Mass and Change

Chemistry Modeling

Mass and Change Lab

Group	Initial Mass (g)	Final mass (g)	Change in mass (g) (Final – Initial)
Steel wool	3.00	2.00	2.00 – 3.00 = - 1.00
Ice			
Sugar			
Alka Seltzer			
Burnt steel wool			
Precipitate			

Calculating Change

Group	Initial Mass	Final mass	Change in mass (g)
Steel wool	3.00	2.85	-0.15

Final – Initial = Change

Final Mass – Initial Mass = Change

2.85 – 3.00 = -0.15

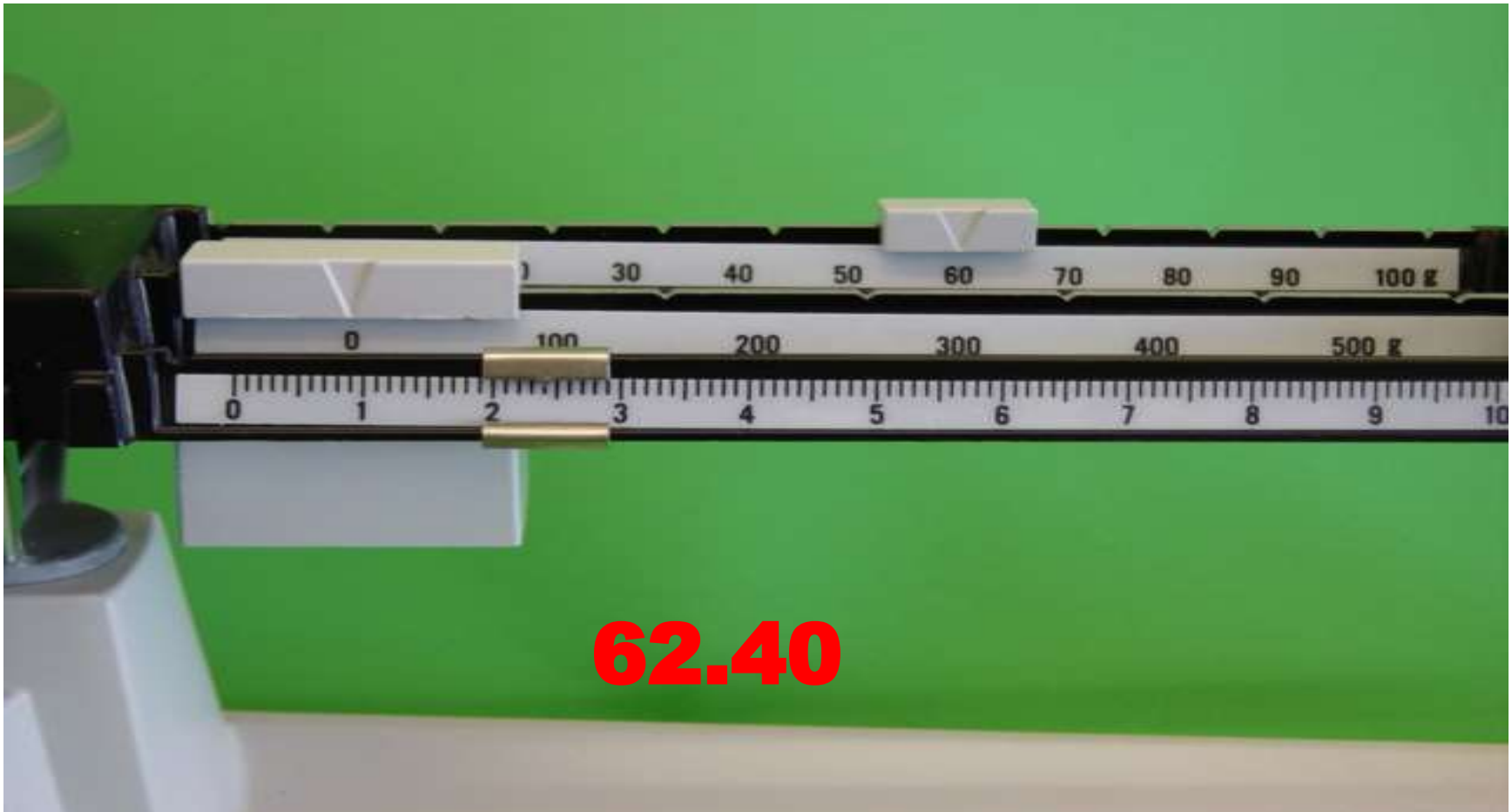
- indicates mass loss

Final Mass – Initial Mass = Change

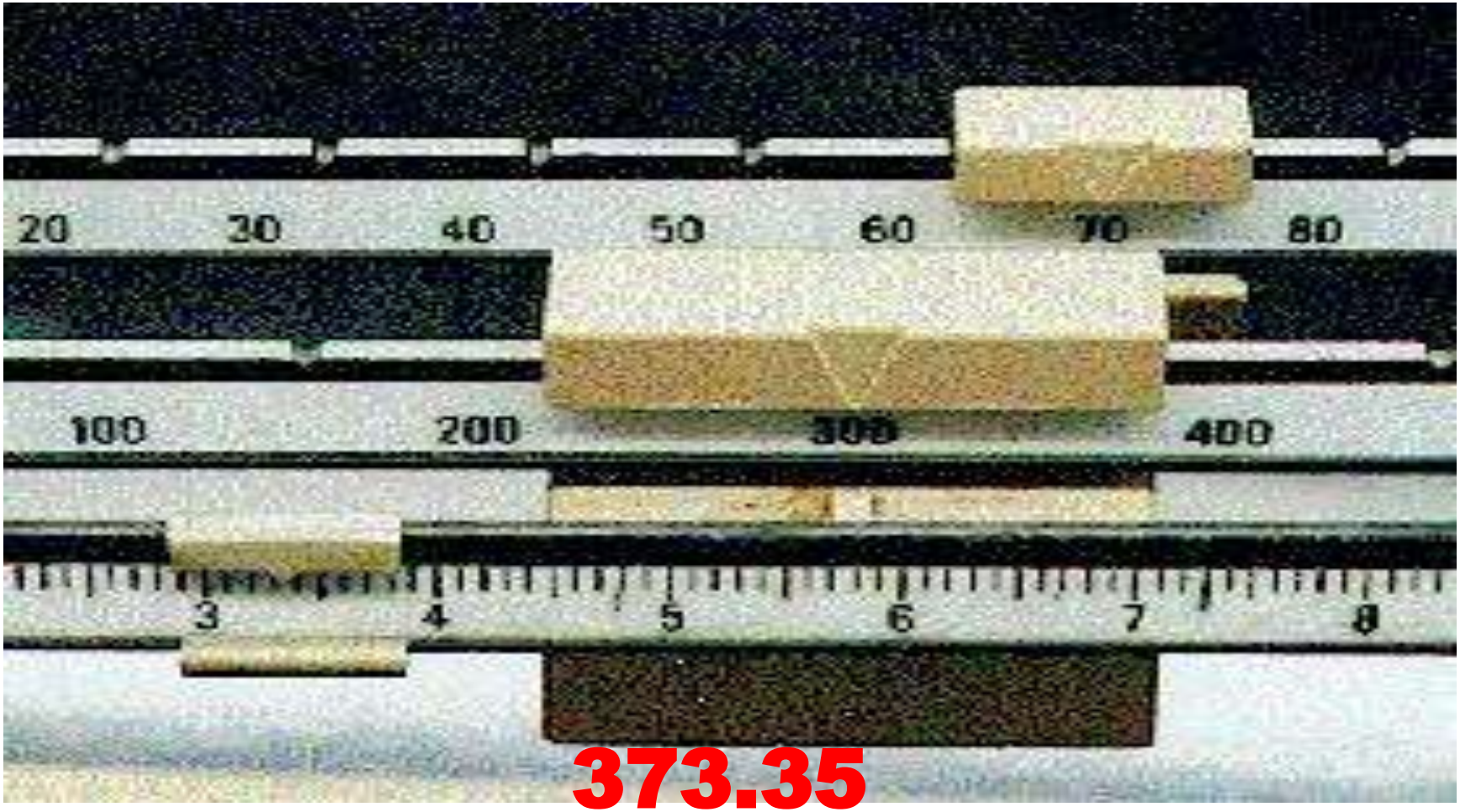
3.00 – 3.95 = +0.95

✚ indicates mass gain

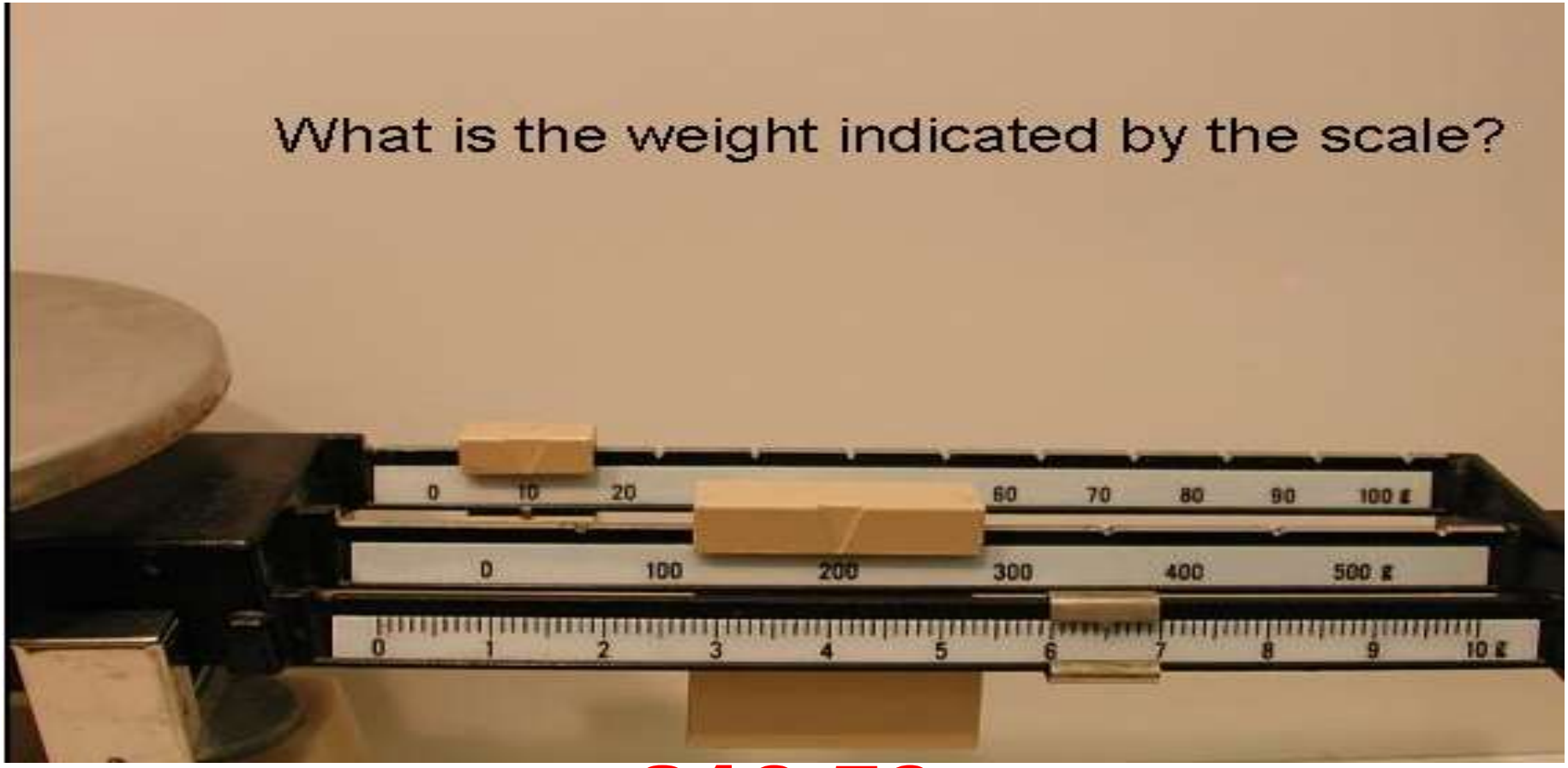
Triple Beam Balance: Measuring mass in grams (g) – use addition!



Example 2

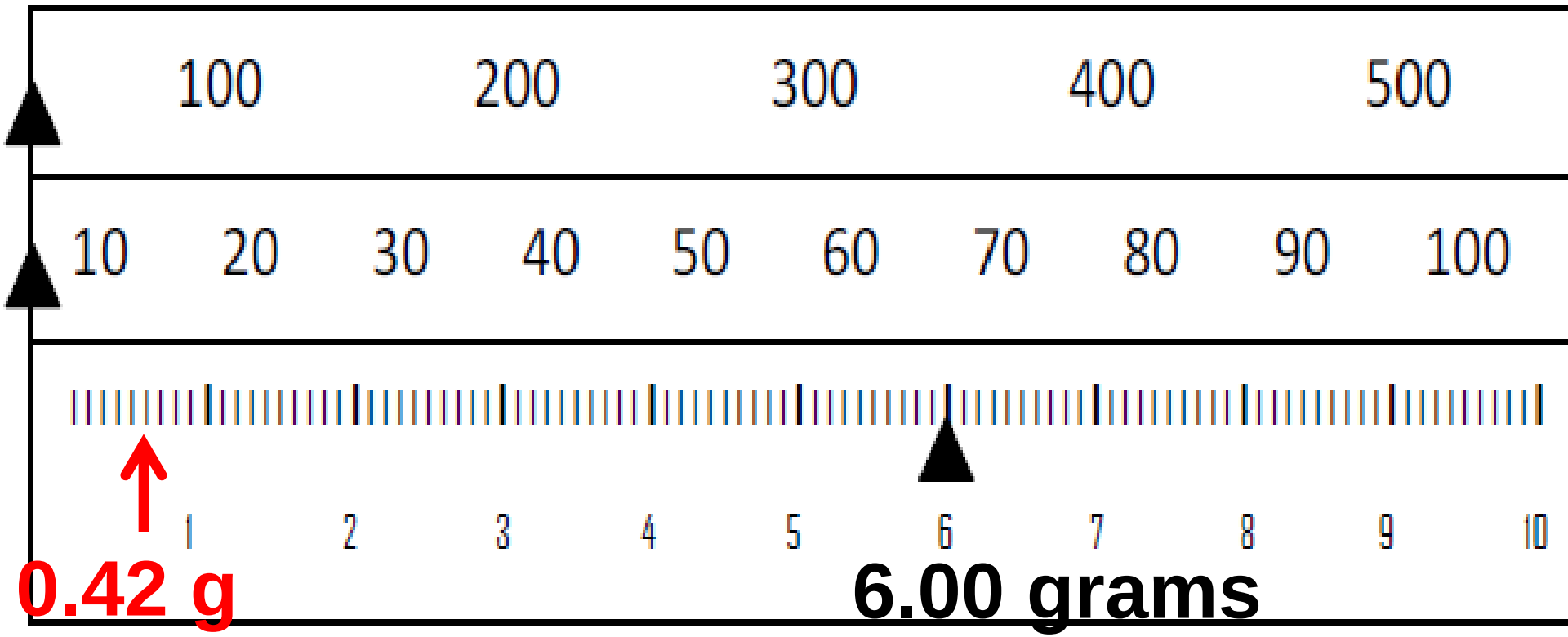


Example 3



216.50

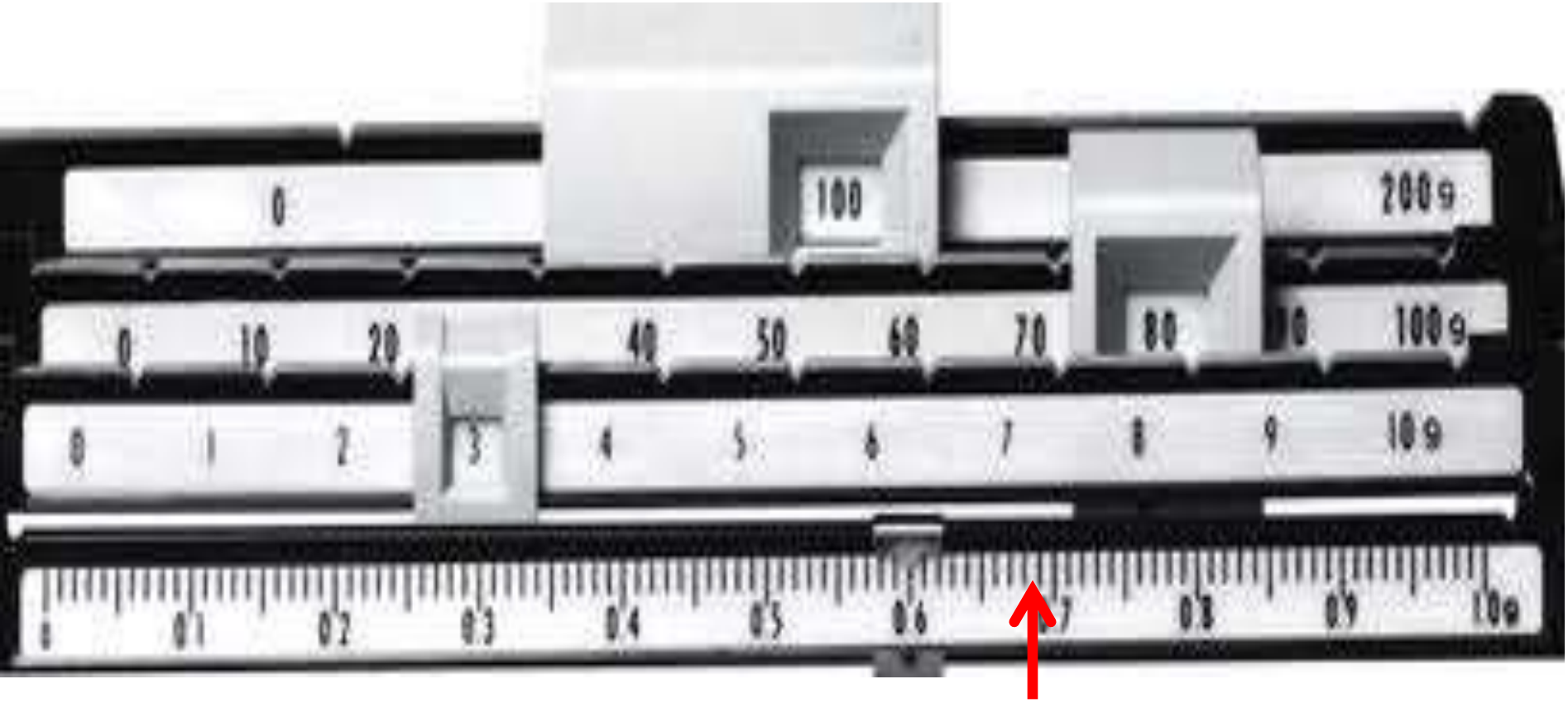
Triple Bream Example 3, **Uncertainty**



Uncertainty:

Smallest division on the scale = 0.1g. Uncertainty is ½ of smallest division: 0.1 ÷ 2 = 0.05. So the 6.00g measurement could really be as low as 5.95g or as high as 6.05 g.

Quad Beam



183.60

183.680

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 _____ .**
- The above prediction is a hypothesis.

Mass and Change Lab

Group	Initial Mass	Final mass	Change in mass (g)
Steel wool			
Ice			
Sugar			
Alka Seltzer			
Burnt steel wool			
Precipitate			

Mass and Change Lab

Group	Initial Mass (g)	Final mass (g)	Change in mass (g) (Final – Initial)
Steel wool	3.00	2.85	2.85 – 3.00 = - 0.15
Ice	3.00	3.95	3.95 – 3.00 = 0.95
Sugar			
Alka Seltzer			
Burnt steel wool			
Precipitate			

Calculating Change

Group	Initial Mass	Final mass	Change in mass (g)
Steel wool	3.00	2.85	-0.15

Final – Initial = Change

Final Mass – Initial Mass = Change

2.85 – 3.00 = -0.15

- indicates mass loss

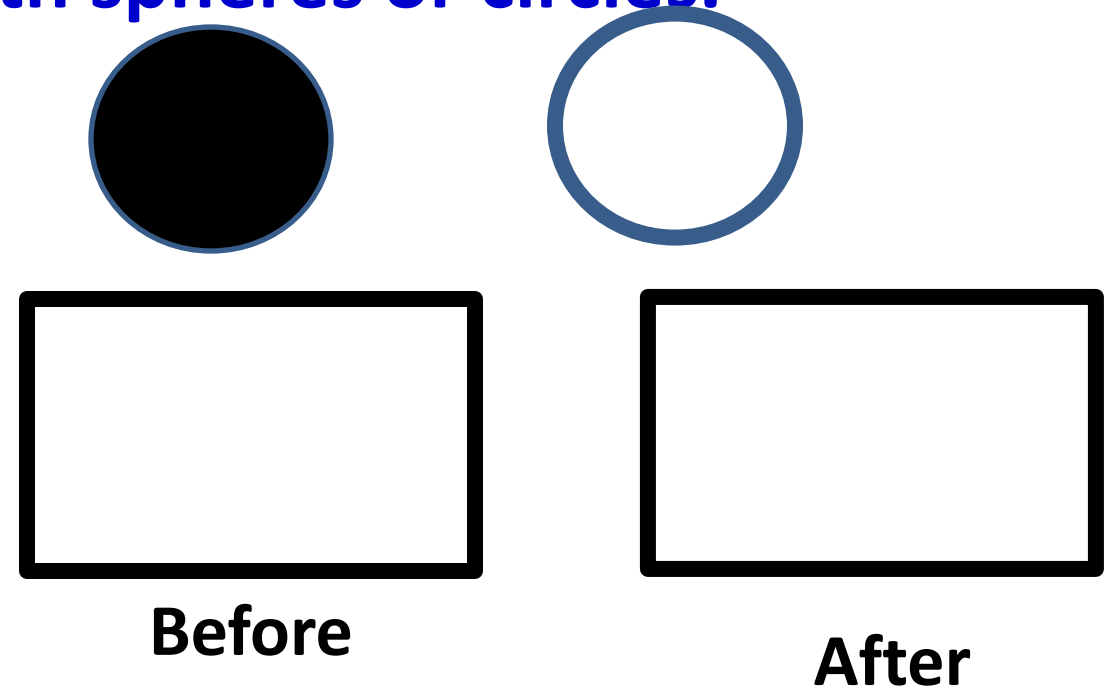
Final Mass – Initial Mass = Change

3.95 – 3.00 = +0.95

✚ indicates mass gain

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.**



Steel Wool Drawings

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

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.**

Melting Ice

- **Represent the particles of water in the solid and then liquid states.**

Ice

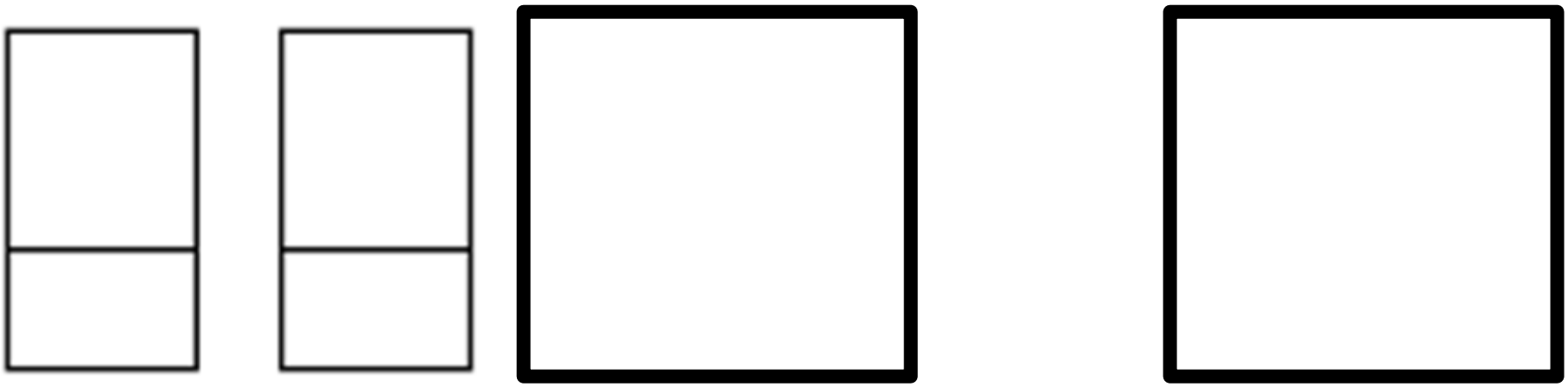
Melted Ice

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 _____.**

Sugar

- **Represent the particles of sugar and water before the sugar dissolved and after the sugar dissolved.**



Before

After

Solubility

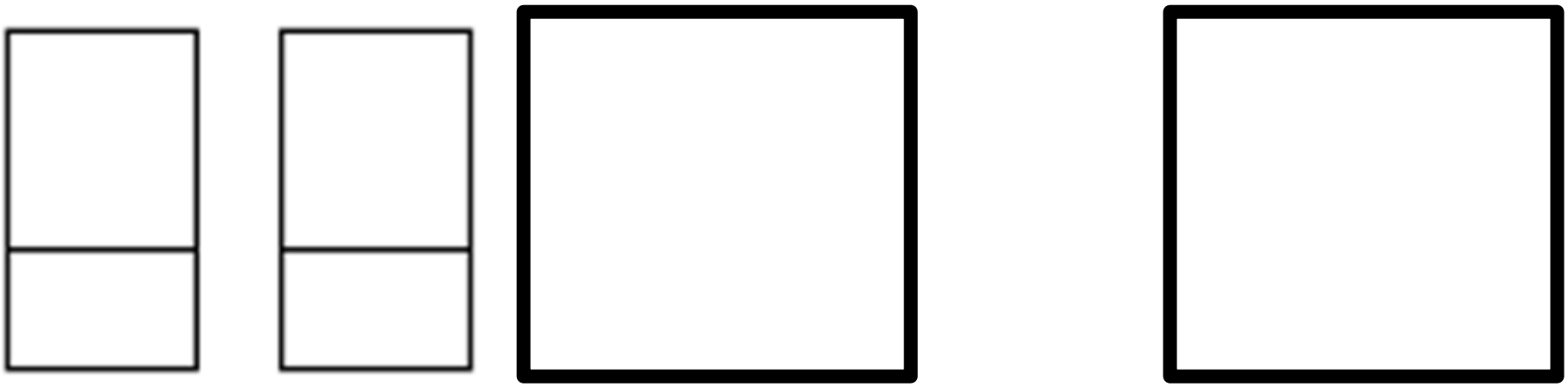
- **Solubility: How much something dissolves.**
- **Solvent - the thing that does the dissolving**
- **Solute - the thing that gets dissolved.**
- Sugar & water
  - Identify the solvent
  - Identify the solute.
- Alcohol & Water
  - Identify the solvent
  - Identify the solute.
- **Solvent - the thing in the larger quantity that does the dissolving**
- **Solute - the thing in the smaller quantity that gets dissolved.**

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 _____.**

Alka Seltzer

- **Represent the particles of Alka seltzer and water particles before the pill started fizzing and after the pill stopped fizzing .**



Before **After**

Precipitate

- Make a prediction:

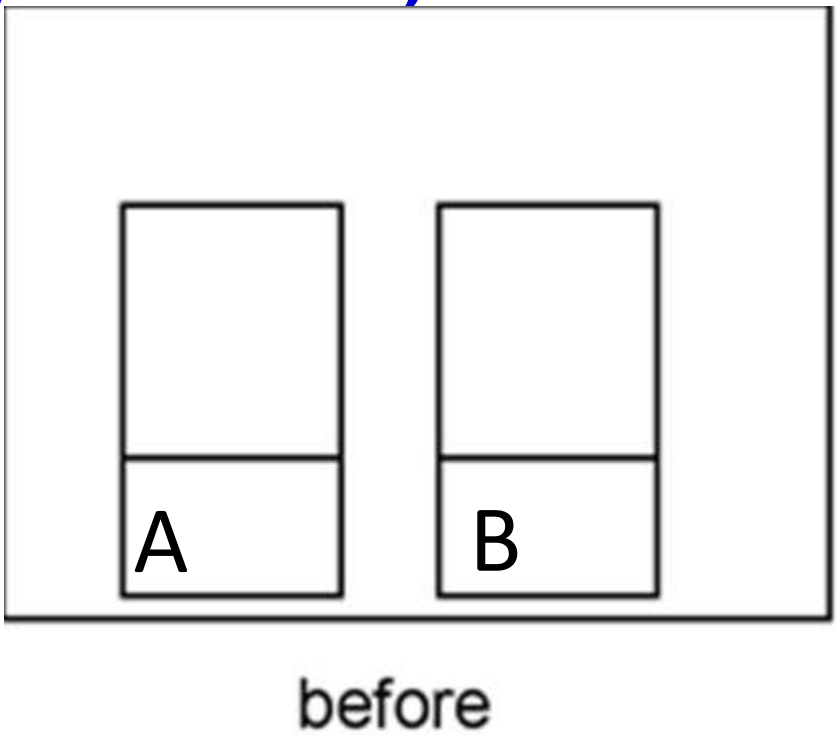
- **Does the mass change when the solid is formed?**

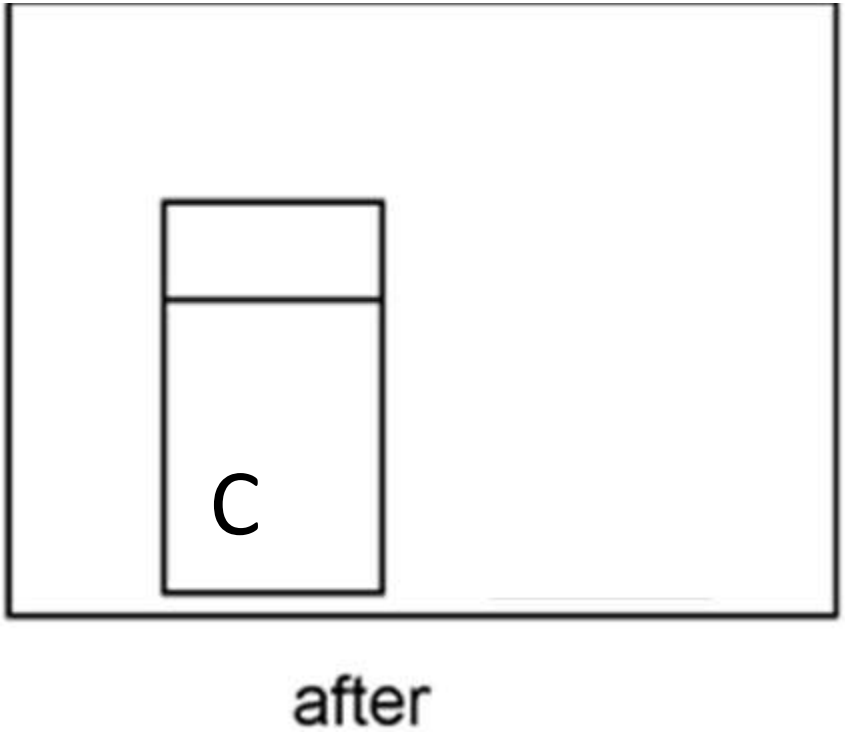
- Write a hypothesis in your lab book.

- **If the solid forms (because I mixed chemical A & B) then the mass will _____.**

Precipitate

- **Represent the particles of the substances in the solutions before mixing and after the precipitate has formed.**
- **Mixing Chem A + Chem B produces Chem C (the yellow stuff).**





Mass and Change Lab

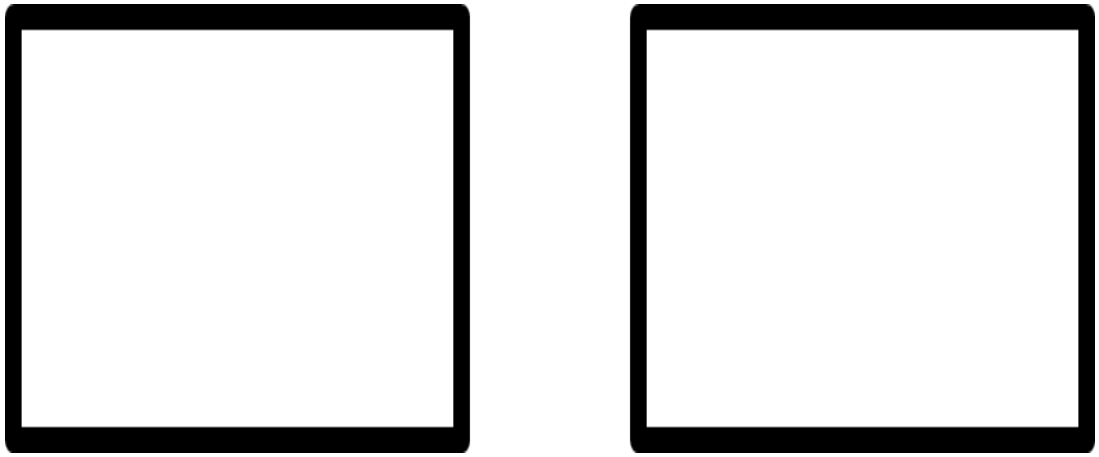
Group	Initial Mass	Final mass	Change in mass (g)
Steel wool			
Ice			
Sugar			
Alka Seltzer			
Burnt steel wool			
Precipitate			

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 _____.**

Burning Steel Wool

- Did the mass increase, decrease or stay the same.
- **If the mass increased, show in the after picture where the increased mass came from.**
- **If the mass decreased, show in the "after" picture where the missing mass went.**



Before **After**

System

- The system is what you are studying (or experimenting with) including the container that you put the stuff in.
- **If the system is open, stuff can enter and exit the system.**
- **If the system is closed, nothing can enter or exit the system.**

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		none	open
Ice	Ice melted		none	closed
Sugar	Sugar dissolved		none	closed
Alka Seltzer	Gave off gas, pill dissolved		decrease	open
Burnt steel wool	Color changed, looked different		increase	open
Precipitate	Yellow powder!!!		none	closed

Chemical or Physical Change

Physical change

Physical change: does not result in a new substance.

A physical change can usually be undone and result in the original composition of the substance.

Example: water can be frozen into ice then melted back to water.

Chemical change

A chemical change results in a new substance(s).

A chemical change is a chemical reaction.

Example: Burning (combustion) a match results in ash, water vapor and carbon dioxide

Chemical or Physical Change

Group	Change in Appearance		New substance(s)	Change
Steel wool stretched	Volume increased		No	Physical
Ice	Ice melted		**No (its still water)**	Physical
Sugar	Sugar dissolved		**No**	Physical
Alka Seltzer	Gave off gas, pill dissolved		**Yes (bubbles/ gas)**	Chemical
Burnt steel wool	Color changed, looked different, mass increased of steel wool		**yes**	Chemical
Precipitate	Yellow powder!!!		**Yes (chemical C)**	Chemical

1. The first model of the atom was proposed by Democritus and closely resembles the model we've used throughout this unit. **List the features of the model you have learned so far.**

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

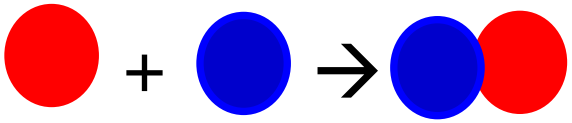
   Mass is a measure of the number of particles present.

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

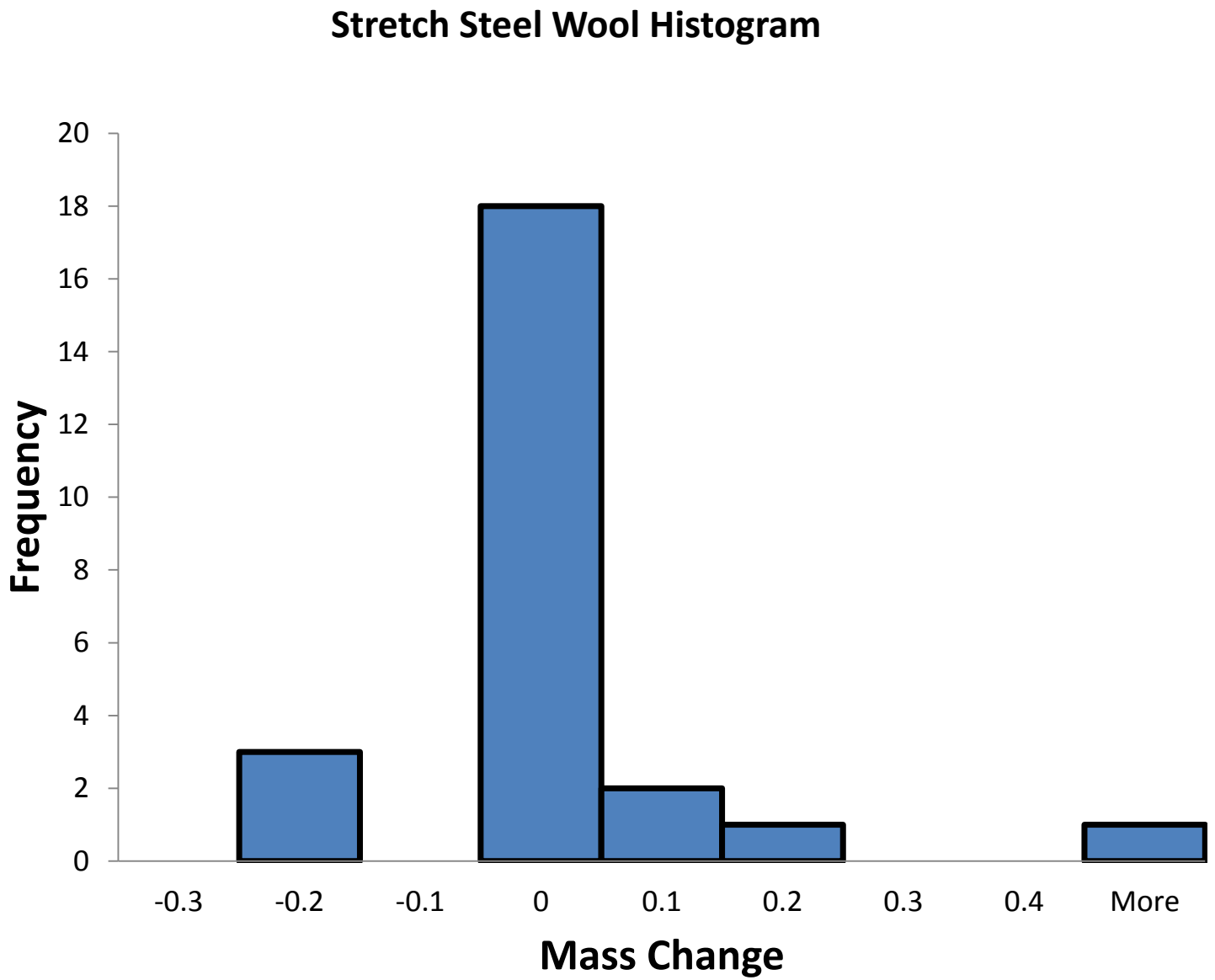
2. **The particles cannot be divided.**
3. **In a chemical reaction the amount of mass does not change, but the particles can rearrange and form new substances.**

 # 3 is a statement of the law of conservation of mass.

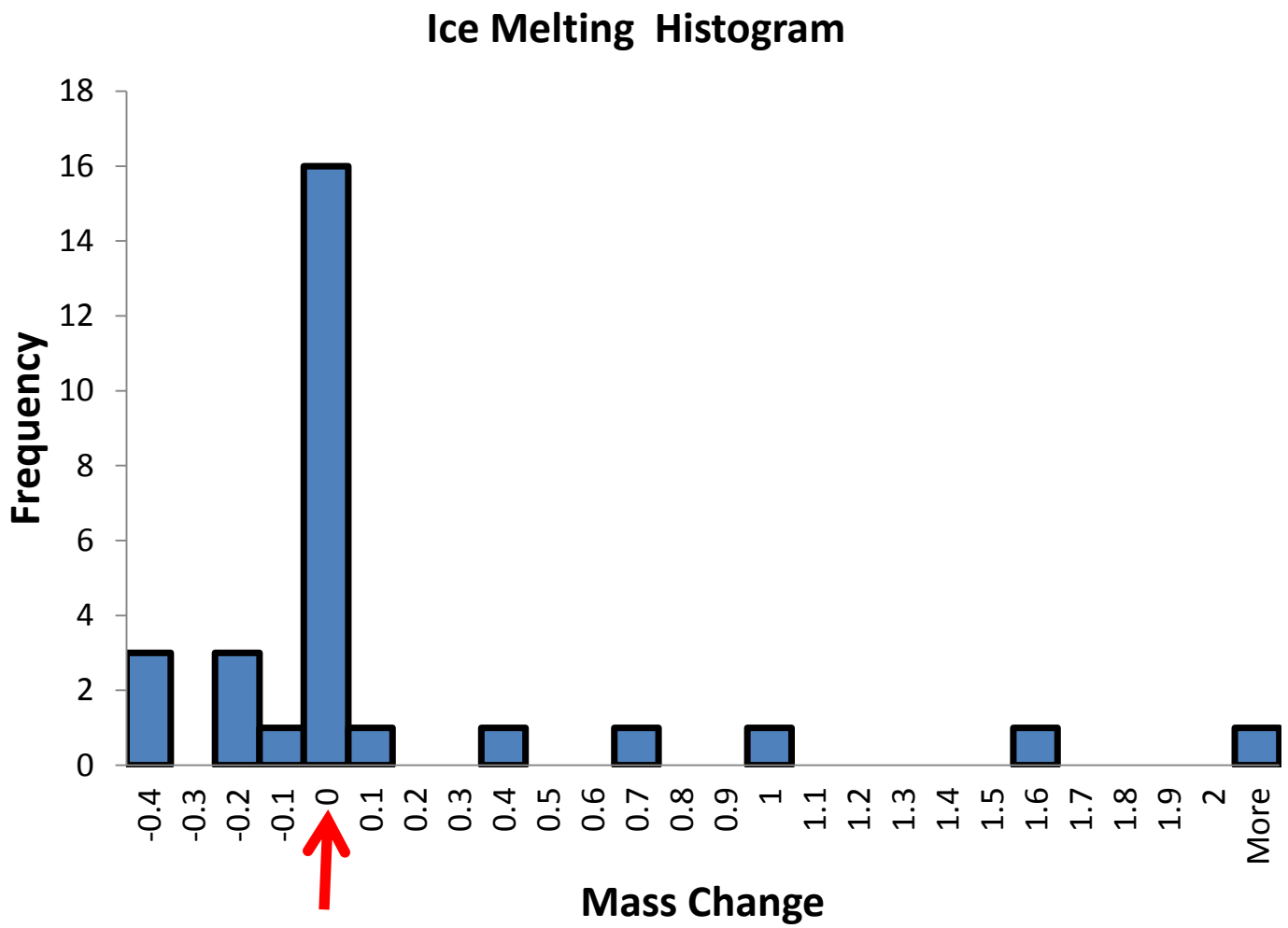
Example A + B → C



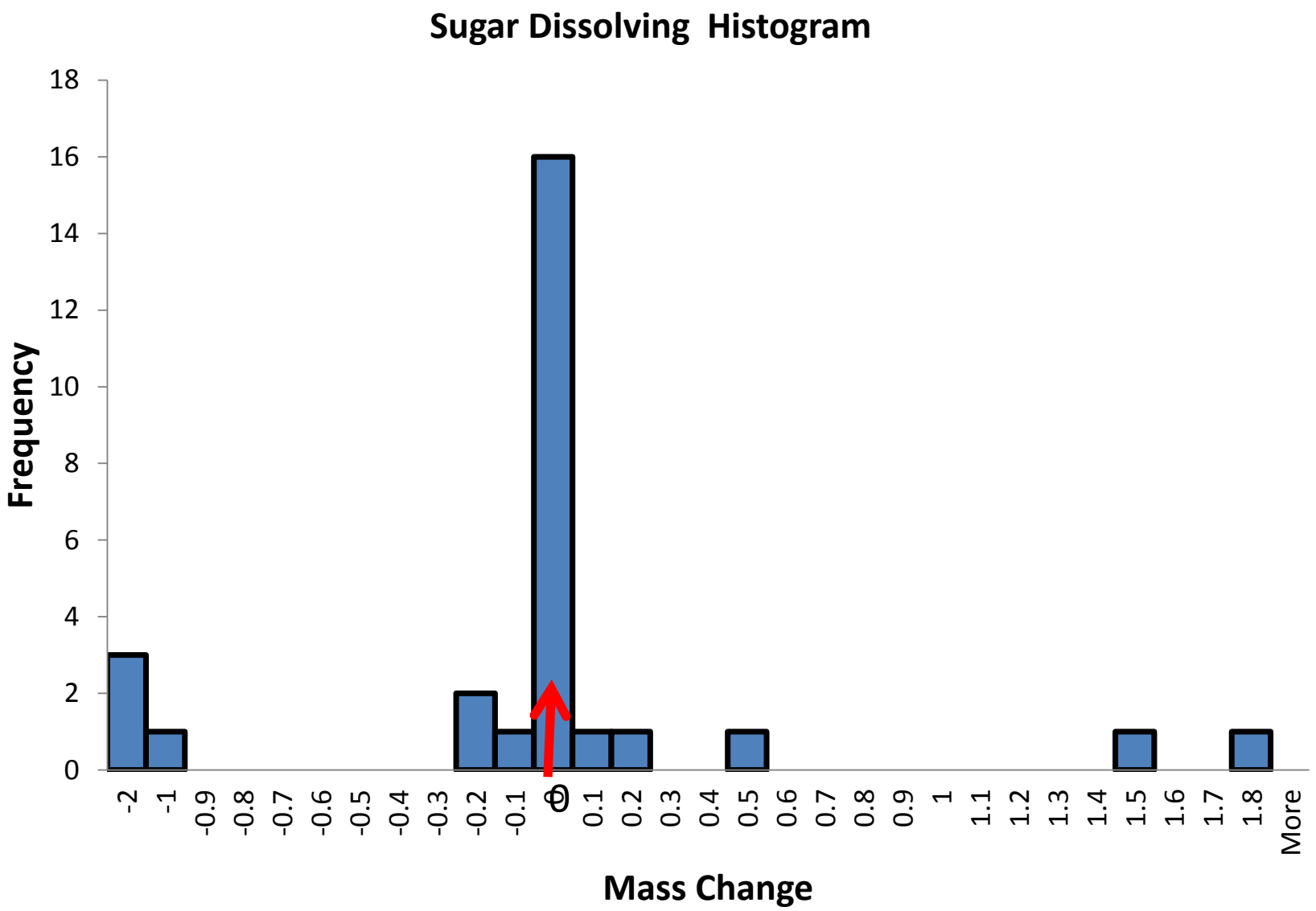
Histogram


Stretch Steel Wool Histogram
Frequency
20
18
16
14
12
10
8
6
4
2
0
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
More
Mass Change

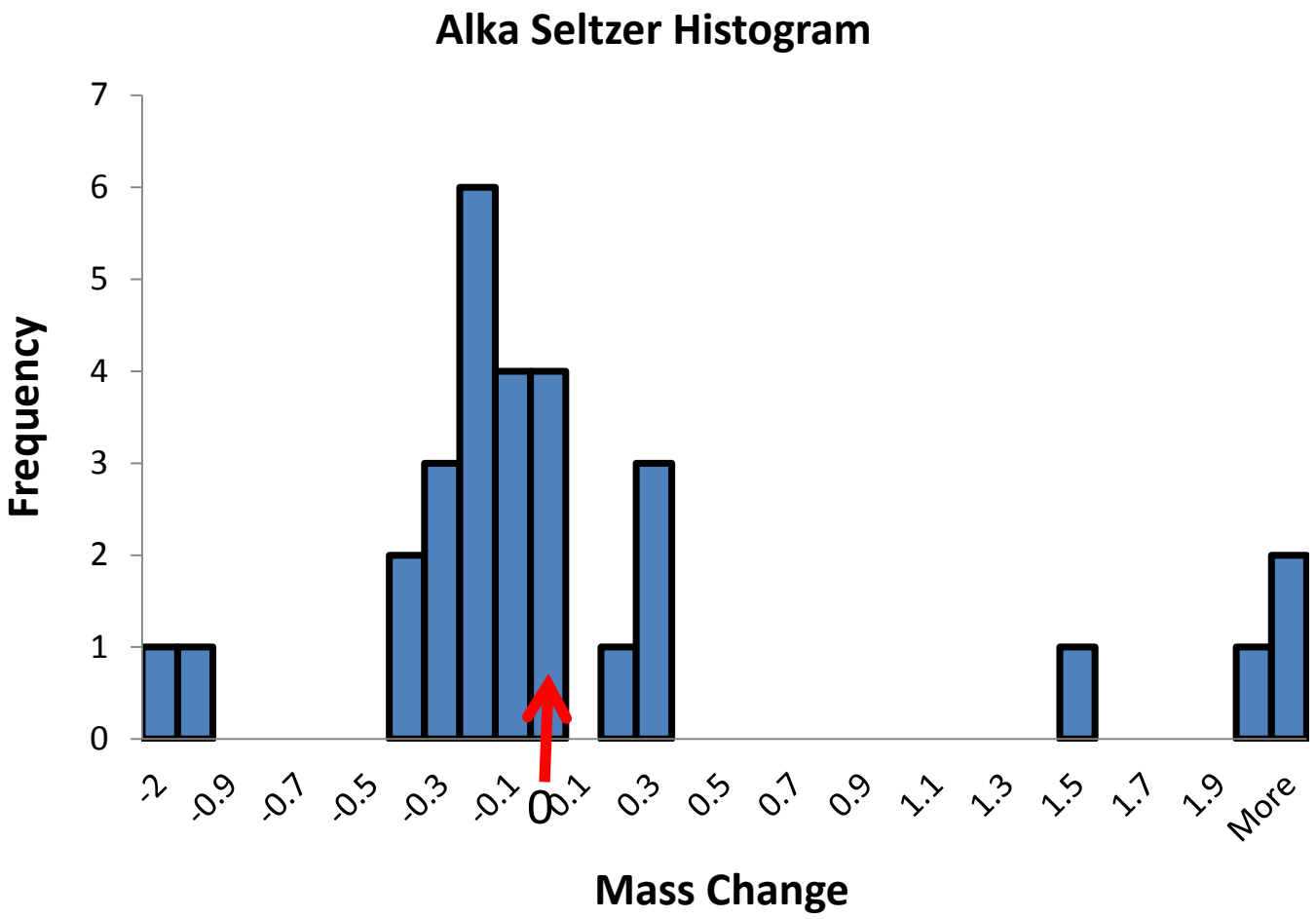
Histogram


Ice Melting Histogram
Frequency
18
16
14
12
10
8
6
4
2
0
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
More
Mass Change

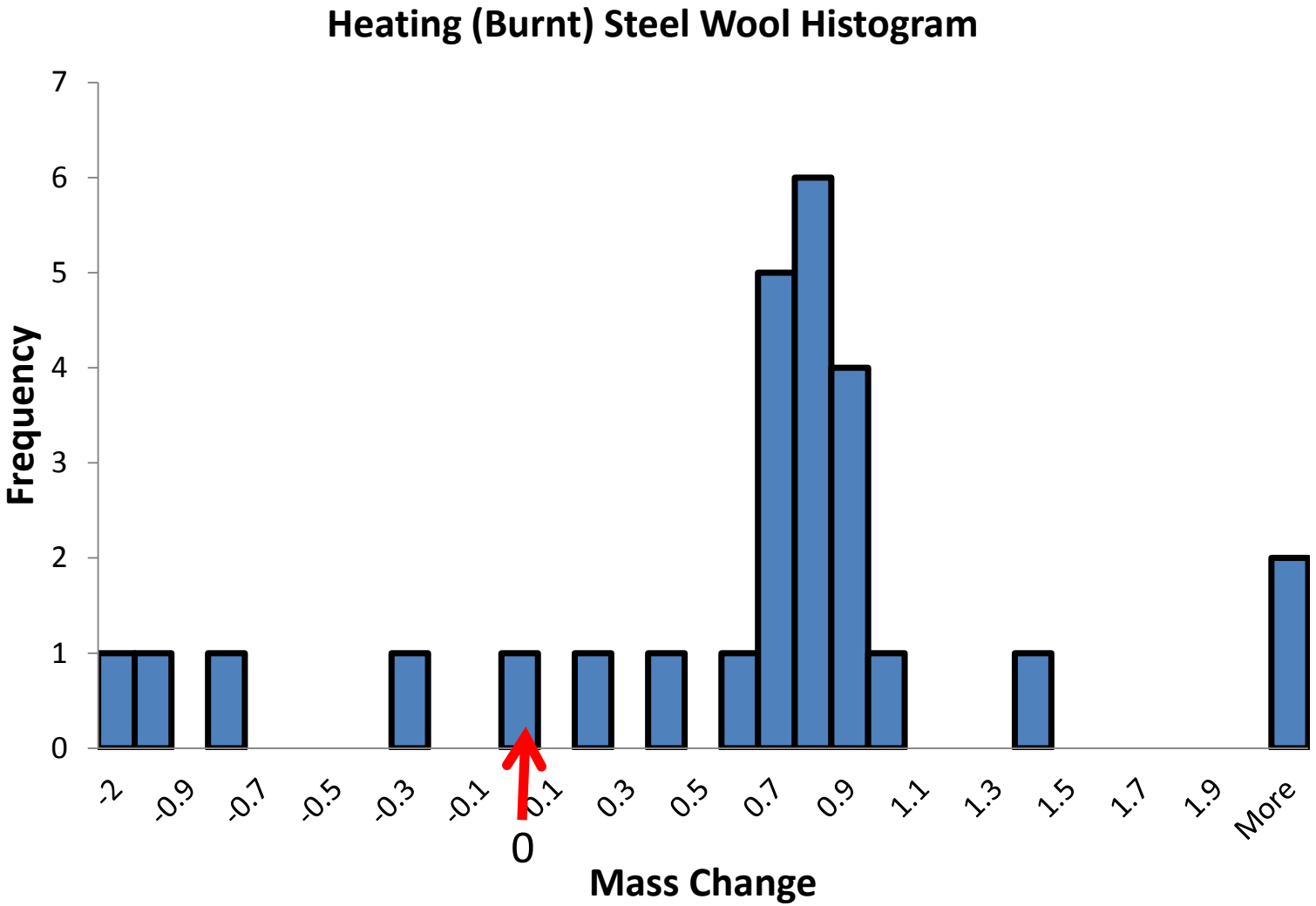
Histogram


Sugar Dissolving Histogram
Frequency
18
16
14
12
10
8
6
4
2
0
-2
-1
-0.9
-0.8
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
More
Mass Change

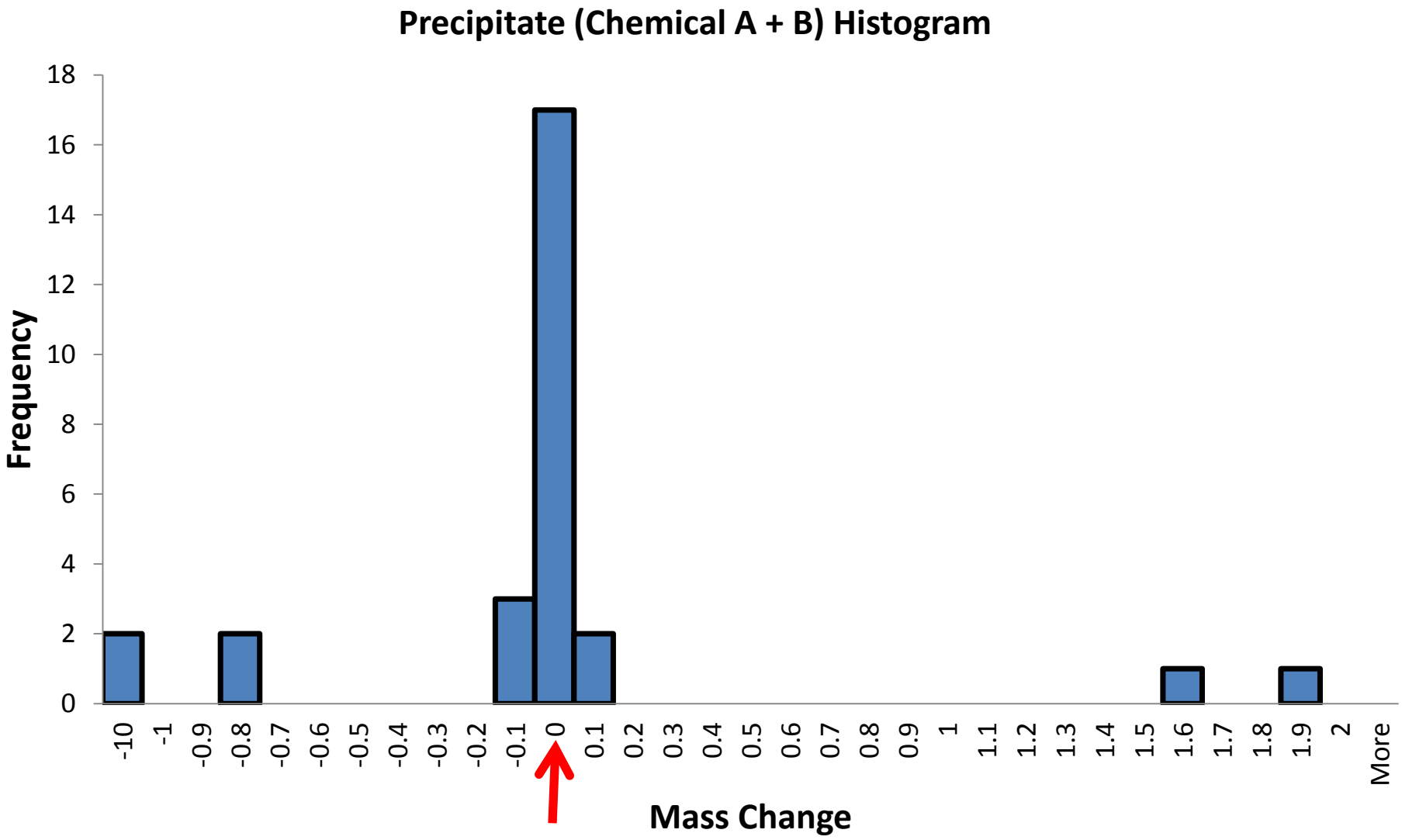
Histogram


Alka Seltzer Histogram
Frequency
7
6
5
4
3
2
1
0
-2
-0.9
-0.7
-0.5
-0.3
-0.1
0
0.1
0.3
0.5
0.7
0.9
1.1
1.3
1.5
1.7
1.9
More
Mass Change

Histogram


Heating (Burnt) Steel Wool Histogram
Frequency
7
6
5
4
3
2
1
0
-2
-0.9
-0.7
-0.5
-0.3
-0.1
0.1
0.3
0.5
0.7
0.9
1.1
1.3
1.5
1.7
1.9
More
0
Mass Change

Histogram


Precipitate (Chemical A + B) Histogram
Frequency
18
16
14
12
10
8
6
4
2
0
-10
-1
-0.9
-0.8
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
More
Mass Change