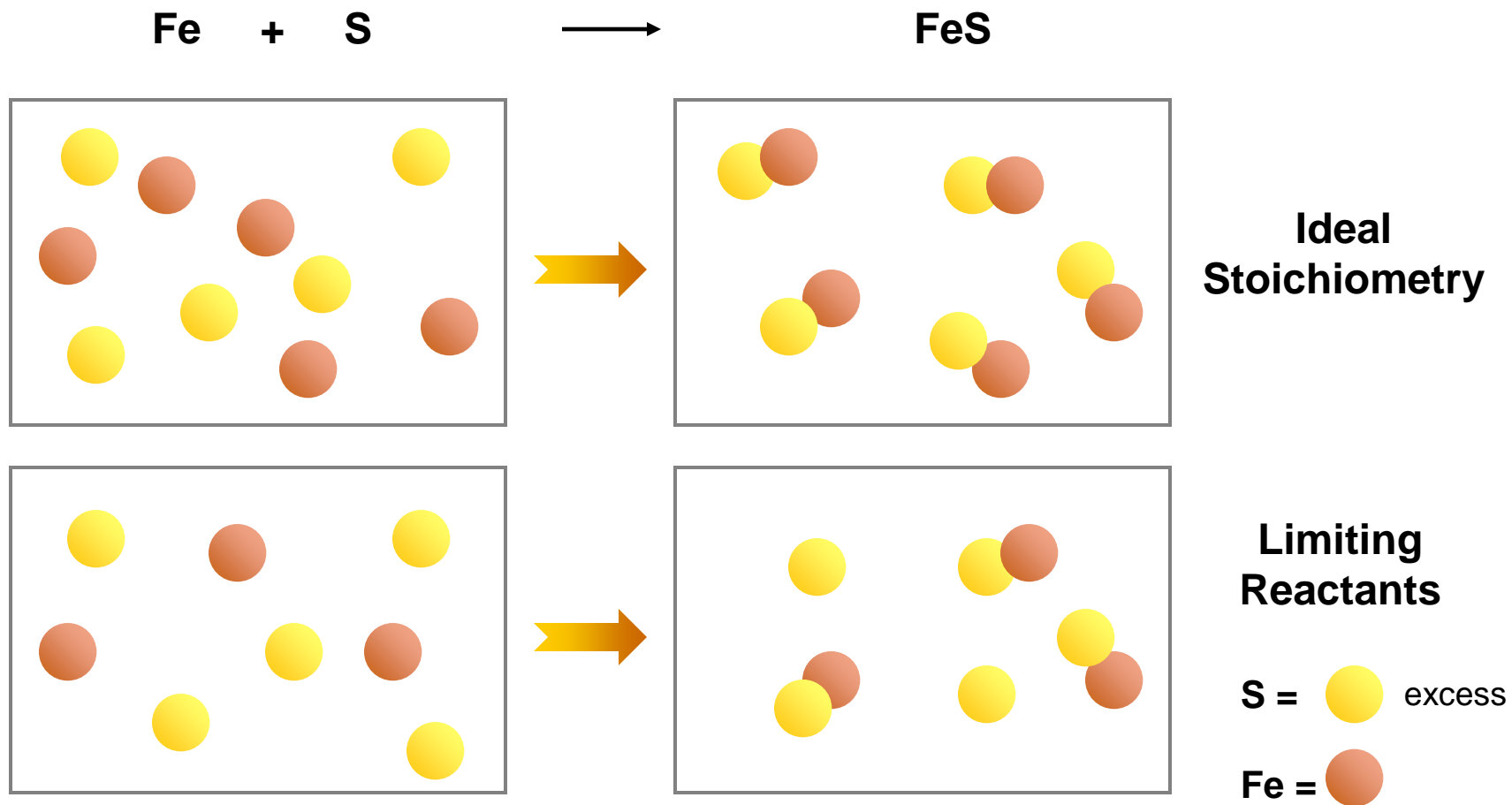
Before the reaction



After the reaction

LIMITING REACTANT DETERMINES AMOUNT OF PRODUCT

Real-World Stoichiometry: Limiting Reactants





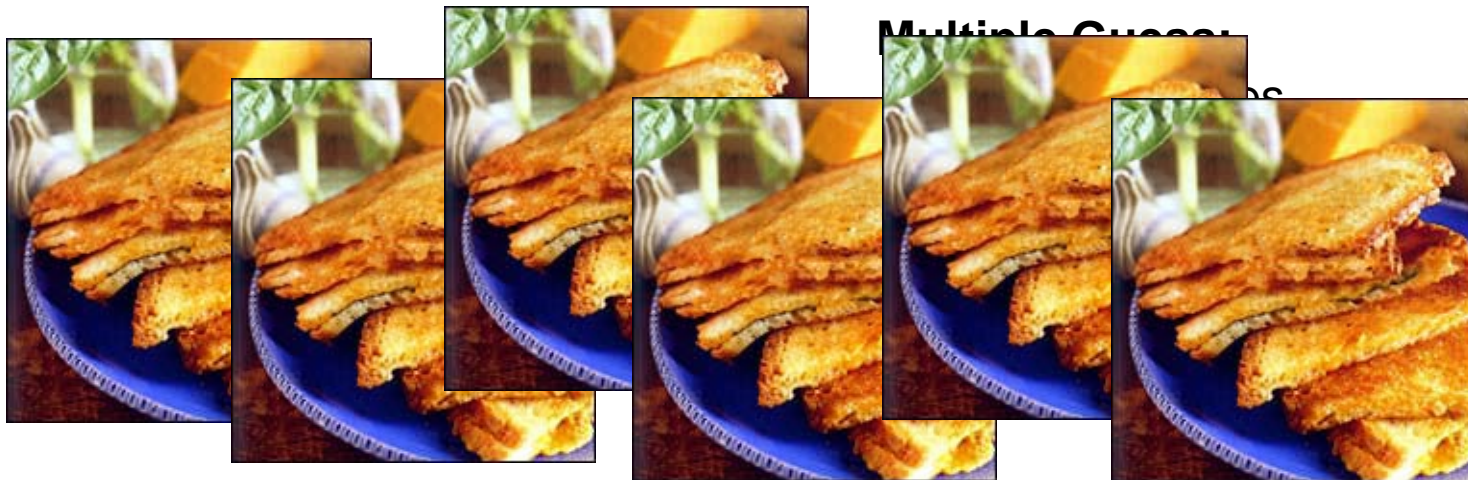
Grilled Cheese Sandwich



Bread + Cheese \rightarrow 'Cheese Melt'

2 B + C \rightarrow B₂C

100 bread 30 slices 30 sandwiches



Multiple Cues

given



Limiting Reactants

- **Available Ingredients**

- 4 slices of bread
- 1 jar of peanut butter
- 1/2 jar of jelly



- **Limiting Reactant**

- bread



- **Excess Reactants**

- peanut butter and jelly

Limiting Reactants

- **Limiting Reactant**
 - used up in a reaction
 - determines the amount of product
- **Excess Reactant**
 - added to ensure that the other reactant is completely used up
 - cheaper & easier to recycle

The Limiting Reactant



A balanced equation for making a Big Mac® might be:



With...	...and...	...one can make...
30 M	excess B and excess EE	15 $\text{B}_3\text{M}_2\text{EE}$
30 B	excess M and excess EE	10 $\text{B}_3\text{M}_2\text{EE}$
30 M	30 B and excess EE	10 $\text{B}_3\text{M}_2\text{EE}$



The Limiting Reactant

A balanced equation for making a tricycle might be:



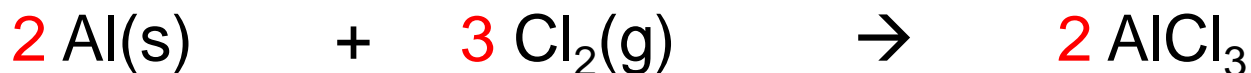
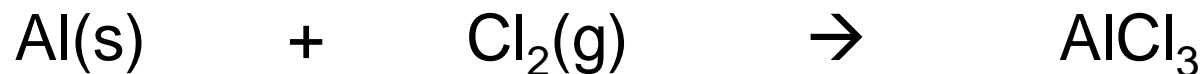
With...	...and...	...one can make...
50 P	excess of all other reactants	25 W_3P_2SHF
50 S	excess of all other reactants	50 W_3P_2SHF
50 P	50 S and excess of all other reactants	25 W_3P_2SHF



Limiting Reactants



aluminum + chlorine gas \rightarrow aluminum chloride



100 g

100 g

? g

A. 200 g

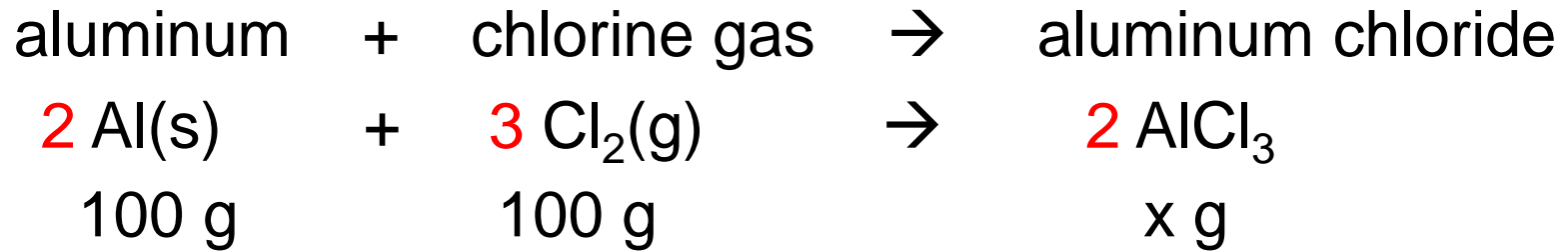
B. 125 g

C. 667 g

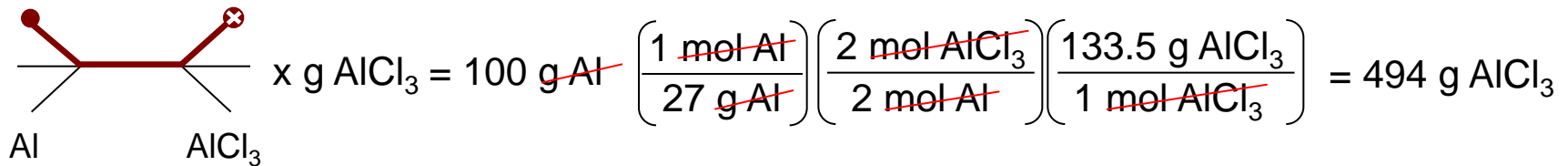
D. 494 g



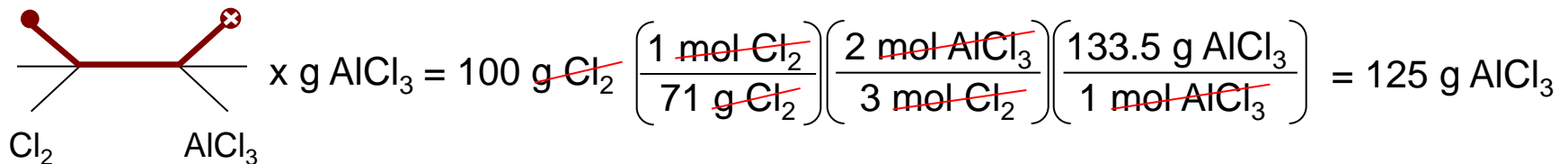
Limiting Reactants



How much product would be made if we begin with 100 g of aluminum?



How much product would be made if we begin with 100 g of chlorine gas?



Limiting Reactants – Method 1

1. Write a balanced equation.
2. For each reactant, calculate the amount of product formed.
3. Smaller answer indicates:
 - limiting reactant
 - amount of product

Limiting Reactants – Method 2

- Begin by writing a correctly *balanced chemical equation*
- Write down all quantitative values under equation (include units)
- Convert ALL reactants to units of *moles*
- Divide by the coefficient in front of each reactant
- The smallest value is the limiting reactant!