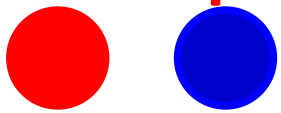
# Mass and Change

Chemistry Modeling

# Particle Model of Matter

1) matter is comprised of particles that have mass and take up space. 

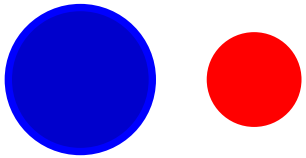
Mass is a measure of the number of particles present.

Volume is a measure of the space the particles take up.

2) The particles cannot be divided.

3) Some particles are more massive than others particles: 

1 mass unit 5 mass units

4) and some particles take up more space. 

5) Each substance is comprised of a particles with a unique mass and volume. Particles of a given substance are identical. Example, all water particles have the same mass & volume, they are identical. Sugar particles are different than water particles.

# Mass and Change Lab

| | Initial Mass (g) | Final mass (g) | Change in mass (g) | Type of Change | Opened /closed |
|---|---|---|---|---|---|
| Steel wool | | | | | |
| Ice | | | | | |
| Sugar | | | | | |
| Alka Seltzer | | | | | |
| Burnt steel wool | | | | | |
| Precipitate | | | | | |

# Stretching steel wool

- Is volume a measure of the “amount of stuff” in a sample?
- Is mass a measure of the “amount of stuff” in a sample?
- **Predict whether the mass will change or will not change if the wad of steel wool is pulled apart.**
- **Write the prediction in your lab book as follows:**
- **If the steel wool is stretched, its mass will _____ .**

# Stretching steel wool

- **Predict whether the mass will change or will not change if the wad of steel wool is pulled apart.**
- **Write the prediction in your lab book as follows:**
- **If the steel wool is stretched, its mass will _____ .**
- The above prediction is a hypothesis.

# Calculating Change

| Group | Initial Mass | Final mass | Change in mass (g) |
|---|---|---|---|
| Steel wool | | | |

- Zero the scale
- Weigh the steel wool in a weighing dish before you stretch it .
- Write this weight as the initial mass in your data table.
- Stretch the steel wool over a lab tray.
- Transfer all the steel wool that fell of the pad into the weighing dish.
- Weigh the stretched steel wool in the weighing dish .
- Write this as the final mass in your data table.

# Calculating Change

| Group | Initial Mass | Final mass | Change in mass (g) |
|---|---|---|---|
| Steel wool | 30.00 | 29.85 | -0.15 |

**Final – Initial = Change**

**Final Mass – Initial Mass = Change**

**29.85 – 30.00 = -0.15**

**- indicates mass loss**

**Final Mass – Initial Mass = Change**

**30.10 – 30.00 = +0.10**

**✚ indicates mass gain**

# Sugar

- What happens when something dissolves?
- A soluble solid appears to disappear in solution.
- **Predict what will happen to the mass when sugar dissolves in water.**
  - **When the sugar dissolves the mass will _____.**

- **Determine the initial and final mass.**

- **Weigh everything in a beaker!**
- **When transferring the contents of one vial to another, *always do this over the beaker so you catch whatever spills.***

# Mass and Change Lab

| | Initial Mass (g) | Final mass (g) | Change in mass (g) | Type of Change | Opened /closed |
|---|---|---|---|---|---|
| Steel wool | | | | | |
| Ice | | | | | |
| Sugar | | | | | |
| Alka Seltzer | | | | | |
| Burnt steel wool | | | | | |
| Precipitate | | | | | |

# Melting Ice

- What happens when you leave a soft drink in the freezer?

- So, it follows that a piece of ice will have a smaller volume when it melts to water.

- The question is: does the mass also decrease?

- Make prediction in your lab books**: The mass will _____ if the ice melts.**

# Mass and Change Lab

| | Initial Mass (g) | Final mass (g) | Change in mass (g) | Type of Change | Opened /closed |
|---|---|---|---|---|---|
| Steel wool | | | | | |
| Ice | | | | | |
| Sugar | | | | | |
| Alka Seltzer | | | | | |
| Burnt steel wool | | | | | |
| Precipitate | | | | | |

# Alka Seltzer

- In the previous experiment. A soluble solid appeared to disappear in solution, yet the mass remained nearly constant.
- Predict what will happen to the mass when the Alka Seltzer dissolves.
- **When the Alka Seltzer dissolves, the mass will _____.**

# Mass and Change Lab

| | Initial Mass (g) | Final mass (g) | Change in mass (g) | Type of Change | Opened /closed |
|---|---|---|---|---|---|
| Steel wool | | | | | |
| Ice | | | | | |
| Sugar | | | | | |
| Alka Seltzer | | | | | |
| Burnt steel wool | | | | | |
| Precipitate | | | | | |

# Precipitate

- Make a prediction:
- **Does the mass change when the solid is formed?**
- Write a hypothesis in your lab book.
- **If the solid forms then the mass will _____.**

# Mass and Change Lab

| | Initial Mass (g) | Final mass (g) | Change in mass (g) | Type of Change | Opened /closed |
|---|---|---|---|---|---|
| Steel wool | | | | | |
| Ice | | | | | |
| Sugar | | | | | |
| Alka Seltzer | | | | | |
| Burnt steel wool | | | | | |
| Precipitate | | | | | |

# Burning Steel Wool

- What happens when something burns.
- Does the mass of what is left become bigger or smaller?
- Predict in your lab books what will happen to the mass of the steel wool when it is heated?
- **If the steel wool is heated the mass will _____.**

# Mass and Change Lab

| | Initial Mass (g) | Final mass (g) | Change in mass (g) | Type of Change | Opened /closed |
|---|---|---|---|---|---|
| Steel wool | | | | | |
| Ice | | | | | |
| Sugar | | | | | |
| Alka Seltzer | | | | | |
| Burnt steel wool | | | | | |
| Precipitate | | | | | |

# Results of Experiment

Histograms

# Mass and Change Lab

| | Initial Mass (g) | Final mass (g) | Change in mass (g) | Type of Change | Opened /closed |
|---|---|---|---|---|---|
| Steel wool | | | | | |
| Ice | | | | | |
| Sugar | | | | | |
| Alka Seltzer | | | | | |
| Burnt steel wool | | | | | |
| Precipitate | | | | | |

# Law of Conservation of Mass???

## Is the system open or closed?

## What is the Law of Conservation of Mass?

**Your results are evidence for the Law of Conservation of Mass**

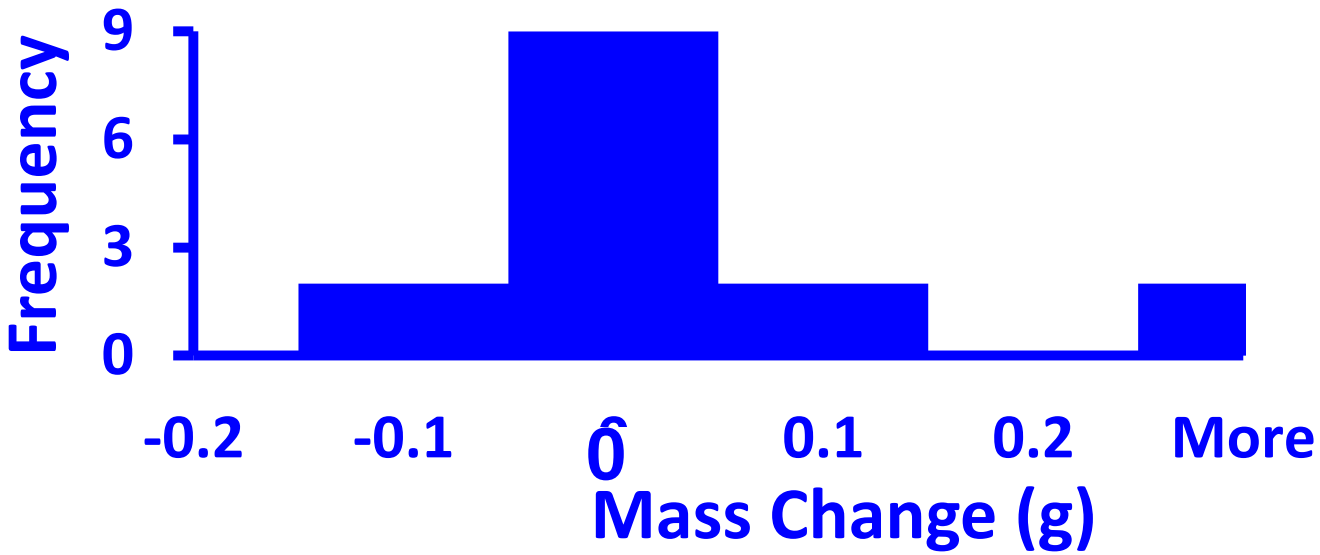
| Group | Change in Appearance | Change in mass (g) | Open/ closed System |
|---|---|---|---|
| **Steel wool stretched** | Volume increased | **No Change** | **closed** |
| **Ice** | Ice melted | **No Change** | **closed** |
| **Sugar** | Sugar dissolved | **No Change** | **closed** |
| **Alka Seltzer** | Gave off gas, pill dissolved | **Lost mass** | **open** |
| **Burnt steel wool** | Color changed, looked different | **Gained mass** | **open** |
| **Precipitate** | Yellow powder!!! | **No change** | **closed** |

# Histograms

**A precipitate is**

**a solid that forms and settles out of a liquid usually due to a chemical change.**

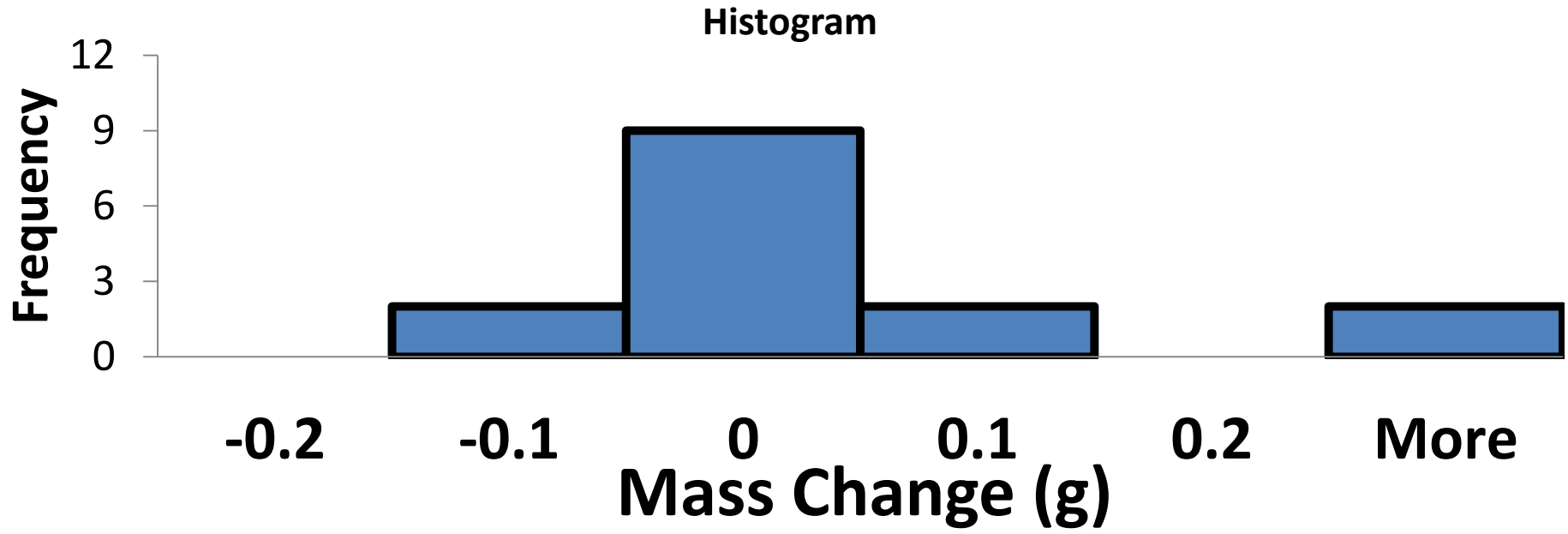
**What data do histograms display?**




**Histograms show the results (the DV) of an experiment on the x axis and the number of times (frequency) that result was obtained on the y axis.**

# Histograms

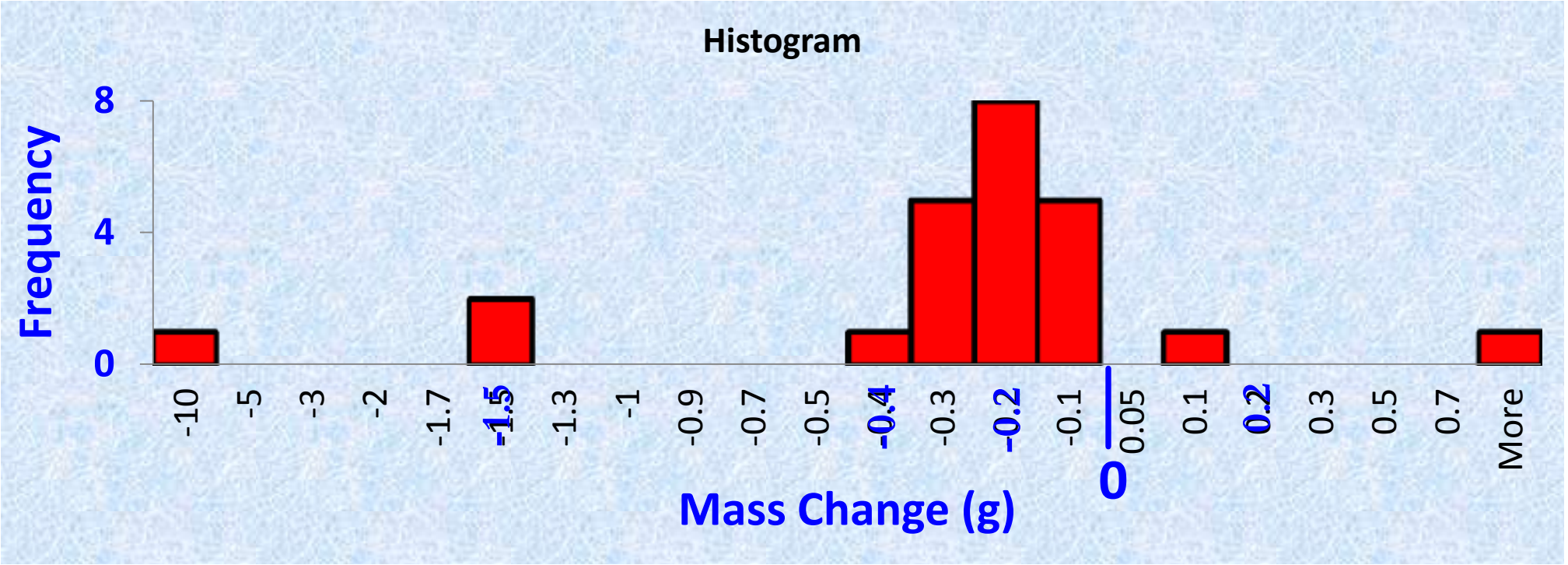
**Which of the following explanations best fits the data?**




- **This histogram explains the results of all experiments where mass is unchange (where mass is conserved):**
- **Stretching steel wool**
- **Melting Ice**
- **Two solutions were mixed and formed a precipitate. (Chem A + Chem B)**
- **Dissolving sugar in water**

# Chemistry, Bell Work, Monday , Sept 18

**Which of the following explanations best fits the data?**

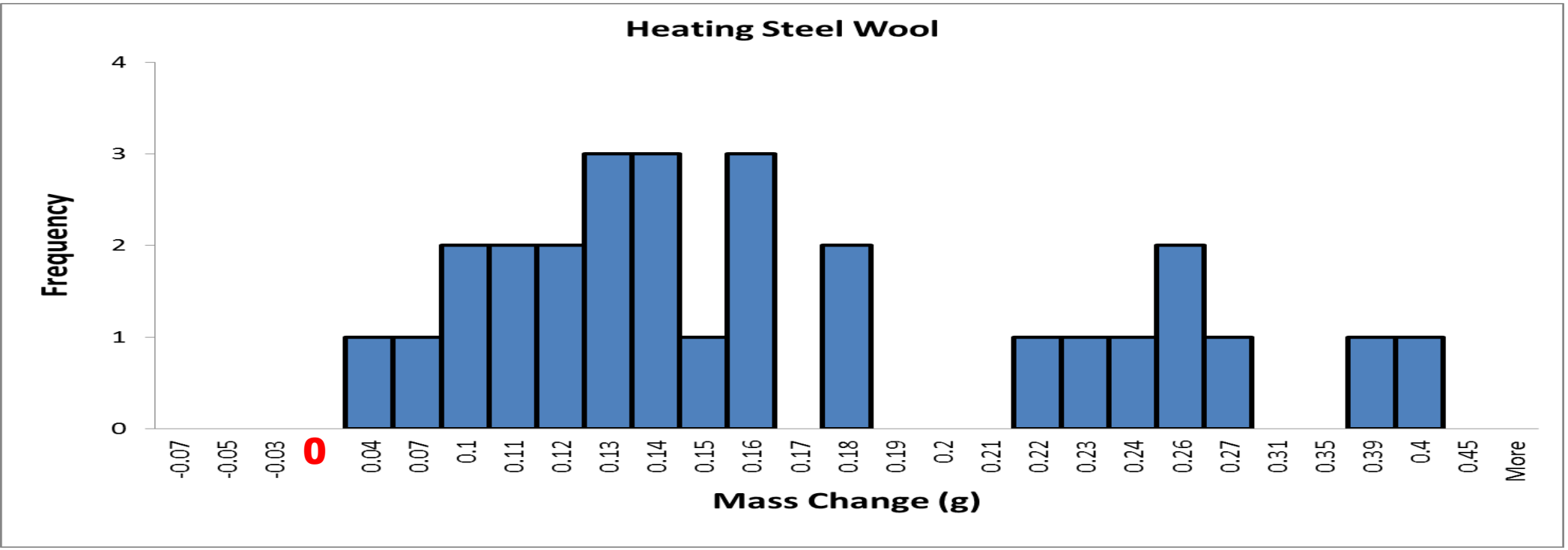



**Histogram shows mass decreased. The experiment that lost where mass decreased was:**

**Alka-Seltzer was dissolved in water**

# Histogams

## Which of the following explanations best fits the data?




**Histogram shows mass increased. The experiment that gained mass decreased was: Burning steel wool.**

**Steel is mostly iron (steel wool is mostly iron) which reacts with oxygen to form rust (iron oxide). Thus oxygen was added from outside the system thereby increasing the overall mass of the system.**

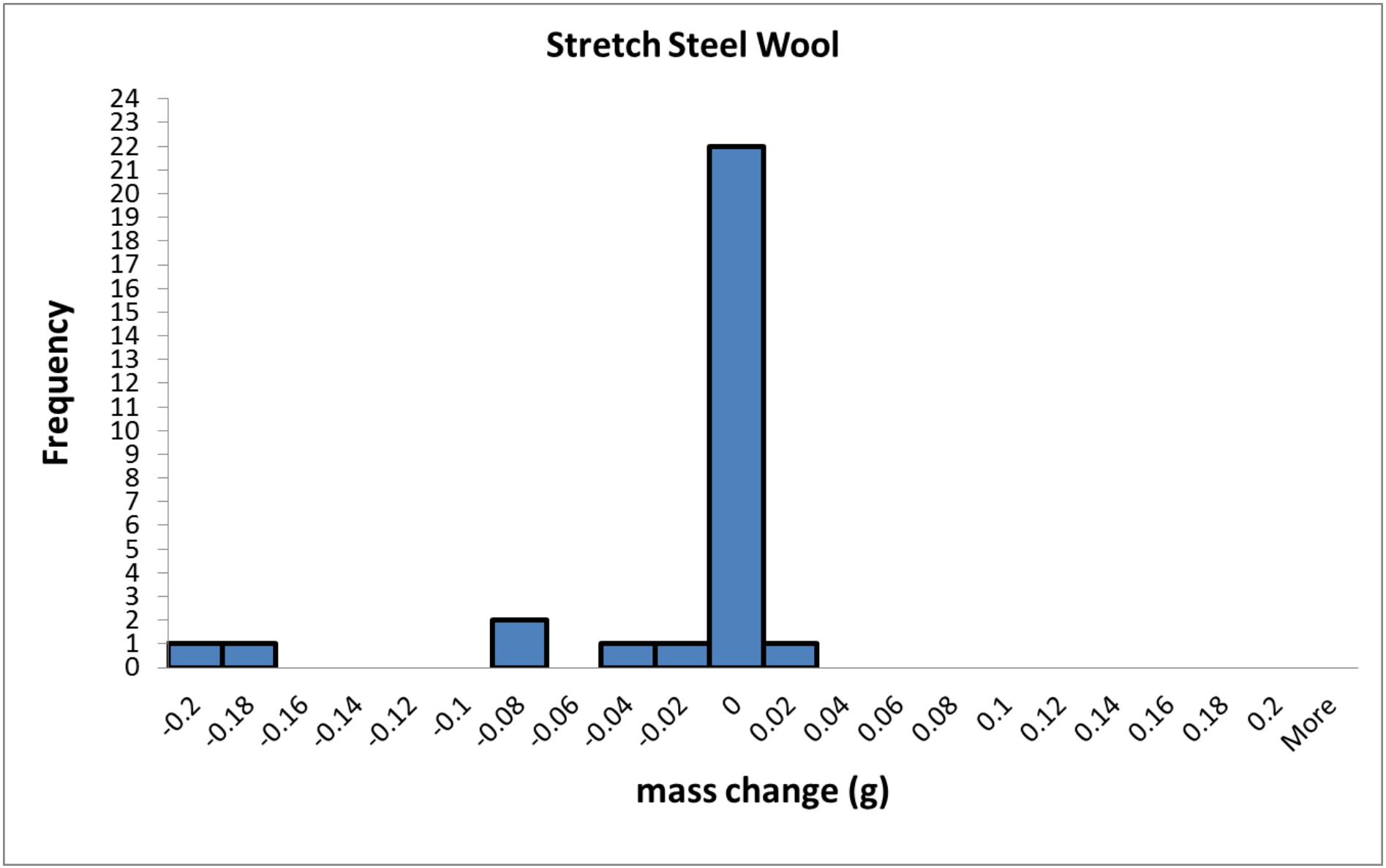
**When an iron nail rusts, its mass ____. Why? Is rusting a physical or chemical change?**

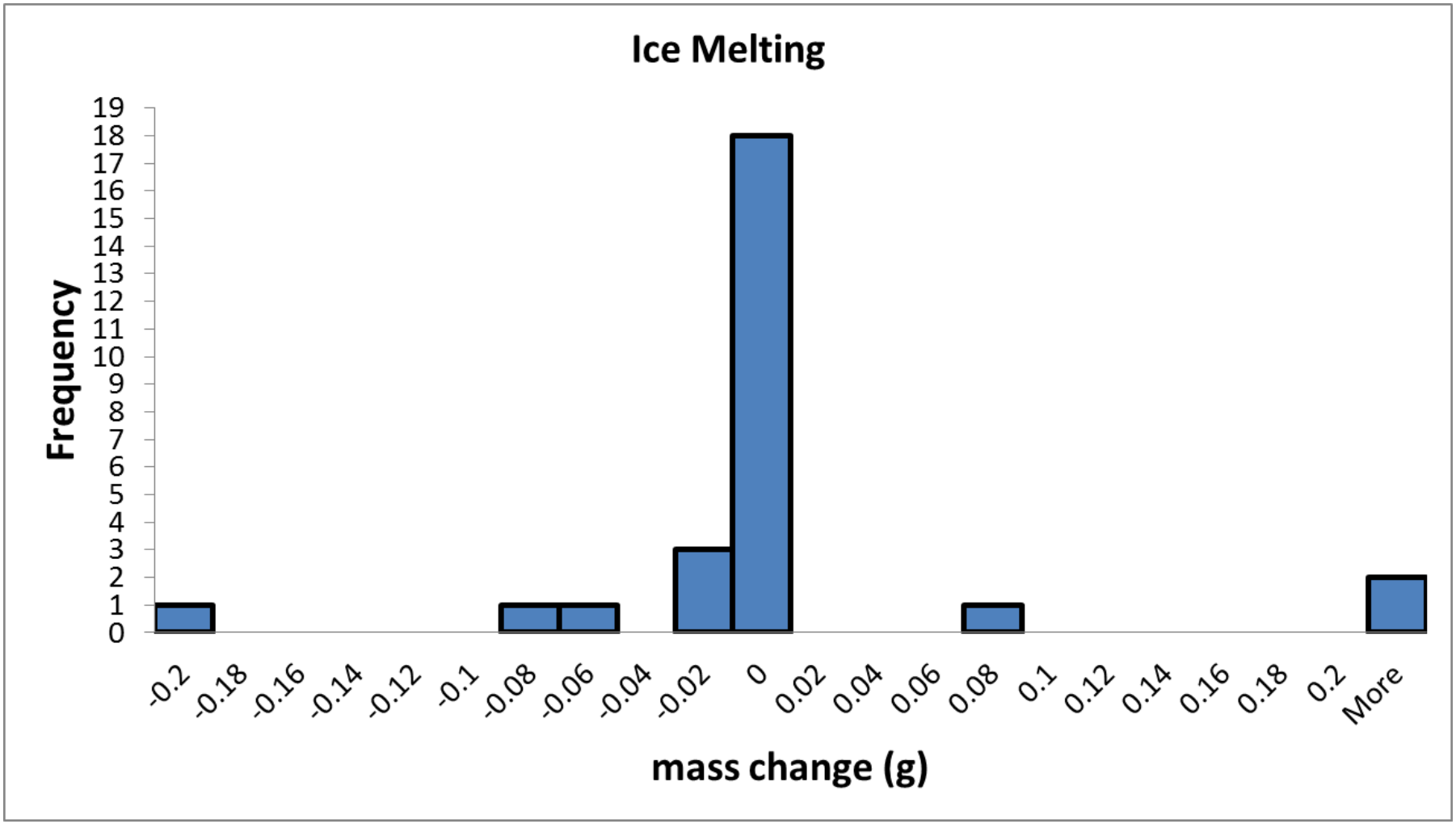
a. increases
b. decreases
c. stays the same
d. cannot be determined

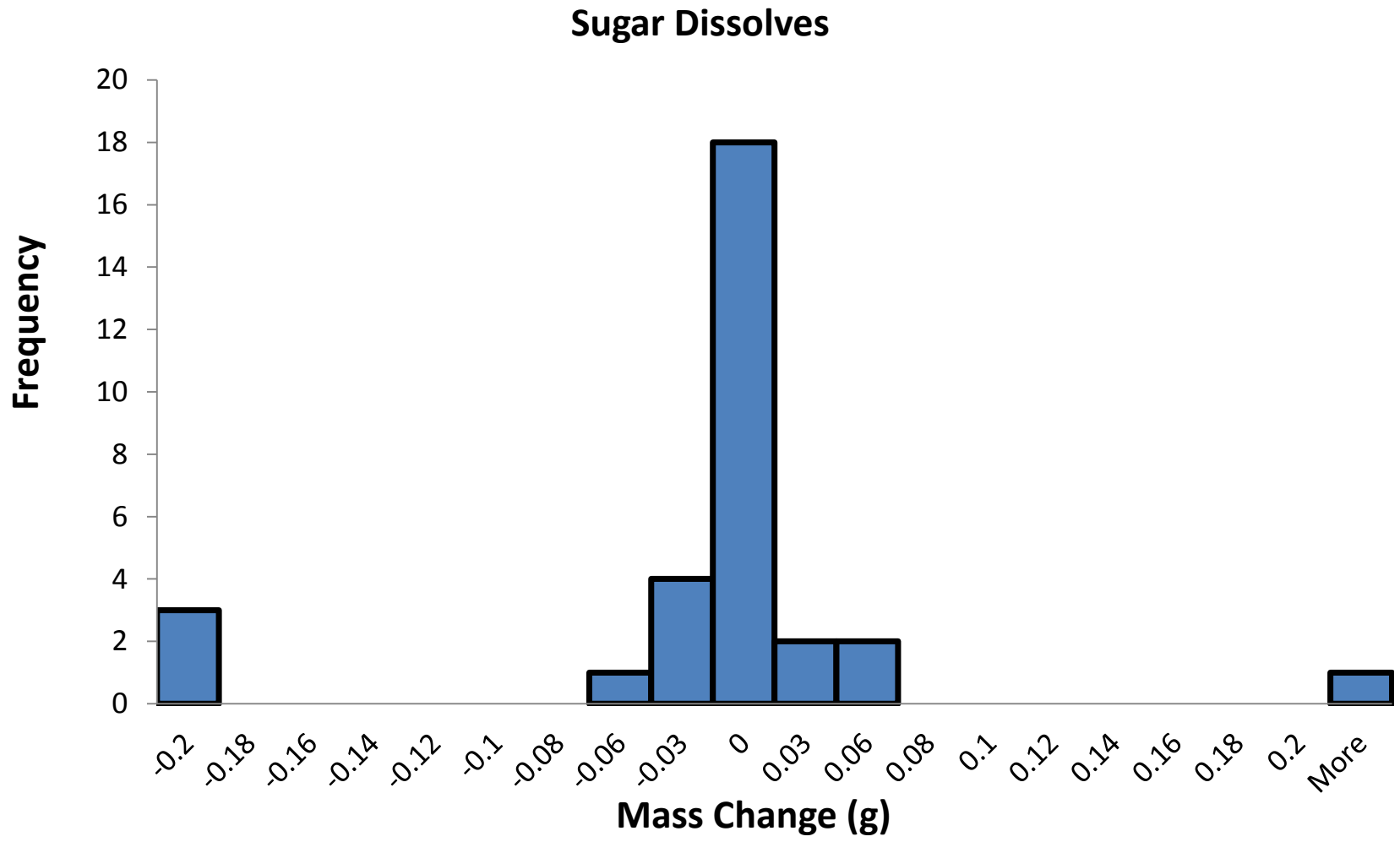
- **The mass increases because oxygen is added to the iron.**
- **The iron reacts with oxygen in the air and produces a new "compounded substance", iron oxide, aka: rust.**
- **Rusting (aka: oxidation) is a chemical change.**

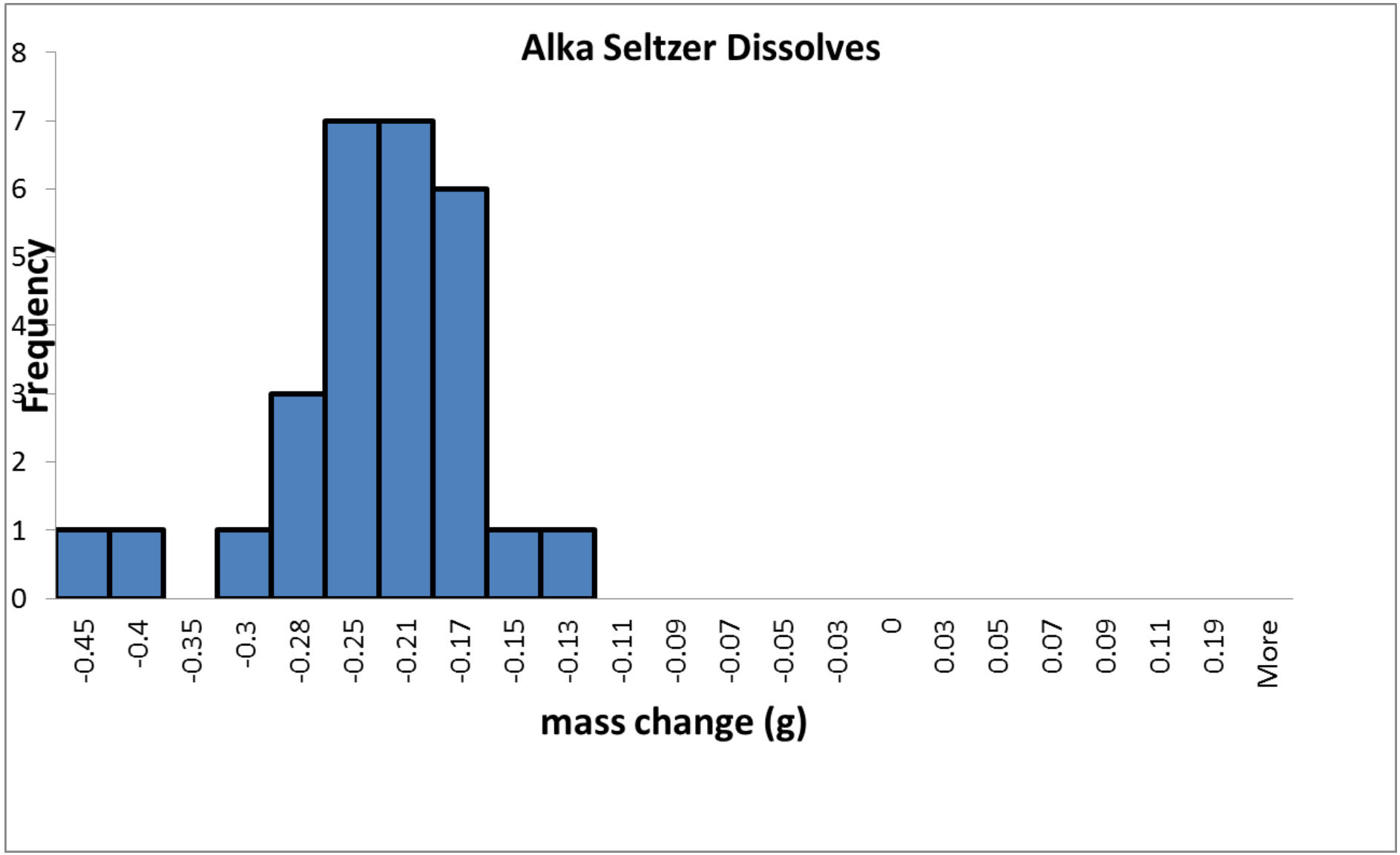
  **iron + oxygen → Rust**

# Class Results for Mass and Change Experiment

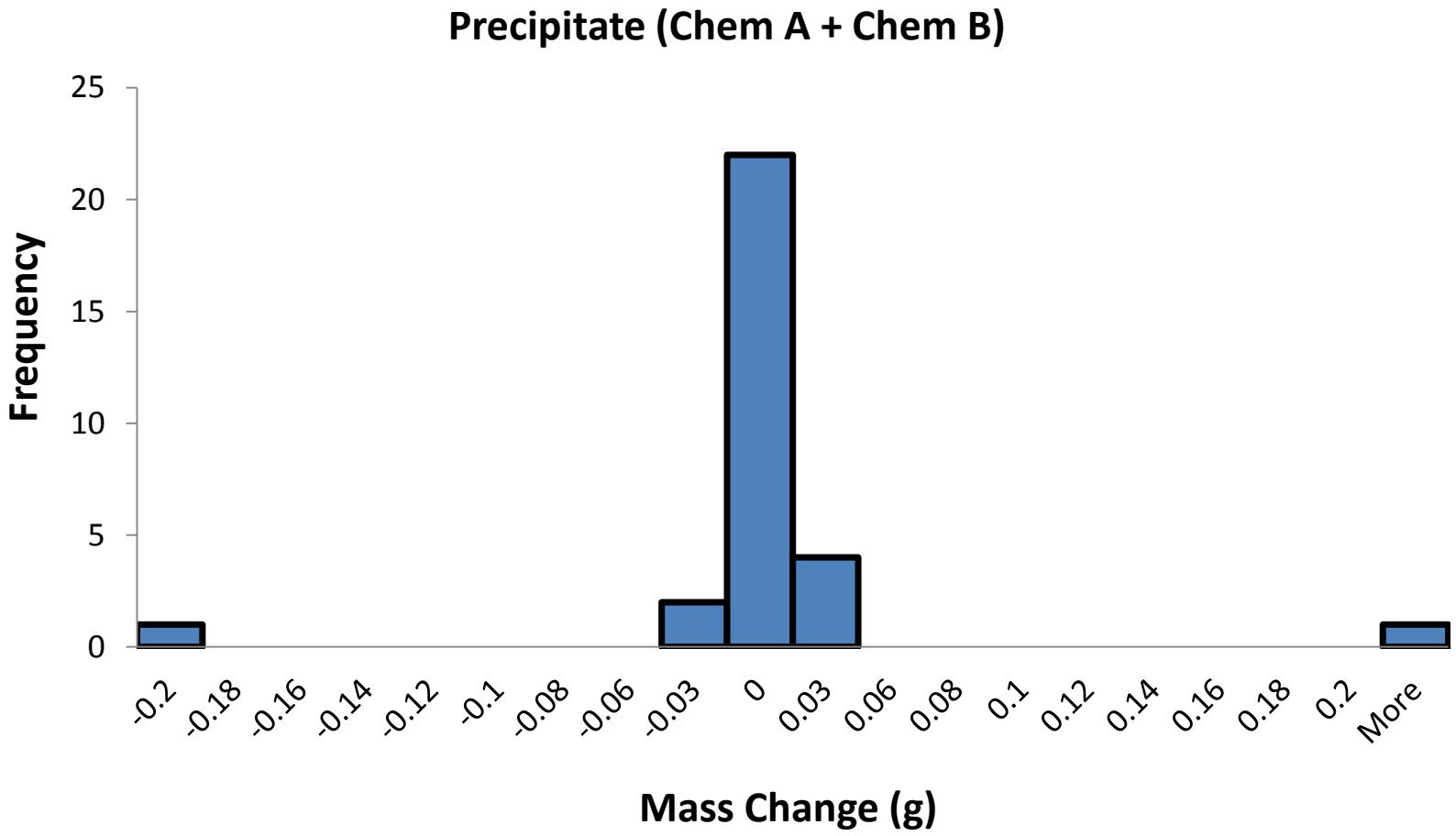

Stretch Steel Wool
Frequency
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-0.2
-0.18
-0.16
-0.14
-0.12
-0.1
-0.08
-0.06
-0.04
-0.02
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
More
mass change (g)

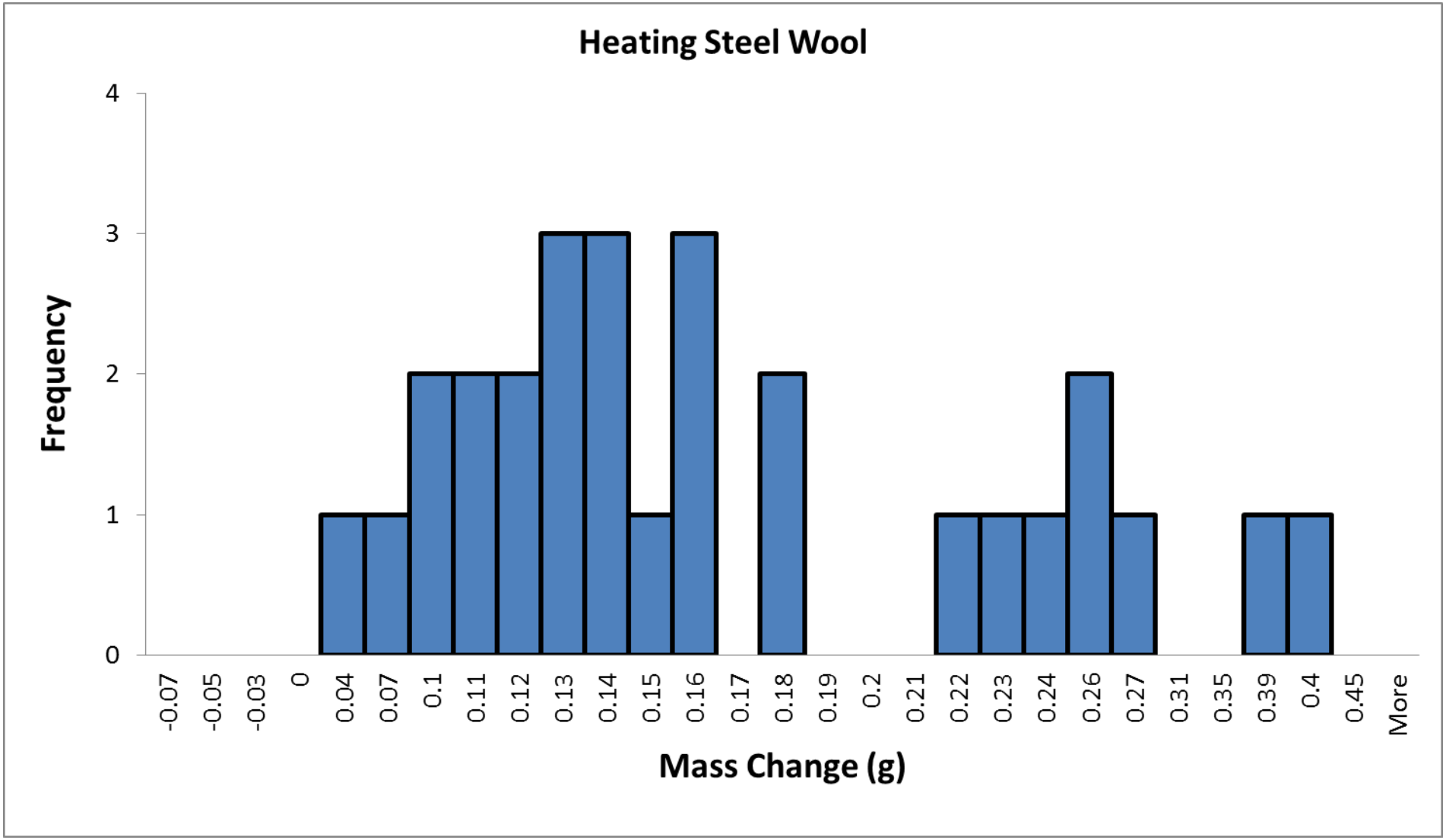

Ice Melting
Frequency
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-0.2
-0.18
-0.16
-0.14
-0.12
-0.1
-0.08
-0.06
-0.04
-0.02
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
More
mass change (g)


Sugar Dissolves
Frequency
20
18
16
14
12
10
8
6
4
2
0
-0.2
-0.18
-0.16
-0.14
-0.12
-0.1
-0.08
-0.06
-0.03
0
0.03
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
More
Mass Change (g)


Alka Seltzer Dissolves
Frequency
0
1
2
3
4
5
6
7
8
-0.45
-0.4
-0.35
-0.3
-0.28
-0.25
-0.21
-0.17
-0.15
-0.13
-0.11
-0.09
-0.07
-0.05
-0.03
0
0.03
0.05
0.07
0.09
0.11
0.19
More
mass change (g)

# Chemical A + Chemical B → Chemical C




Heating Steel Wool
Frequency
0
1
2
3
4
-0.07
-0.05
-0.03
0
0.04
0.07
0.1
0.11
0.12
0.13
0.14
0.15
0.16
0.17
0.18
0.19
0.2
0.21
0.22
0.23
0.24
0.26
0.27
0.31
0.35
0.39
0.4
0.45
More
Mass Change (g)

# Mass and Change Lab

| | Initial Mass (g) | Final mass (g) | Change in mass (g) | Type of Change | Opened /closed |
|---|---|---|---|---|---|
| Steel wool | | | | | |
| Ice | | | | | |
| Sugar | | | | | |
| Alka Seltzer | | | | | |
| Burnt steel wool | | | | | |
| Precipitate | | | | | |

# Law of Conservation of Mass???

## Is the system open or closed?

## What is the Law of Conservation of Mass?

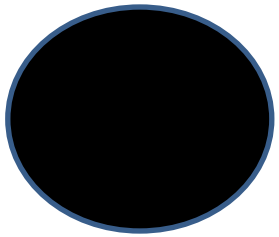
**Your results are evidence for the Law of Conservation of Mass**

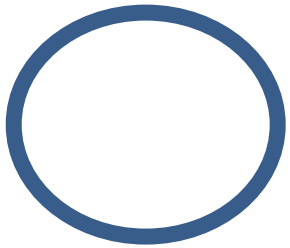
| Group | Change in Appearance | | Change in mass (g) | Open/ closed System |
|---|---|---|---|---|
| **Steel wool stretched** | Volume increased | | No Change | closed |
| **Ice** | Ice melted | | No Change | closed |
| **Sugar** | Sugar dissolved | | No Change | closed |
| **Alka Seltzer** | Gave off gas, pill dissolved | | Lost mass | open |
| **Burnt steel wool** | Color changed, looked different | | Gained mass | open |
| **Precipitate** | Yellow powder!!! | | No change | closed |

| Group | Change in Appearance | Mass Change Class Result | Open or closed system? | Chemical or Physical Change |
|---|---|---|---|---|
| Steel wool (s/w) | Volume increased | unchanged | closed | physical |
| Ice Melts (ice) | Ice melted | unchanged | closed | physical |
| Sugar Dissolves (sugar) | Sugar dissolved | unchanged | closed | physical |
| Alka Seltzer & water (a/s) | Gave off gas, pill dissolved | decreased | open | chemical |
| Burnt steel wool (burnt s/w) | Color changed, looked different | increased | open | chemical |
| Precipitate Forms (precip) | Yellow powder!!! | unchanged | closed | chemical |

# Steel Wool Drawings

- **We are going to assume that all matter is made of particles.**
- **This called the particle model.**
- **We are going to represent these particles with spheres or circles.**

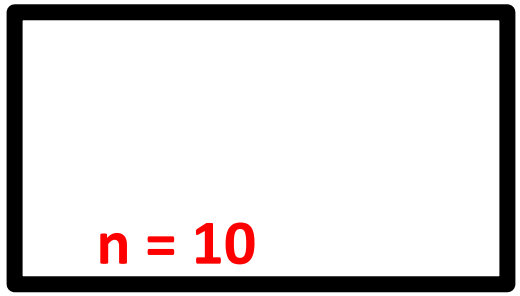




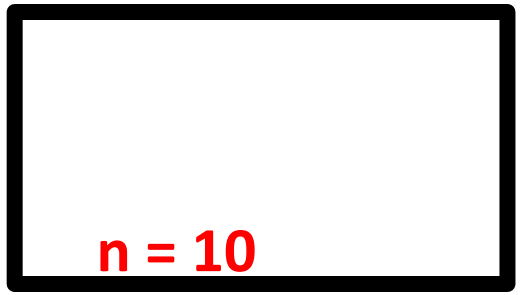
- ***All steel wool particles are identical.***
- **The size, shape, and color of the steel wool particles never changes.**

# Steel Wool Drawings

- **Use little circles to represent the steel wool particles.**
- **Draw in your lab book a picture of what a group of these particles looked like before you stretched the steel wool.**
- **Draw in *your lab book a picture of what a group these particles look like after you stretched the steel wool.***




**Before**



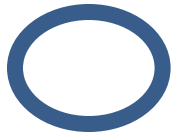

**After**

- **Show the number of particles for the group by writing n = , and fill in a number**
  **Example: n =10, means 10 particles in the group.**

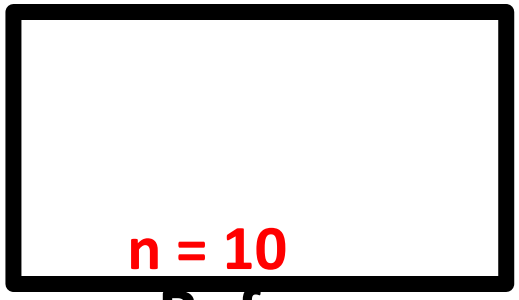
- **If no particles have been added or subtracted, the number of particles should be the same for the before and after drawings.**

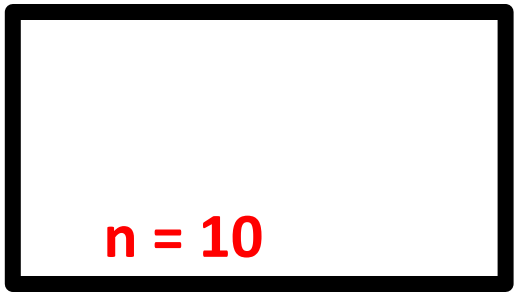
# Sugar

- **Represent a group of particles of sugar and water *before* the sugar dissolved and *after* the sugar dissolved.**
**Sugar particles are different than water particles.**
- **Draw a key  = sugar,**

 **= water**

- **Show the number of particles for before & after as follows: n = ___. Complete the blank with an estimated # of particles**
- **If nothing is added or lost in the vials, the number of particles should be the same.**



# Law of Conservation of Mass???

## Is the system open or closed?

## What is the Law of Conservation of Mass?

**Your results are evidence for the Law of Conservation of Mass**

| Group | Change in Appearance | | Change in mass (g) | Open/ closed System |
|---|---|---|---|---|
| **Steel wool stretched** | Volume increased | | **No Change** | |
| **Ice** | Ice melted | | **No Change** | |
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| **Burnt steel wool** | Color changed, looked different | | **Gained mass** | |
| **Precipitate** | Yellow powder!!! | | **No change** | |

# Law of Conservation of Mass???

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| Group | Change in Appearance | | Change in mass (g) | System |
|---|---|---|---|---|
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| **Ice** | Ice melted | | **No Change** | **closed** |
| **Sugar** | Sugar dissolved | | **No Change** | **closed** |
| **Alka Seltzer** | Gave off gas, pill dissolved | | **Lost mass** | **open** |
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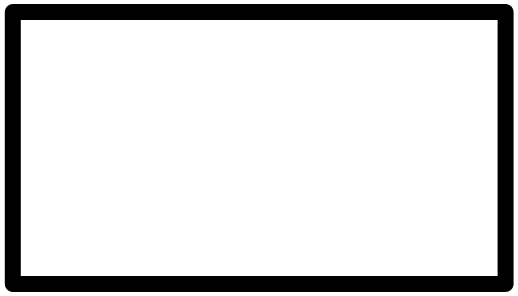
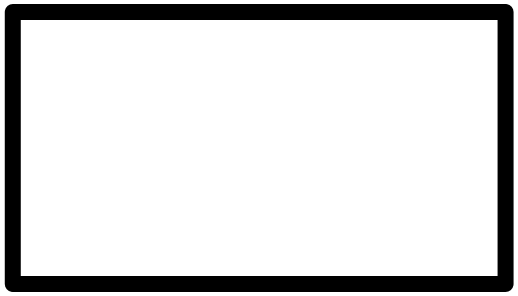
| **Precipitate** | Yellow powder!!! | | **No change** | **closed** |

# Melting Ice

- **Represent for a group of particles of ice (frozen water) and then as melted ice (liquid water).**
- **Represent the volume of the ice & melted ice correctly for a group of particles. Which is larger?**
- **Remember: a water particle, whether frozen or liquid, is the same size. But the group of particles will be different sizes.**



Ice



Melted Ice (liquid water)

- **Show the number of particles for each group**
- **If nothing is added or lost in the vials, the number of particles should be the same.**

# Alka Seltzer

- **Represent for a group of particles of Alka Seltzer and water with the pill in the water before the fizzing starts**
- **Represent for a group of particles after the fizzing ends including the water**
- **Include a key for each particle**
- **Show the number of particles before fizzing and after fizzing.**

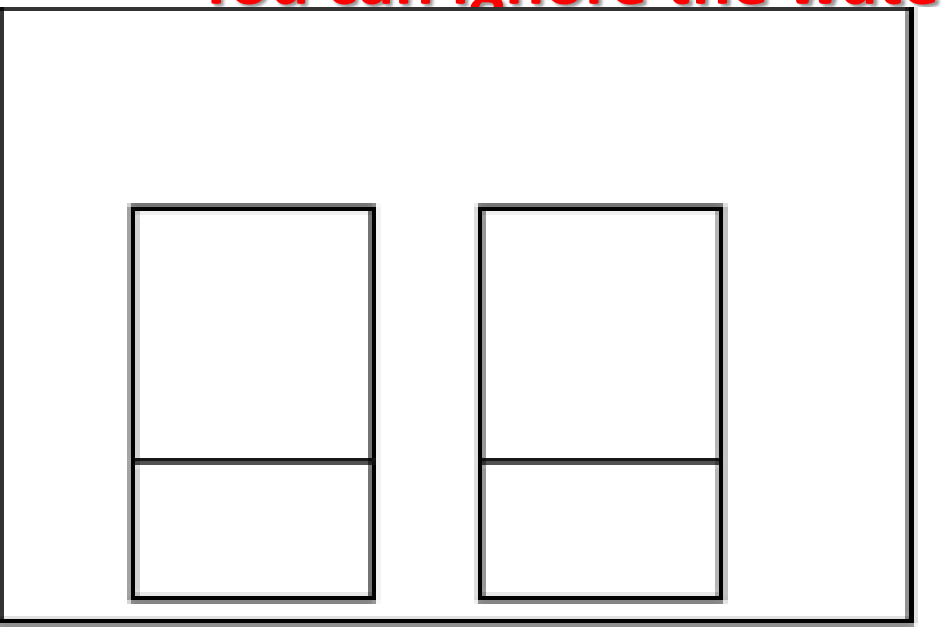
**Pill & Water before fizzing**

**After pill dissolved (include water and gas)**

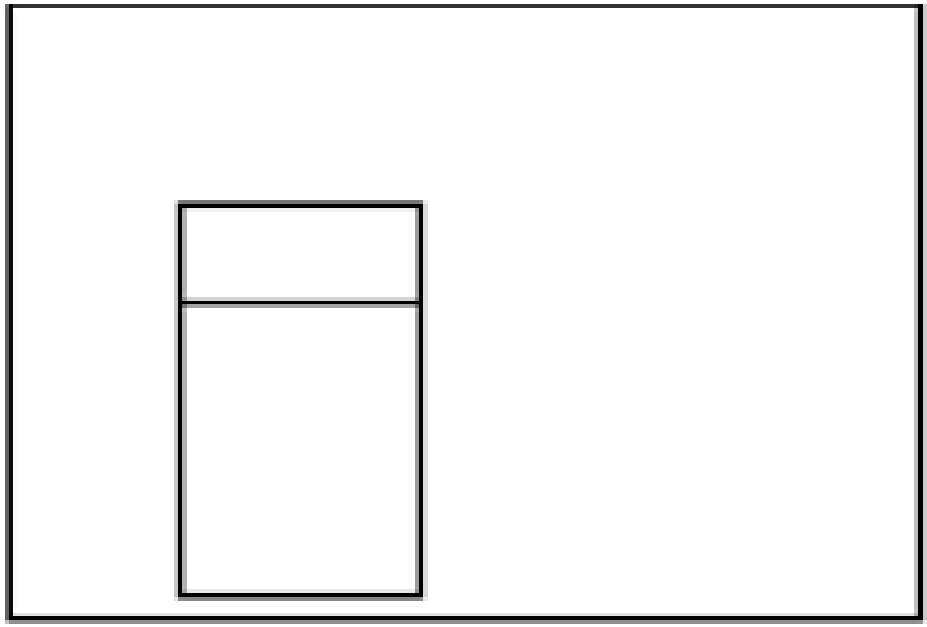
- **Show the number of particles for each group**
- **If nothing is added or lost in the vials, the number of particles should be the same.**

# Precipitate

- **Represent the particles of the substances in the solutions before mixing and after the precipitate has formed.**
- **Include a key or legend for each different particle.**
- **Show the number of particles before and after.**
- **You can ignore the water.**



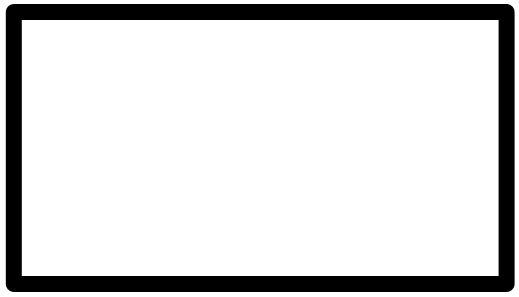
before



after

# Burning Steel Wool

- **Use little circles to represent the steel wool particles.**
- **Draw in your lab book a picture of what a group of these particles looked like before and after you burned the steel wool.**
- **Include a key or legend for each different particle.**



**Before**

**After**

- **Show the number of particles for the group by writing n = , and fill in a number in or below the before and after boxes.**

**Example: n =10, means 10 particles in the group.**

# Law of Conservation of Mass???

## Is the system open or closed?

## What is the Law of Conservation of Mass?

**Your results are evidence for the Law of Conservation of Mass**

| Group | Change in Appearance | | Change in mass (g) | System |
|---|---|---|---|---|
| **Steel wool stretched** | Volume increased | | **No Change** | **closed** |
| **Ice** | Ice melted | | **No Change** | **closed** |
| **Sugar** | Sugar dissolved | | **No Change** | **closed** |
| **Alka Seltzer** | Gave off gas, pill dissolved | | **Lost mass** | **open** |
| **Burnt steel wool** | Color changed, looked different | | **Gained mass** | **open** |
| **Precipitate** | Yellow powder!!! | | **No change** | **closed** |