How Science Works

Grade 7

Class Question:

Module 2: Conservation of Mass

Scientist (Your Name): _____

Teacher's Name: _____

SciTrek Volunteer's Name: _____

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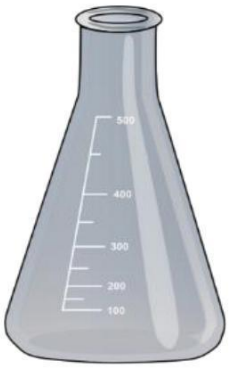
LAB TOOLS

Weighing Balance



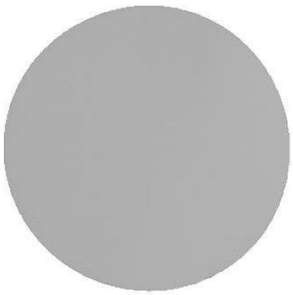
Erlenmeyer Flask

Beaker

Graduated Cylinder

Plastic Funnel

Weighing Boat



Filter Paper

Petri Dish

Tongs

Day 1 Marshmallow Madness and Steel Wool

Marshmallow Madness Procedure

1	Write down your hypothesis and your justification. What will happen to the mass of the marshmallow after burning and why?
2	Record the mass of the glass Petri dish.
3	Record the mass of the Petri dish + a marshmallow (before burning).
4	Subtract the mass of the Petri dish from the mass of the Petri dish + the marshmallow to obtain the initial mass of the marshmallow.
5	Set the Petri dish with the marshmallow on the desk away from any pieces of paper.
6	Using the metal tongs, hold the marshmallow over a lit candle to ignite it.
7	Quickly put the marshmallow back in the Petri dish. Record your observations.
8	After the marshmallow is finished burning, allow the Petri dish to cool for two minutes.
9	Record the mass of the Petri dish + the burned marshmallow.
10	Subtract the mass of the Petri dish to obtain the final mass of the marshmallow.

Prediction

I think that burning the marshmallows will cause an_____(*increase/decrease/no change)* in mass.

Justification

When the marshmallows are burned, the reaction occurs in an _____(*open/closed)* system, causing it to *(lose/gain/have the same)* mass because...

Data Table

Mass of glass Petri dish	
Mass of Petri dish + marshmallow (**before burning**)	
Initial mass of marshmallow	
Mass of Petri dish + marshmallow (**after burning**)	
Final mass of marshmallow	
Change in mass of marshmallow	

Observations *(Using your five senses to get info)*

I noticed that the heat causes the marshmallow to change color, indicating a _____

1 Did a chemical reaction take place? What is your evidence?

2 Was your prediction correct? Explain using evidence from the data collected.

3 Draw a model (visual representation) of the burning marshmallow to explain what is happening to the atoms during the reaction. Label all relevant parts visible and not visible.

Combustion of Steel Wool Procedure

1	Write down your hypothesis and your justification. What will happen to the mass of the steel wool after burning and why?
2	Record the mass of the glass Petri dish
3	Fluff the piece of steel wool so that it just fits in the Petri dish
4	Add the steel wool to the Petri dish and record the mass of the Petri dish + the steel wool
5	Subtract the mass of the Petri dish from the mass of the Petri dish + the steel wool to obtain the initial mass of the steel wool
6	Set the Petri dish with the steel wool on the desk away from any pieces of paper
7	Light the steel wool on fire
8	Record your observations
9	After the steel wool has been extinguished, allow the Petri dish to cool for two minutes
10	Record the mass of the Petri dish + the burned steel wool, then subtract the mass of the Petri dish to obtain the final mass of the steel wool

Prediction

I predict that the combustion of steel wool will cause the iron to___(*lose/gain/ have the same)* mass.

Justification

I believe my prediction is correct because….

Data Table

Mass of glass Petri dish	
Mass of Petri dish + steel wool (before burning)	
Initial mass of steel wool	
Mass of Petri dish + steel wool (after burning)	
Final mass of steel wool	

Observations *(Using your five senses to get info)*

1	Did a chemical reaction take place? What is your evidence?
2	Was your prediction correct? Explain using evidence from the data collected.
3	Draw a model (visual representation) of the burning steel wool to explain what is happening to the atoms during the reaction. Label all relevant parts visible and not visible.

Day 2 Mixing Copper Sulfate and Sodium Bicarbonate

"Rien ne se perd, rien ne se crée, tout se transforme."

"Nothing is lost, nothing is created, everything is transformed."

– Antoine Lavoisier 1789

Procedure:

1. Place a clean, dry 50 mL graduated cylinder on the balance and press "zero." This cancels out the mass of the graduated cylinder so that we can measure only the liquid that we put into it.

2. Carefully add about 20 mL of the copper sulfate ($CuSO_4$) solution to the graduated cylinder and record the mass in your data table.

3. Pour the copper sulfate solution into a 125 mL Erlenmeyer flask. Get as much of the solution out of the graduated cylinder as you can

Materials:
1 laboratory balance
1 50 mL graduated cylinder
2 125 mL Erlenmeyer flasks
1 piece of filter paper
1 plastic funnel
1 plastic weighing tray
copper sulfate solution
sodium carbonate solution

4. Clean out the graduated cylinder in the sink and dry it using a paper towel. Make sure there is no water left inside.

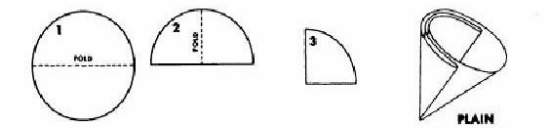
5. Put the graduated cylinder back on the balance and zero it again. Then add about 20 mL of the sodium carbonate (Na_2CO_3) solution to the cylinder and record its mass.

6. Add the sodium carbonate solution to the same Erlenmeyer flask. Record your observations in the space provided.

7. Swirl the contents of the flask to ensure that they are thoroughly mixed together.

8. Record the mass of the other 125 mL Erlenmeyer flask.

9. Record the mass of a piece of filter paper.



10. Fold the filter paper as shown in the diagram above (ask a SciTrek volunteer for help!) and place it into the plastic funnel. Place the plastic funnel and filter paper in the second Erlenmeyer flask.

11. Carefully pour the contents of the first Erlenmeyer flask through the filter paper. Make sure that all of the solid ends up in the funnel.

12. While the solution is draining, place the plastic weighing tray on the scale and press "zero."

13. Allow the solids to drain until there is no more liquid in the funnel, then remove the filter paper and place it in the plastic weighing boat. Record the mass of the filter paper + solids in the data table.

14. Record the mass of the Erlenmeyer flask + the drained liquid.

Table 1. Data Table for recorded masses.

Observations

Item to be measured	Mass in grams (g)
(A) Mass of 20 mL $CuSO_4$ +solution	
(B) Mass of 20 mL Na_2CO_3 solution	
(C) Mass of empty 125 mL Erlenmeyer flask	
(D) Mass of dry filter paper	
(E) Mass of Erlenmeyer flask + liquids	
(F) Mass of filter paper + solids	

Mass of $CuSO_4$ Solution **(A)**		Mass of Na_2CO_3 Solution **(B)**		Total Initial Mass
	+		=	
Mass of Erlenmeyer flask + liquids **(E)**		Mass of empty Erlenmeyer flask **(C)**		Mass of Liquids Collected
	-		=	
Mass of filter paper + solids **(F)**		Mass of filter paper **(D)**		Mass of Solids Collected
	-		=	
Mass of Liquids Collected		Mass of Solids Collected		Total Final Mass
	+		=	
TOTAL FINAL MASS		TOTAL INITIAL MASS		CHANGE IN MASS
	-		=	

Discussion *Talk with your classmates and write a detailed explanation for your reasoning.*

1	Why was it important to get all of the liquid out of the graduated cylinder in Step 3?
2	Is the **filter paper** part of the reaction? Why do we need to know its mass?
3	Did a chemical reaction occur? What is your evidence?
4	Draw a model (visual representation) of this chemical reaction to explain what is happening to the atoms during the reaction. Label all relevant parts visible and not visible.

Day 3 Baking Soda and Vinegar

Yesterday, you performed an experiment to see if the mass of the reactants in a chemical reaction was equal to the mass of the products. You also identified possible sources of error in your measurements. At the end of the lab, you came up with a theory about chemical reactions.

An important test of any theory is its applicability to a range of problems. Today, you will attempt to gather evidence to support your theory by using a different chemical reaction, but by keeping the general procedure the same.

If you get stuck, refer to Lab 1 from yesterday for help.

Procedure:

1. Use the graduated cylinder, the balance, and the "tare/zero" button to carefully measure the mass of 20 mL of vinegar.

Materials:
1 Laboratory Balance
1 50 mL graduated cylinder
1 125 mL Erlenmeyer Flask
1 100 mL Beaker
1 Plastic Funnel
1 Plastic Weigh Boat

Vinegar
Baking Soda

2. Record the mass of the 100 mL beaker.

3. Add about 2 grams of baking soda to the beaker, then record the mass of the beaker + the baking soda.

4. Place the beaker with the baking soda on the table and slowly add the vinegar. Record your observations. If the solution bubbles over, you will need to start again from step one.

5. While the reaction is finishing, write down your hypothesis in your handbook. Will the mass decrease, stay the same, or increase? Provide a brief explanation.

6. When the reaction is done, weigh the beaker and products.

Prediction

I predict that when the baking soda & vinegar are mixed, the total mass of the reactants must be _____ (greater/equal /less) than the total mass of the products.

Justification

I believe this will happen because...

Table 1. Data Table for recorded masses.

Item to be measured	Mass in grams (g)	Observations
Mass of 20 mL vinegar		As we mixed baking soda & vinegar, I noticed the formation of _____, indicating the presence of _____ (*gas/solid/liquid*) molecules.
Mass of the beaker		
Mass of beaker + baking soda		
Mass of beaker + products		

Calculations

Use the space below to do your calculations. Record your final results in the table at the bottom.

Total Initial Mass (g)	
Total Final Mass (g)	
CHANGE IN MASS (g)	

Discussion

1	What was the change in mass? Include units (for example, grams, milliliters)!
2	What caused the mass to change? In what ways is this reaction different from the copper sulfate and the sodium carbonate reaction? Draw a model to show what is happening to the atoms in this reaction. Label all relevant parts visible and not visible. Provide evidence for your answer.
3	What chemicals or types of chemicals are being made in this reaction (the produces)? How can you keep track of all of these? (how could you measure them?). Is there a way to keep track of all the products in this reaction? How might you change the experiment? Your goal for today and tomorrow will be to design and test a closed system (isolated environment) for this reaction. Sketch and label your design below.

Days 4 & 5 Final Experiment

Chemists		Per		UCSB Leader	

Introduction *Write a brief statement describing the purpose of this experiment.*

Design Sketch *Draw how you will build your design. Label all materials. Your experiment may change as you go through each trial. Make sure to redraw every change that you make as you progress through each attempt.*

Trial #1
Trail #2
Trail #3

Data Table for recorded masses.

Item to be measured	**Mass in grams (g)**		
Any item you use needs to be measured!	Trial 1	Trial 2	Trial 3

Calculations *Use the space below to do your calculations*

Trial 1	Trial 2	Trial 3

Results of each Trial

Write down what you think contributes to the variability in your data (that is, why your results aren't all identical)

	1	2	3	
Total Initial Mass (g)				
Total Final Mass (g)				
CHANGE IN MASS (g)				

Calculation Page:

Use the space below to do any calculations that you may not have had room on the previous page to complete!!!

Glossary:

- **Observation:** Any information that can be obtained by using your five senses(For these experiments we will only be using smell, sight, and hearing to gather information).
- **Prediction:** Using background knowledge of previous experiences to state what might occur in the future.
- **Justification:** Explaining the prediction by using background information to provide the logic to your prediction.
- **Chemical Reaction:** A reaction that takes place in which the starting substance are changed into a different substance by the end of the reaction. Some examples are combustion, mixing acids and water, rusting.
- **Physical Reaction:** A reaction that takes place in which the starting substances remain the same once the reaction is over. Some examples are melting, freezing, evaporating.
- **Data Table:** A place to record measurements to be used for further discovery and analysis.
- **Error Source:** An educated guess as to why something wrong occurred before, during, or after the experiment.
- **Closed System Reaction:** A reaction that takes place in an environment that does not lose any of the reaction's matter to the surroundings.
- **Open System Reaction:** A reaction that takes place in an environment that loses some of the reaction's matter to the surroundings.
- **System:** The environment where the reaction takes place.
- **Surroundings:** The environment that exists outside the reaction.
- **Universe:** The environment that is made up of both the system and the surroundings.