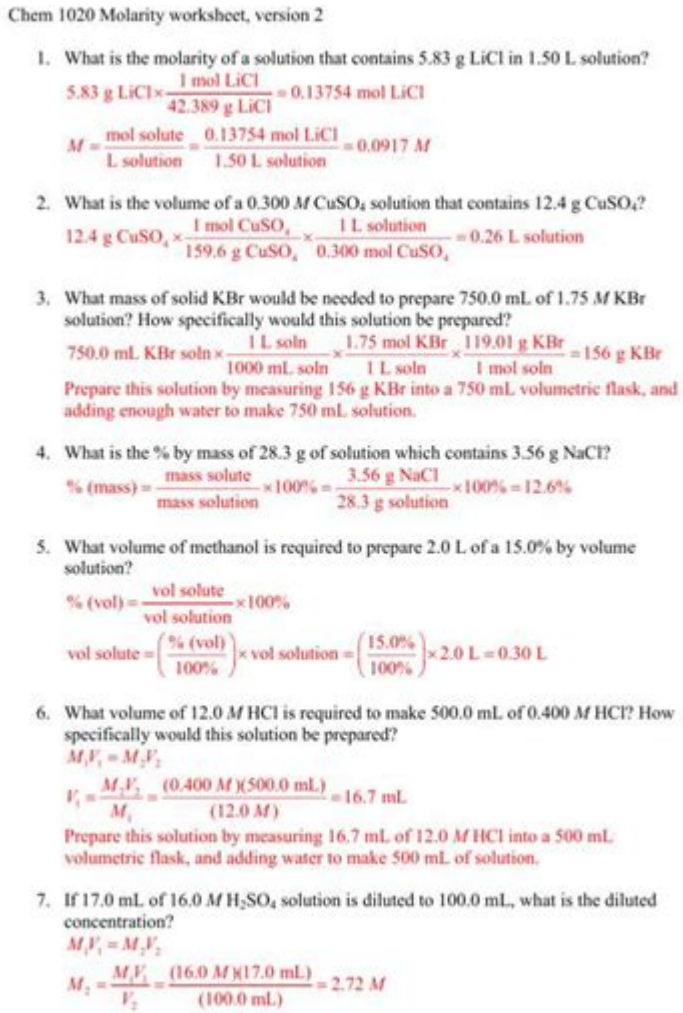
Smores Stoichiometry Lab Answer Key



Chem 1020 Molarity worksheet, version 2

1. What is the molarity of a solution that contains 5.83 g LiCl in 1.50 L solution?

$$5.83\text{ g LiCl}\times\frac{1\text{ mol LiCl}}{42.389\text{ g LiCl}}=0.13754\text{ mol LiCl}$$

$$M=\frac{\text{mol solute}}{\text{L solution}}=\frac{0.13754\text{ mol LiCl}}{1.50\text{ L solution}}=0.0917\ M$$

2. What is the volume of a 0.300 M $CuSO_4$ solution that contains 12.4 g $CuSO_4$?

$$12.4\text{ g CuSO}_4\times\frac{1\text{ mol CuSO}_4}{159.6\text{ g CuSO}_4}\times\frac{1\text{ L solution}}{0.300\text{ mol CuSO}_4}=0.26\text{ L solution}$$

3. What mass of solid KBr would be needed to prepare 750.0 mL of 1.75 M KBr solution? How specifically would this solution be prepared?

$$750.0\text{ mL KBr soln}\times\frac{1\text{ L soln}}{1000\text{ mL soln}}\times\frac{1.75\text{ mol KBr}}{1\text{ L soln}}\times\frac{119.01\text{ g KBr}}{1\text{ mol soln}}=156\text{ g KBr}$$

Prepare this solution by measuring 156 g KBr into a 750 mL volumetric flask, and adding enough water to make 750 mL solution.

4. What is the % by mass of 28.3 g of solution which contains 3.56 g NaCl?

$$\%\text{ (mass)}=\frac{\text{mass solute}}{\text{mass solution}}\times100\%=\frac{3.56\text{ g NaCl}}{28.3\text{ g solution}}\times100\%=12.6\%$$

5. What volume of methanol is required to prepare 2.0 L of a 15.0% by volume solution?

$$\%\text{ (vol)}=\frac{\text{vol solute}}{\text{vol solution}}\times100\%$$

$$\text{vol solute}=\left(\frac{\%\text{ (vol)}}{100\%}\right)\times\text{vol solution}=\left(\frac{15.0\%}{100\%}\right)\times2.0\text{ L}=0.30\text{ L}$$

6. What volume of 12.0 M HCl is required to make 500.0 mL of 0.400 M HCl? How specifically would this solution be prepared?

$$M_1V_1=M_2V_2$$

$$V_1=\frac{M_2V_2}{M_1}=\frac{(0.400\ M)(500.0\text{ mL})}{(12.0\ M)}=16.7\text{ mL}$$

Prepare this solution by measuring 16.7 mL of 12.0 M HCl into a 500 mL volumetric flask, and adding water to make 500 mL of solution.

7. If 17.0 mL of 16.0 M H_2SO_4 solution is diluted to 100.0 mL, what is the diluted concentration?

$$M_1V_1=M_2V_2$$

$$M_2=\frac{M_1V_1}{V_2}=\frac{(16.0\ M)(17.0\text{ mL})}{(100.0\text{ mL})}=2.72\ M$$

Smores stoichiometry lab answer key is an essential resource for students and educators who are exploring the fascinating world of chemical reactions through hands-on experiments. S'mores, a popular campfire treat made from graham crackers, chocolate, and marshmallows, serve as a delicious metaphor for understanding stoichiometry, which is the branch of chemistry that deals with the quantitative relationships between the reactants and products in a chemical reaction. In this article, we will delve into the concept of stoichiometry, outline a typical s'mores stoichiometry lab, and provide a comprehensive answer key that can guide students in their understanding of the calculations involved.

Understanding Stoichiometry

Stoichiometry is derived from the Greek words "stoicheion" (meaning element) and

"metron" (meaning measure). It involves the calculation of reactants and products in chemical reactions based on the conservation of mass. The fundamental principles of stoichiometry include:

1. Mole Concept: The mole is a unit used to measure the amount of substance. One mole contains approximately 6.022×10^{23} entities (atoms, molecules, etc.).

2. Balanced Chemical Equations: A balanced equation represents a chemical reaction where the number of atoms of each element is equal on both sides of the equation.

3. Molar Ratios: These are derived from the coefficients of a balanced equation and are used to convert from moles of one substance to moles of another.

4. Conversions: Stoichiometric calculations often involve converting grams to moles and vice versa, which requires knowledge of the molar mass of the substances involved.

The S'mores Stoichiometry Lab

The s'mores stoichiometry lab is designed to engage students in understanding the principles of stoichiometry through a relatable and enjoyable activity. Here's how the lab typically unfolds:

Materials Needed

- Graham crackers
- Marshmallows
- Chocolate bars
- A heat source (e.g., campfire or microwave)
- Measuring scales
- Stopwatch or timer
- Thermometer

Procedure

1. Preparation: Each group gathers the materials needed for making s'mores. The students will weigh the individual components: graham crackers, chocolate, and marshmallows.

2. Reaction Setup: Students will assemble a s'more by placing a marshmallow between two graham crackers with a piece of chocolate on top. They will then heat the s'more until the marshmallow is melted.

3. Observation: Students should take note of the changes that occur during the heating process, including the melting of the marshmallow and chocolate, and any changes in the appearance of the graham crackers.

4. Data Collection: After heating, students will weigh the s'mores again to observe any changes in mass and record their observations.

5. Calculations: Using the data collected, students will perform stoichiometric calculations to determine the ratios of the ingredients used in their s'mores, focusing on how much of each ingredient is required to create the perfect s'more.

Stoichiometry Calculations

To effectively analyze the results of the s'mores lab, students will need to perform several calculations. The following steps outline how to approach stoichiometric calculations based on the ingredients used.

Step 1: Determine the Molar Mass of Each Component

- Graham Cracker: Approximately 2.5 g per cracker (molar mass depends on composition).

- Marshmallow: Approximately 7 g per marshmallow.

- Chocolate: Approximately 10 g per piece.

Step 2: Calculate Moles of Each Component

Using the formula:

$$
\text{Moles} = \frac{\text{mass (g)}}{\text{molar mass (g/mol)}}
$$

For example:

- If a student uses 2 graham crackers (5 g total), 1 marshmallow (7 g), and 1 piece of chocolate (10 g), the calculations would be:

- Graham Crackers:
$$
\text{Moles of Graham Crackers} = \frac{5 \, \text{g}}{2.5 \, \text{g/mol}} = 2 \, \text{moles}
$$

- Marshmallow:
$$
\text{Moles of Marshmallow} = \frac{7 \, \text{g}}{7 \, \text{g/mol}} = 1 \, \text{mole}
$$

- Chocolate:
$$
\text{Moles of Chocolate} = \frac{10 \, \text{g}}{10 \, \text{g/mol}} = 1 \, \text{mole}
$$

Step 3: Establish the Stoichiometric Ratios

Students need to determine the stoichiometric ratios from their moles calculated. For example, if the balanced equation for creating a s'more could be represented as:

$$
2 \text{ (Graham Cracker)} + 1 \text{ (Marshmallow)} + 1 \text{ (Chocolate)} \rightarrow \text{S'more}
$$

The ratio here would be 2:1:1 for graham crackers, marshmallows, and chocolate respectively.

Step 4: Analyze the Results

Students should analyze their data to see if the ratios they obtained match the expected ratios from the balanced equation. They will also reflect on the implications of their observations, such as:

- Did they have leftover ingredients?
- Was any ingredient used in excess?
- What adjustments could be made for the next trial to optimize the s'more making process?

Answer Key for Common Calculations

Here are some sample answers that students may derive from their experiments:

1. If you used 10 g of graham crackers, 7 g of marshmallows, and 10 g of chocolate, calculate the moles of each:

- Graham Crackers:
$$
\text{Moles} = \frac{10 \, \text{g}}{2.5 \, \text{g/mol}} = 4 \, \text{moles}
$$

- Marshmallows:
$$
\text{Moles} = \frac{7 \, \text{g}}{7 \, \text{g/mol}} = 1 \, \text{mole}
$$

- Chocolate:
$$
\text{Moles} = \frac{10 \, \text{g}}{10 \, \text{g/mol}} = 1 \, \text{mole}
$$

2. What is the limiting reactant in this scenario?

- Since the balanced equation requires 2 moles of graham crackers for every 1 mole of marshmallow and chocolate, the limiting reactant here would be the marshmallow as you have enough graham crackers (4 moles) to pair with the 1 mole of marshmallow and chocolate.

3. If you wanted to make 3 s'mores, how many graham crackers, marshmallows, and chocolates would you need?

- For 3 s'mores:
- Graham Crackers: $3 \times 2 = 6$
- Marshmallows: $3 \times 1 = 3$
- Chocolates: $3 \times 1 = 3$

Conclusion

The s'mores stoichiometry lab offers a unique and engaging way for students to learn about stoichiometry in a practical setting. By measuring and calculating the relationships between the ingredients, students can gain hands-on experience that reinforces their understanding of chemical reactions and the principles of stoichiometry. The answer key provided serves as a valuable tool for educators to guide students through their calculations and help them grasp the concept more thoroughly. Whether in a classroom setting or a fun science experiment at home, the principles of stoichiometry can be delicious and enlightening!

Frequently Asked Questions

What is the main purpose of the s'mores stoichiometry lab?

The main purpose is to understand the principles of stoichiometry through a fun and engaging activity that involves the ingredients of s'mores.

What are the key ingredients used in the s'mores stoichiometry lab?

The key ingredients typically include graham crackers, marshmallows, and chocolate, which represent reactants in a chemical reaction.

How can the concept of limiting reactants be applied in the s'mores lab?

The concept of limiting reactants can be demonstrated by determining which ingredient runs out first when making s'mores, limiting the total number that can be produced.

What calculations are typically required in the s'mores stoichiometry lab?

Calculations usually involve determining the mole ratios of ingredients, calculating the mass of each ingredient needed, and identifying the number of complete s'mores that can be made.

What is the significance of using real food items in a stoichiometry lab?

Using real food items makes the lab more relatable and engaging for students, helping them better visualize and understand stoichiometric concepts.

How can students demonstrate their understanding of stoichiometry in this lab?

Students can demonstrate their understanding by accurately calculating the amounts of each ingredient needed to create a specific number of s'mores based on stoichiometric ratios.

What safety considerations should be taken into account during the s'mores stoichiometry lab?

Safety considerations include handling hot items if toasting marshmallows, avoiding cross-contamination with allergens, and ensuring proper cleanup of materials.

How can the s'mores stoichiometry lab be modified for virtual or online learning?

The lab can be modified by using virtual simulations, videos of the process, or assigning students to create their own recipes and calculate the stoichiometry involved.

Smores Stoichiometry Lab Answer Key

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