LESSON MAKER PRO

# Reaction Reality Check

*Find what runs out, then compare what forms.*

**HIGH SCHOOL · CHE.6.6**

**CHE.6.6** "Use mathematics and computational analysis to support the concept of percent yield and limiting reagent."

NAME _____ DATE _____

## TWO YIELD CHECKS

Use the balanced equation to find how much product each reactant could make. The reactant that makes less product is limiting, and percent yield = actual yield / theoretical yield × 100%.

## WORKED EXAMPLE

For $2H_2 + O_2 \rightarrow 2H_2O$, 3 mol of $H_2O$ forms. Find the limiting reactant and percent yield.

**STARTING AMOUNTS**

| $H_2$ | $O_2$ |
|---|---|
| 6 mol | 2 mol |

1. 6 mol $H_2$ could make 6 mol $H_2O$.
2. 2 mol $O_2$ could make 4 mol $H_2O$, so $O_2$ is limiting.
3. Percent yield = 3/4 × 100% = 75%.

**Answer: $O_2$ is limiting; percent yield is 75%.**

## PRACTICE 4 problems

**1** $N_2 + 3H_2 \rightarrow 2NH_3$. With 5 mol $N_2$ and 12 mol $H_2$, which reactant is limiting?

**ANSWER** _____

**2** $C + O_2 \rightarrow CO_2$. With 9 mol C and 7 mol $O_2$, what is the theoretical yield of $CO_2$?

**ANSWER** _____

**3** A reaction could make 25 g of product but makes 20 g. What is its percent yield?

**ANSWER** _____

**4** $2Mg + O_2 \rightarrow 2MgO$. With 9 mol Mg and 5 mol $O_2$, name the limiting reactant and theoretical yield of MgO.

**ANSWER** _____

## APPLY IT Show your work

**1** A hand warmer uses $4Fe + 3O_2 \rightarrow 2Fe_2O_3$. It starts with 20 mmol Fe and 18 mmol $O_2$; 8 mmol $Fe_2O_3$ forms. Find the limiting reactant and percent yield.

WORK SPACE

**ANSWER** _____

**2** A vinegar-and-baking-soda volcano makes $CO_2$. The reactants combine in a 1:1 mole ratio. With 15 mmol baking soda and 10 mmol vinegar acid, 9 mmol $CO_2$ forms. Find the limiting reactant and percent yield.

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

A repair shop recovers copper: $CuO + H_2 \rightarrow Cu + H_2O$. It uses 160 g CuO and 6 g $H_2$, then recovers 112 g Cu. Given CuO = 80 g/mol, $H_2$ = 2 g/mol, and Cu = 64 g/mol, find the limiting reactant and percent yield.

WORK SPACE AND ANSWER

# Reaction Reality Check



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | $N_2 + 3H_2 \rightarrow 2NH_3$. With 5 mol $N_2$ and 12 mol $H_2$, which reactant is limiting? | **$H_2$** |
| 2 | $C + O_2 \rightarrow CO_2$. With 9 mol C and 7 mol $O_2$, what is the theoretical yield of $CO_2$? | **7 mol $CO_2$** |
| 3 | A reaction could make 25 g of product but makes 20 g. What is its percent yield? | **80%** |
| 4 | $2Mg + O_2 \rightarrow 2MgO$. With 9 mol Mg and 5 mol $O_2$, name the limiting reactant and theoretical yield of MgO. | **Mg; 9 mol MgO** |

## PART 2 · APPLY IT

1. **Fe; 80%** Fe could make 10 mmol $Fe_2O_3$, while $O_2$ could make 12 mmol. Fe is limiting, and 8/10 × 100% = 80%.
2. **Vinegar acid; 90%** Vinegar acid limits the theoretical yield to 10 mmol $CO_2$. The percent yield is 9/10 × 100% = 90%.

## CHALLENGE

**CuO is limiting. It makes at most 2 mol, or 128 g, of Cu; 112/128 × 100% = 87.5%.**

Accept the reactant name or formula. For yield answers, accept equivalent fractions or decimals when the percent is clear.