

Percentage Yield

Answer all the questions below and then check your answers.

Use the equation box below to help answer the questions:

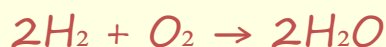
$$\text{percentage yield} = \frac{\text{mass of product actually made in grams}}{\text{maximum theoretical mass of product in grams}} \times 100\%$$

1. What is the theoretical yield?
2. What is actual yield?
3. Why is the actual yield always less than the theoretical yield?
4. Calculate the percentage yield of a reaction where the theoretical yield is 20 grams and the actual yield is 15 grams.
5. In a reaction, 5.0 grams of reactant A produces 12 grams of product B. If the theoretical yield of product B is 15 grams, calculate the percentage yield.
6. A reaction has a theoretical yield of 25 grams of product C. If the reaction only produces 18 grams, what is the percentage yield?

7. In the synthesis of water from hydrogen and oxygen, 2 grams of hydrogen react with excess oxygen to theoretically produce 18 grams of water. However, only 16 grams of water are collected. Calculate the percentage yield.
8. Which of the following factors does NOT cause the actual yield to be less than the theoretical yield?
- A. Incomplete reactions
 - B. Side reactions
 - C. Loss of product during handling
 - D. Using pure reactants
9. If a reaction has a theoretical yield of 30 grams and an actual yield of 24 grams, what is the percentage yield?
- A. 60%
 - B. 80%
 - C. 120%
 - D. 100%
10. Match the following terms with their correct definitions:

Term	Definition
Theoretical yield	The ratio of actual yield to theoretical yield, expressed as a percentage
Actual yield	The maximum possible amount of product that can be formed
Percentage yield	The amount of product obtained in a reaction

11. Fill in the gaps to complete the questions below:
- a. The _____ yield is the maximum amount of product that could be formed from given amounts of reactants.
- b. The formula to calculate the percentage yield is:
(_____ yield / theoretical yield) x 100.
12. Explain why actual yields are always less than theoretical yields, providing at least three reasons.
13. Given the reaction:



- a. Calculate the percentage yield if 4 grams of hydrogen produces 32 grams of water, and the theoretical yield is 36 grams. (5 marks)

Answers

1. What is the theoretical yield?

The theoretical yield is the maximum amount of product that could be formed from given amounts of reactants, assuming complete reaction and no losses.

2. What is actual yield?

The actual yield is the amount of product actually obtained from a reaction.

3. Why is the actual yield always less than the theoretical yield?

The actual yield is always less than the theoretical yield due to factors like incomplete reactions, side reactions, loss of product during handling, and impurities in reactants.

4. Calculate the percentage yield of a reaction where the theoretical yield is 20 grams and the actual yield is 15 grams.

Answer: Percentage yield = (Actual yield \div Theoretical yield) \times 100%

Percentage yield = (15 grams \div 20 grams) \times 100% = 75%

5. In a reaction, 5.0 grams of reactant A produces 12 grams of product B. If the theoretical yield of product B is 15 grams, calculate the percentage yield.

Answer: Percentage yield = (Actual yield \div Theoretical yield) \times 100%

Percentage yield = (12 grams \div 15 grams) \times 100 = 80%

6. A reaction has a theoretical yield of 25 grams of product C. If the reaction only produces 18 grams, what is the percentage yield?

Answer: Percentage yield = (18 grams \div 25 grams) \times 100 = 72%

7. In the synthesis of water from hydrogen and oxygen, 2 grams of hydrogen react with excess oxygen to theoretically produce 18 grams of water. However, only 16 grams of water are collected. Calculate the percentage yield.

Answer: Percentage yield = $(16 \text{ grams} \div 18 \text{ grams}) \times 100 \approx 88.89\%$

8. Which of the following factors does NOT cause the actual yield to be less than the theoretical yield?
- A. Incomplete reactions
 - B. Side reactions
 - C. Loss of product during handling
 - D. Using pure reactants

Answer: D. Using pure reactants

9. If a reaction has a theoretical yield of 30 grams and an actual yield of 24 grams, what is the percentage yield?
- A. 60%
 - B. 80%
 - C. 120%
 - D. 100%

Answer: B. 80%

10. Match the following terms with their correct definitions:

Term	Definition
Theoretical yield	The ratio of actual yield to theoretical yield, expressed as a percentage
Actual yield	The maximum possible amount of product that can be formed
Percentage yield	The amount of product obtained in a reaction

11. Fill in the gaps to complete the questions below:

a. The _____ yield is the maximum amount of product that could be formed from given amounts of reactants.

Answer: theoretical

b. The formula to calculate the percentage yield is:

(_____ yield / theoretical yield) x 100.

Answer: actual

12. Explain why actual yields are always less than theoretical yields, providing at least three reasons.

Answer:

Actual yields are always less than theoretical yields due to:

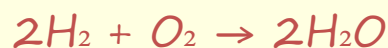
Incomplete reactions: Not all reactants react to form products.

Side reactions: Other reactions may occur, producing different products.

Loss of product: During handling, transferring, or purification processes, some product may be lost.

Impurities: Reactants may contain impurities that do not react to form the desired product.

13. Given the reaction:



a. Calculate the percentage yield if 4 grams of hydrogen produces 32 grams of water, and the theoretical yield is 36 grams. (5 marks)

Answer: Percentage yield = (Actual yield ÷ Theoretical yield) × 100%

Percentage yield = (32 grams ÷ 36 grams) × 100 ≈ 88.89%