LESSON MAKER PRO

Reaction Yield Lab

For Parts 1 to 3, use this mass ratio: 3 g Mg + 2 g O₂ -> 5 g MgO.

HIGH SCHOOL · CHE.6.7

CHE.6.7 "Plan and conduct a controlled scientific investigation to produce mathematical evidence to predict and confirm the limiting reagent and percent yield in the reaction. Analyze quantitative data, draw conclusions, and communicate findings..."

NAME _____ **DATE** _____

PREDICT, THEN CHECK

Use the reaction's mass ratio to find how much product each reactant could make. The reactant that makes less product is the limiting reagent, and that smaller amount is the theoretical yield. Percent yield = actual yield / theoretical yield × 100%.

WORKED EXAMPLE

Fe + S -> FeS. In this reaction, 7 g Fe combines with 4 g S to make 11 g FeS. You start with 14 g Fe and 12 g S and collect 11 g FeS. Find the limiting reagent, theoretical yield, and percent yield.

1. 14 g Fe could make 22 g FeS.
2. 12 g S could make 33 g FeS.
3. Fe makes less product, so Fe is limiting and the theoretical yield is 22 g FeS.
4. Percent yield = 11 g / 22 g × 100% = 50%.

Answer: Fe is limiting; theoretical yield = 22 g FeS; percent yield = 50%.

PRACTICE 6 problems

1 Start with 3 g Mg and 6 g O_2. Which reactant is limiting?

ANSWER _____

2 Start with 15 g Mg and 2 g O_2. Which reactant is limiting?

ANSWER _____

3 Start with 9 g Mg and 6 g O_2. What is the theoretical yield of MgO?

ANSWER _____

4 Start with 18 g Mg and 8 g O_2. What is the theoretical yield of MgO?

ANSWER _____

5 Start with 21 g Mg and 14 g O_2. You collect 28 g MgO. Find the theoretical yield and percent yield.

ANSWER _____

6 Start with 24 g Mg and 16 g O_2. You collect 30 g MgO. Find the limiting reagent and percent yield.

ANSWER _____

APPLY IT Show your work

1 A school ceramics club makes magnesium oxide for a heat-resistant phone stand. The club starts with 36 g Mg and 16 g O_2 and collects 32 g of dry MgO. Which reactant is limiting? Find the theoretical yield and percent yield.

WORK SPACE

ANSWER _____

2 A lab turns magnesium scrap from bicycle frames into magnesium oxide for a ceramic glaze. A trial starts with 27 g Mg and 24 g O_2 and collects 27 g MgO. Which reactant is limiting? Find the theoretical yield and percent yield.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Three lab groups each start with 45 g Mg and 30 g O_2. Use their collected masses to find the theoretical yield and each group's percent yield. Which result needs checking? Give one possible reason and name one condition the groups should keep the same for a fair comparison.

CLASS MGO RESULTS

Group	MgO collected (g)
A	60
B	72
C	81

WORK SPACE AND ANSWER

Reaction Yield Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Start with 3 g Mg and 6 g O_2. Which reactant is limiting?	**Mg**
2	Start with 15 g Mg and 2 g O_2. Which reactant is limiting?	**O_2**
3	Start with 9 g Mg and 6 g O_2. What is the theoretical yield of MgO?	**15 g MgO**
4	Start with 18 g Mg and 8 g O_2. What is the theoretical yield of MgO?	**20 g MgO**
5	Start with 21 g Mg and 14 g O_2. You collect 28 g MgO. Find the theoretical yield and percent yield.	**35 g MgO; 80%**
6	Start with 24 g Mg and 16 g O_2. You collect 30 g MgO. Find the limiting reagent and percent yield.	**Neither reactant is limiting; 75%.**

PART 2 · APPLY IT

1. **O_2 is limiting; 40 g MgO; 80%.** The 16 g O_2 could make 40 g MgO and needs only 24 g Mg, so O_2 is limiting. Percent yield = 32/40 × 100% = 80%.
2. **Mg is limiting; 45 g MgO; 60%.** The 27 g Mg needs 18 g O_2 and could make 45 g MgO, so Mg is limiting. Percent yield = 27/45 × 100% = 60%.

CHALLENGE

Theoretical yield: 75 g MgO. A: 80%; B: 96%; C: 108%. Check C because 81 g exceeds the theoretical yield for pure, dry MgO. Moisture in the collected solid could raise its measured mass. The groups should use the same drying method.

In Practice 6 and the challenge, the starting reactants are in the exact mass ratio, so both are used up. Accept equivalent explanations for Group C's suspect result and other appropriate controlled conditions.