SCIENCE FOUNDATIONS

Percent yield

Difficulty level: Advanced

Science Foundations

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Overview of the concept

This is how a factory checks whether a batch actually produced as much product as the recipe promised, and how much was lost along the way. A drug manufacturer compares what came out of the reactor with what the recipe said should come out, and investigates when the gap is too big. A baker scaling up a recipe notices the same thing when some batter stays stuck in the bowl. Knowing percent yield tells you how efficient a process really is, and whether the losses are worth chasing.



Rule

Percent yield: $\%\ \text{yield} = \dfrac{\text{actual yield}}{\text{theoretical yield}} \times 100.$

The theoretical yield is the most product the reaction could make, and the actual yield is what was really made. In a correct result the percent yield cannot be over 100.

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Worked examples

EXAMPLE 1

Q Actual 72.0 g, theoretical 90.0 g: percent yield?

SOLUTION

Write the rule:

percent yield = actual ÷ theoretical × 100

Substitute:

72.0 ÷ 90.0 = 0.80

Multiply by 100:

0.80 × 100 = 80.0%

The result is 80.0 percent.

EXAMPLE 2

Q Actual 40.0 g, theoretical 50.0 g: percent yield?

SOLUTION

Write the rule:

percent yield = actual ÷ theoretical × 100

Substitute:

40.0 ÷ 50.0 = 0.80

Multiply by 100:

0.80 × 100 = 80.0%

The result is 80.0 percent.

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Practice questions

1. A factory makes aspirin tablets.
One batch should produce 400 g of aspirin, but the workers collect only 340 g. What is the percent yield of the batch?

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2. A jam maker's recipe should give 250 g of jam, and her percent yield is usually 80.0 percent. How many grams of jam does she actually collect?

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3. A student collects 45.0 g of copper from a reaction, and her percent yield is 75.0 percent. What was the theoretical yield?

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4 **Which is the formula for percent yield?**

- **A** Actual divided by theoretical, times 100
- **B** Theoretical divided by actual, times 100
- **C** Actual plus theoretical, divided by 100
- **D** Actual times theoretical, divided by 100

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5 **A student gets a percent yield of 108 percent for a reaction. Can this be a correct result? Answer yes or no.**

- **A** Yes
- **B** No

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6 Two batches of the same medicine are made. Batch A should make 120 g and makes 96 g. Batch B should make 200 g and makes 170 g. Which batch has the higher percent yield?

- A Batch A
- B Batch B

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7 A lab should produce 500 g of salt, but the dried crystals weigh 0.40 kg. What is the percent yield?

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8

A chemist spills a little product while pouring it into a jar. How does the spill change the percent yield?

A. It lowers the percent yield

B. It raises the percent yield

C. It does not change the percent yield

D. It makes the percent yield 100 percent

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9

A soap maker runs the same recipe three times. The theoretical yield is 150 g each time, and she collects 120 g, 135 g, and 144 g. What is the percent yield of the best run?

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10

A reaction should make 200 g of product, but only 180 g is collected. How many grams of product were lost?

A 10 g

B 20 g

C 180 g

D 200 g

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ANSWER KEY

1. 85.0 percent

2. 200 g

3. 60.0 g

4. Actual divided by theoretical, times 100

5. No

6. Batch B

7. 80.0 percent

8. It lowers the percent yield

9. 96.0 percent

10. 20 g

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