# 12. How Many Grams Of Glucose (C6H1206) Is Produced If 17.3 Mol Of H20 Is Reacted According To Thisbalanced

**12. How Many Grams Of Glucose (C6H12O6) Is Produced If 17.3 Mol Of H2O Is Reacted According To This Balanced**

Understanding the relationship between reactants and products in chemical reactions is fundamental in stoichiometry, which allows chemists to determine the amounts of substances involved in reactions. In this article, we explore a specific reaction involving water and glucose, focusing on calculating the mass of glucose produced when a known amount of water reacts according to a balanced chemical equation. Specifically, we are asked to determine how many grams of glucose (C6H12O6) are produced if 17.3 mol of H2O are reacted. To do this accurately, we need to analyze the balanced chemical equation, understand molar ratios, and perform conversions from moles to grams.

## Understanding the Reaction and Its Balanced Equation

### Identifying the Chemical Reaction

Before performing any calculations, it is essential to identify the specific reaction involving glucose and water. A common context where water reacts to produce glucose involves photosynthesis, but in a typical laboratory or stoichiometry problem, the reaction might be simplified or hypothetical.

Suppose the reaction is:

C6H12O6 + 6 H2O → products

However, this is not a typical reaction for glucose and water. Instead, if the problem states that water is reacting to produce glucose, it might refer to a process like hydrolysis or a different reaction.

For the sake of this problem, let us assume the relevant reaction is the photosynthesis process, which is:

6 CO2 + 6 H2O → C6H12O6 + 6 O2

In this reaction, 6 moles of water produce 1 mole of glucose.

Alternatively, if the question is about a reaction where glucose is produced from water, perhaps through a different process, the key is to interpret the chemical equation correctly.

Assumption: Based on typical stoichiometric calculations, the most common reaction involving water and glucose is the photosynthesis reaction, which produces glucose from carbon dioxide and water.

## Balanced Chemical Equation

For the purposes of this calculation, we assume the following balanced equation:

6 $H_2O$ + 6 $CO_2$ → $C_6H_{12}O_6$ + 6 $O_2$

This indicates:

- 6 moles of water produce 1 mole of glucose.

Note: The problem states "if 17.3 mol of $H_2O$ are reacted," so we will use this ratio to determine the moles of glucose produced.

# Calculating Moles of Glucose Produced

## Understanding the Mole Ratio

From the balanced reaction:

- 6 mol $H_2O$ → 1 mol $C_6H_{12}O_6$

Thus, the molar ratio of water to glucose is:

- 6:1

This means for every 6 moles of water reacted, 1 mole of glucose is produced.

## Performing the Calculation

Given:

- Moles of water reacted = 17.3 mol

Using the ratio:

- Moles of glucose produced = (17.3 mol $H_2O$) × (1 mol $C_6H_{12}O_6$ / 6 mol $H_2O$)

Calculating:

$$
\text{Moles of glucose} = 17.3 \times \frac{1}{6} \approx 2.883 \text{ mol}
$$

So, approximately 2.883 moles of glucose are produced from 17.3 mol of water.

# Converting Moles of Glucose to Grams

## Molar Mass of Glucose

To convert moles to grams, we need the molar mass of glucose ($C_6H_{12}O_6$). Calculated as:

- Carbon (C): 12.01 g/mol × 6 = 72.06 g/mol
- Hydrogen (H): 1.008 g/mol × 12 = 12.096 g/mol
- Oxygen (O): 16.00 g/mol × 6 = 96.00 g/mol

Adding:

$$
72.06 + 12.096 + 96.00 = 180.156 \text{ g/mol}
$$

Rounding to a reasonable precision:

$$
\text{Molar mass of glucose} \approx 180.16 \text{ g/mol}
$$

## Calculating the Mass of Glucose

Using the molar mass:

$$
\text{Mass of glucose} = \text{moles} \times \text{molar mass}
$$

$$
\text{Mass} = 2.883 \text{ mol} \times 180.16 \text{ g/mol} \approx 519.07 \text{ g}
$$

Therefore, approximately 519.07 grams of glucose are produced when 17.3 mol of water reacts according to the balanced equation.

# Summary of Steps and Key Points

- Identify the balanced chemical equation relevant to the reaction.
- Determine the molar ratio between the reactant (water) and the product (glucose).

- Use the molar ratio to calculate the number of moles of glucose produced from given moles of water.
- Calculate the molar mass of glucose.
- Convert moles of glucose to grams using the molar mass.

# Additional Considerations

## Assumptions Made

- The reaction follows the simplified photosynthesis equation.
- The molar ratios are based on the balanced equation.
- The reaction is complete and proceeds with 100% efficiency.

## Potential Variations

- If the actual reaction differs, the molar ratio may change, affecting the final calculation.
- If other reactants or products are involved, the calculation would need to be adjusted accordingly.
- Real-world reactions often have yields less than 100%, so actual amounts might be lower.

# Conclusion

By understanding the stoichiometric relationships in the balanced chemical equation, we can accurately determine the amount of glucose produced from a given amount of water. In this scenario, reacting 17.3 mol of water according to the assumed photosynthesis reaction produces approximately 519 grams of glucose. This process exemplifies the importance of molar ratios, molar masses, and careful interpretation of chemical equations in quantitative chemistry.

# Frequently Asked Questions

## How many grams of glucose ($C_6H_{12}O_6$) are produced when 17.3 mol of $H_2O$ react according to the balanced equation?

Approximately 312.6 grams of glucose are produced.

## What is the molar ratio between water and glucose in the balanced chemical equation?

The molar ratio of $H_2O$ to $C_6H_{12}O_6$ is 6:1.

## How do you calculate the grams of glucose from the moles of water reacted?

First, determine the moles of glucose using the molar ratio, then multiply by the molar mass of glucose (180.16 g/mol).

## What is the molar mass of glucose ($C_6H_{12}O_6$)?

The molar mass of glucose is approximately 180.16 grams per mole.

## If 17.3 mol of $H_2O$ reacts, how many mol of glucose are produced?

Given the 6:1 ratio, 17.3 mol of $H_2O$ produces approximately 2.88 mol of glucose.

## What assumptions are made in calculating the grams of glucose from water reacted?

Assumes complete reaction according to the balanced equation and no side reactions occur.

## Why is understanding the molar ratio important in this calculation?

Because it allows conversion between the moles of water reacted and the moles of glucose produced.

## Can this calculation be applied to other amounts of water? How?

Yes, by using the same molar ratio and proportional calculations based on the amount of water reacted.

## What is the significance of balancing the chemical equation in this context?

It ensures the molar ratios used in calculations are accurate, leading to correct yield predictions.

## If the amount of water reacted changes, how does that affect the grams of glucose produced?

The grams of glucose produced will change proportionally, based on the molar ratio and molar mass

calculations.

# Additional Resources

12. How Many Grams Of Glucose ($C_6H_{12}O_6$) Is Produced If 17.3 Mol Of $H_2O$ Is Reacted According To This Balanced Equation?

In the realm of biochemistry and chemical engineering, understanding the quantitative relationships in chemical reactions is fundamental. Among these reactions, the synthesis of glucose ($C_6H_{12}O_6$) — a vital sugar in biological systems and a key component in various industrial processes — often involves complex stoichiometric calculations. Today, we delve into a specific scenario: determining how many grams of glucose are produced when 17.3 mol of water ($H_2O$) react according to a balanced chemical equation. This inquiry not only exemplifies the importance of molar relationships but also highlights the practical application of stoichiometry in real-world contexts.

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Understanding the Context: The Relevance of Glucose Synthesis

Glucose synthesis, particularly in biological systems, occurs via photosynthesis — a process where plants convert carbon dioxide and water into glucose and oxygen. The simplified overall chemical reaction for photosynthesis is:

$6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$

This reaction indicates that six molecules of water react with six molecules of carbon dioxide to produce one molecule of glucose and six molecules of oxygen.

In industrial and laboratory settings, similar stoichiometric principles are applied when synthesizing glucose or analyzing related reactions. The question at hand involves a specific amount of water reacting according to a balanced equation, and we are tasked with calculating the resultant grams of glucose formed.

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The Core Question: How Do We Approach This Calculation?

The primary goal is to determine the mass of glucose produced when 17.3 mol of water reacts. To accomplish this, we need to:

1. Identify the stoichiometric relationship between water and glucose in the balanced equation.
2. Use molar ratios to find the moles of glucose produced from the given moles of water.
3. Convert the moles of glucose into grams using its molar mass.

The key steps involve understanding the molar ratios from the balanced chemical equation and applying basic molar mass calculations.

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Step 1: Analyzing the Balanced Chemical Equation

The most relevant chemical equation for glucose synthesis, as depicted in photosynthesis, is:

$6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$

From this, we observe:

- 6 moles of water ($H_2O$) react to produce 1 mole of glucose ($C_6H_{12}O_6$).

This relationship is fundamental to our calculations.

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Step 2: Establishing the Molar Ratio

Based on the balanced equation, the molar ratio between water and glucose is:

- 6 mol $H_2O$ : 1 mol $C_6H_{12}O_6$

This ratio implies that for every 6 moles of water reacted, 1 mole of glucose is produced.

Given:

- Moles of $H_2O$ reacted = 17.3 mol

The number of moles of glucose produced can be calculated by:

Number of moles of glucose = (17.3 mol $H_2O$) × (1 mol $C_6H_{12}O_6$ / 6 mol $H_2O$)

Calculating this:

Number of moles of glucose = 17.3 / 6 ≈ 2.883 mol

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Step 3: Calculating the Mass of Glucose

Now that we have the moles of glucose, the next step is converting this to grams.

Molar mass of glucose ($C_6H_{12}O_6$):

- Carbon (C): 12.01 g/mol
- Hydrogen (H): 1.008 g/mol
- Oxygen (O): 16.00 g/mol

Calculating:

- Carbon: 6 × 12.01 = 72.06 g
- Hydrogen: 12 × 1.008 = 12.096 g
- Oxygen: 6 × 16.00 = 96.00 g

Total molar mass:

72.06 + 12.096 + 96.00 ≈ 180.156 g/mol

Mass of glucose produced:

Mass = moles × molar mass

Mass = 2.883 mol × 180.156 g/mol ≈ 519.3 grams

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Practical Insights and Significance

This calculation illustrates the tangible outcomes of stoichiometric relationships in chemical reactions. From a relatively modest input of water, approximately 519 grams of glucose can be theoretically produced under ideal conditions. This kind of calculation is essential in fields such as:

- Biotechnology: Optimizing glucose production in fermentation processes.
- Agricultural sciences: Understanding photosynthetic efficiency.
- Pharmaceutical manufacturing: Precise reagent calculations.
- Environmental sciences: Modeling carbon fixation and its impact on ecosystems.

Furthermore, it underscores the importance of molecular understanding: knowing the molar ratios allows scientists and engineers to predict yields, optimize processes, and reduce waste.

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Limitations and Real-World Considerations

While the theoretical calculation provides a clear answer, real-world applications often involve inefficiencies, side reactions, or incomplete conversions. Factors such as enzyme activity in biological systems, reaction conditions in industrial setups, and purity of reactants can influence actual yields.

Moreover, the initial reaction involving water and glucose synthesis is simplified here. In practice, photosynthesis involves multiple steps, intermediates, and environmental factors, making direct laboratory synthesis of glucose from water and carbon dioxide challenging without biological or engineered systems.

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Conclusion: Applying Chemistry for Quantitative Precision

To conclude, based on the balanced equation for photosynthesis, reacting 17.3 mol of water results in the production of approximately 519 grams of glucose. This calculation demonstrates the power of stoichiometry in bridging the gap between molecular-level reactions and macroscopic quantities. Whether in research laboratories or industrial plants, such precise calculations enable scientists to design efficient processes, understand biological phenomena, and develop sustainable technologies.

Understanding these relationships empowers us to harness chemistry’s principles for advancing science, improving agricultural yields, and innovating in the realm of renewable energy sources. As we continue to explore and refine these calculations, the importance of foundational chemical knowledge remains ever clear: it is the key to unlocking the potential of chemical reactions for

societal benefit.

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