Mass & Change

Background
Scientists (and you!) need tools to describe matter in a quantitative way. Mass is one useful property of matter that you can measure to determine how much “stuff” you have. The balance is the tool to measure the mass of an object. This is a six-part lab that gives you the opportunity to examine a number of instances where the appearance of a system changes and you will see if the mass changes as well.

Prelab Questions
Answer the following questions on a separate sheet of paper and submit before lab.

1. Predict whether the mass will change if the wad of steel wool is pulled apart.
2. What happens when you leave a soft drink in the freezer? Predict: does its mass change?
3. When some solutions are combined, a solid forms. Predict: will the mass change when the solid forms?
4. What happens when something burns? Predict: will the mass of an object change after it is burned?
5. What happens when something dissolves? Predict: will the mass of a sugar water solution be the same or different as the initial samples of water and sugar?

Safety
- Always wear safety goggles when working in a lab setting.
- Dispose of all chemicals in appropriate disposal containers.

Materials
- Balance
- Steel wool
- Vial with cap (5)
- Piece of ice
- Ca(NO₃)₂ solution
- Na₂CO₃ solution
- Crucible tongs
- Bunsen burner
- Evaporating dish
- Sugar
- Water
- Alka-Seltzer tablet

Procedure
Record data and observations for each part of this lab in the results table below.

PART 1 – MASS OF STEEL WOOL
1. Determine the mass of a wad of steel wool.
2. Carefully pull the steel wool apart so that it appears roughly twice as “big” as before.
3. Determine the mass of the expanded sample of steel wool.
PART 2 – MASS OF ICE AND WATER
1. Place a piece of ice in a vial.
2. Find the mass of the vial and ice.
3. Set the vial aside and go on to part 3. You can return periodically to warm the vial in your hands to speed up the melting process.
4. Once the ice is melted, find the mass of the vial and its contents.

PART 3 – MASS OF A PRECIPITATE
1. Fill a vial no more than 1/3 full with Ca(NO$_3$)$_2$ solution.
2. Fill a second vial no more than 1/3 full with Na$_2$CO$_3$ solution.
3. Cap the vials and find the mass of both vials with the contents and caps (you’re only finding one mass in this step).
4. Carefully pour the contents of one vial into the other vial. Be careful to not spill any of the contents.
5. Find the mass of both vials (including the empty one), contents, and caps.

PART 4 – MASS OF BURNING STEEL WOOL
1. Find the mass of steel wool and an evaporating dish.
2. Light the burner.
3. Holding the steel wool with tongs near the evaporating dish, heat the steel wool until it glows. Turn the steel wool around in the flame so that all sides are exposed. Any pieces of the steel wool that break free during heating should fall onto the dish.
4. Record your observations when the appearance of the steel wool changes. Let it cool for about 1 minute.
5. Find the mass of the heated steel wool (including any parts that may have fallen during heating) and the evaporating dish.
6. Place the “used” steel wool in the trash can.

PART 5 – MASS OF DISSOLVED SUGAR
1. Fill a vial about 1/2 full with water.
2. Put about a small scoop of sugar in the cap of the vial.
3. Find the mass of the vial, water, cap, and sugar (you are finding one mass in this step).
4. Carefully pour the sugar into the vial (do not spill any). Gently swirl the vial to help the sugar to dissolve. Do not shake the vial vigorously, you don’t want solution to leak out of the vial.
5. When the sugar has completely dissolved, find the mass of the vial, cap, and contents.

PART 6 – MASS OF DISSOLVED ALKA-SELTZER
1. Fill a vial about 1/2 full with water.
2. Find the mass of the vial, water, cap, and an Alka-Seltzer tablet (you are finding one mass in this step).
3. Carefully drop the tablet into the vial (do not spill any).
4. When the tablet has finished reacting, find the mass of the vial, cap, and contents.
## Results

<table>
<thead>
<tr>
<th>Part #</th>
<th>Starting Mass</th>
<th>Final Mass</th>
<th>Change in Mass</th>
<th>Observations</th>
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## Analysis

For each part of the lab:

1. Calculate any change in mass. Record in the table above.
2. Report your group’s results on the board/computer so that the class data can be collected. Change should be recorded as + (for a gain) or – (for a loss).
3. Draw “before” and “after” particle picture explanations in the space below.
Particle Pictures

**Part 1**

Before

Steel Wool, pulled apart

After

**Part 4**

Before

Steel wool, heated

After

**Part 2**

Before

Ice and Water

After

**Part 5**

Before

Sugar dissolved in water

After

**Part 3**

Before

Precipitate

After

**Part 6**

Before

Alka-Seltzer dissolved in water

After
1. Did the mass change or stay mostly the same when you pulled the steel wool apart? What about when you heated it? Explain the difference. Classify each of these experiments as either a physical or chemical change and justify your classification with evidence from your data and observations.

2. When ice melts, the volume of water is smaller than that of the ice. How does the mass of the water compare to the mass of the ice? What does this mean for the density of ice compared to that of water? Does that make sense based on your experience with ice and water?

3. When the precipitate formed from two solutions mixed together, did the total mass change? Would you classify this as a physical or chemical change? Justify your classification with evidence from your data and observations.

4. Did the mass change or stay mostly the same when you dissolved sugar in water? What about when the Alka-Seltzer “dissolved” in the water? Explain the difference. Classify each of these experiments as either a physical or chemical change and justify your classification with evidence from your data and observations.

6. In some of the experiments you did in this lab, you may have seen the mass change by a small amount. Assume that these minor differences are due to small errors introduced during the experiment. For each of the experiments where the mass only changed by a small amount, suggest possible sources of error that could have contributed to the difference.

**Conclusion**

1. You will be assigned one part of this lab to report on to the class, taking into account the data from everyone in class. For your assigned experiment your group should:
   a. sketch a histogram based on class results.
   b. produce a particle representation of the system before and after the change.

2. Your group will present your work to the class.