Lab: What Does Iron Man Eat for Breakfast?

FOR THE TEACHER

Summary
In this lab students will compare and contrast mixtures and solutions. They will be tasked with extracting iron from various breakfast cereals. They will then conclude which cereal would be the healthiest for Iron Man to eat for breakfast.

Grade Level
Elementary and Middle School

Objectives
By the end of this lab, students should be able to
- Differentiate between a mixture and a solution.
- Apply magnetism to extract metallic elements from a mixture.
- Create a hypothesis based on given information and prior knowledge.
- Collect data and then analysis it to make a supported conclusion statement.

Chemistry Topics
This lab supports students’ understanding of
- Separating Mixtures
- Physical Properties
- Solutions
- Mixtures
- Solute & Solvent

Time
Teacher Preparation: 15-20 minutes
Lesson: 2 hours (two class periods needed)

Materials (per group)
- 3 Plastic quart sized bags
- 1 cup of each of the following type of cereals (or generic brand):
  - Total
  - Fruit Loops
  - Cheerios
- Water
- 1 paper plate
- 1 Magnet

Other (for teacher use):
- 1 Cup Measuring Cup
- Colored paper or cardstock (for card sort) (optional)
- Copies of the ingredient lists for each cereal

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Students should wash their hands thoroughly before leaving the lab.
- When students complete the lab, instruct them how to clean up their materials and dispose of
any chemicals.

- Do not consume lab solutions, even if they’re otherwise edible products.
- Food in the lab should be considered a chemical not for consumption.

**Teacher Notes**

- At the elementary level, students are expected to differentiate between mixtures and solutions and recognize that mixtures possess some of the properties of its ingredients. In this lab, I suggest that students begin by completing a card sort about mixtures and solutions (included for download). Any time I give my students paper that I’m planning on keeping or re-using, I laminate it. The card sort can be completed at another time or can be used as a warm-up activity for the lab.
- Note this lab is completed over a two-day period.
- Placing students in small groups or partners is recommended for this lab.

**Background Information:**

- A *solution* is a liquid mixture that contains two components, a *solute* and a *solvent*. The solute is uniformly distributed throughout the solvent. A good example is salt and water. Water is considered as the *Universal Solvent*. When mixing salt and water, the salt molecules still exist; they are being suspended between the water molecules.
- A solution can always be separated through physical means; no chemical changes are needed.
- A solution is often harder to separate than a mixture. Boiling and distillation are common ways to remove the solvent from the solute. [This video](#) can be helpful for students to visualize mixtures and solutions using several examples.
- A solution that you can easily make in class is Kool-Aid. The Kool-Aid powder completely dissolves in water and does not settle out.
- A *mixture* is two or more types of matter combined together. A great classroom example of a mixture to use is trail mix. Students can easily see that there are different components that make up the trail mix and that one component can be easily separated from the rest.
- Classroom Management: This is a lab that can get messy very quickly. Before beginning the lab (I recommend the day before), have a class discussion about properly cleaning lab stations and managing materials appropriately. Also remind students that any food used in the lab cannot be eaten! It helps if at the end of the lab you give each student one of the uncontaminated food items. For example, a small cup of Cheerios for each student once the lab is completed and all stations are cleaned.
- On the day of the lab, model what you expect students to do in terms of how to properly handle the magnets and bags of cereal. Demonstrate crushing the cereal and have a discussion on why it is not appropriate for them to try to punch or “pop” the cereal bags.
- To help with time management and cleanliness, have the cereal pre-measured into each of the bags. Since you are the one controlling the cereal pouring, you are much less likely to find Cheerios or Fruit Loops stuck everywhere for the next few weeks.
- Provide students with sentence starters and hypothesis and conclusion examples to help model your expectations to them. This lab does not require the collection of any quantitative data. In order to have quantitative data, the teacher may wish to create an end of class demo in which he/she extracts the iron from the plastic bags to a petri dish or small container, and then weighs the iron to compare the masses of iron in each cereal, or compared to the nutritional information written on the side of the box.
- Photocopies of the ingredient lists from the side of the cereal boxes will be needed for the students to use during the lab.
- Differentiation: for high level or GT students, you can have them research why companies fortify our foods and common minerals foods are fortified with. You may also have them collect data and compute the percentage of iron present in each cereal based on mass.
FOR THE STUDENT

Lesson

What Does Iron Man Eat for Breakfast?

Background
A lot of the foods we eat are fortified with minerals that our bodies need in order to function correctly. When food is fortified it means that the manufacturer deliberately added an ingredient, often of nutritional value, to the food. One food that is commonly fortified is the cereal you eat for breakfast! The mineral commonly added to cereal is iron, which your body uses to make red blood cells.

We’ve already looked at the meaning of mixtures and solutions. A mixture is two or more types of matter combined together. A solution is a liquid mixture that contains two components, a solute and a solvent. The solute is uniformly distributed throughout the solvent. Each piece of cereal is an example of a mixture – it contains different ingredients, which together make your yummy breakfast.

Pre-lab Questions
1. As a review, complete the Mixtures and Solutions card sort with your partner. When you think you have them sorted correctly, raise your hand so that your teacher can come check them.
2. Explain why cereal is considered a mixture. Then, name two more solids that are also mixtures.
3. Why do you think cereals are fortified with iron?
4. Now, working with your partner, make a hypothesis about your cereal. Use the sentence starter and fill in the blank below to help you:

I think that the cereal with the most iron will be ____________ because ______________.

Objective
Today, you are going to be working with your lab partner to try to extract iron from your assigned cup of cereal. Each group will have three different brands of cereal to analyze. You are going to compare the amount of iron in different types of cereal.

Materials
- 3 Plastic quart sized bags containing 1 cup of each of the following type of cereals:
  - Total
  - Fruit Loops
  - Cheerios
- Water
- 1 paper plate
- 1 Magnet

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- Follow the teacher’s instructions for clean-up of materials and disposal of chemicals.
- Do not consume lab solutions, even if they’re otherwise edible products.
- Food in the lab should be considered a chemical not for consumption.
Procedure

Day One

1. Look at the ingredient lists for your three cereals. Next to each cereal’s name, record the first three ingredients that are listed in your data table below.
2. Look at the other ingredients listed for your cereals. Are there any ingredients listed that you do not recognize? If so, write down three different examples in your data table below.
3. Collect your three different plastic bags filled with different cereals. Take out one piece from each bag and place it on the plate. Hold the magnet over each piece of cereal. Record your observations on your lab sheet.
4. Now, break each piece of cereal on the plate into smaller pieces. Hold the magnet over each type of cereal again. Record any observations on your lab sheet. Do you notice any differences using the smaller pieces of cereal?
5. Add a thin layer of water to your plate. Again, hold the magnet over the pieces of cereal. Try slowly moving the magnet away from the cereal. What do you notice? Record any observations on your lab sheet.
6. Now you need to crush your bags of cereal. First, you need to push most of the air out of the bag and make sure the bag is sealed tightly so we don’t make a mess. When crushing your cereal, you DO NOT need to repeatedly punch the bag. This can cause the bag to break. Instead, use the palm of your hand to apply pressure to the bag. Move your hand in a circle while pressed to the bag to crush all the cereal.
7. Once your cereal has been crushed and approved by the teacher, add 2 cups of water to each cereal bag. You will now have a cereal soup. Move the bag gently to mix the water and crushed cereal. Make sure there are not any holes, if there are holes, double bag your cereal.
8. Write all group member names on the bags using a marker and place.

Day Two

1. Collect your three cereal bags. Do you notice any changes in how your cereal looks today compared to yesterday? Record observations in the data table below.
2. Place each bag of cereal flat on the table (don’t open it!) Very slowly move the magnet over the bag. Record observations in the data table below.
3. Very carefully, while one group member holds the magnet to the bag, another member needs to pick the bag up by the zippered end.
4. Move the bag so that the zipper is the highest point, and the water-cereal mixture is all at the bottom of the bag. Make sure the magnet is touching the bag the entire time! Move the magnet towards the zipper, while in contact with the bag. Record observations in the data table below.
5. Repeat steps 2-4 for each bag of cereal.

Data: Day 1

<table>
<thead>
<tr>
<th>Type of Cereal</th>
<th>First Three Ingredients</th>
<th>Three Ingredients You Don’t Recognize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheerios</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit Loops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Cereal</td>
<td>Magnet held over full piece of cereal</td>
<td>Magnet held over broken pieces of cereal</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Cheerios</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit Loops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data: Day 2

<table>
<thead>
<tr>
<th>Type of Cereal</th>
<th>Observations of cereal on Day 2</th>
<th>Magnet held over flat bag</th>
<th>Magnet held over cereal while holding bag by zipper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheerios</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit Loops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis

1. Was your hypothesis correct? Why or why not?

2. Why was a magnet helpful in this experiment?

3. Can you think of any other metals that you eat? List them below.

Conclusion

1. Use this sentence starter to help you write a conclusion paragraph (4-5 sentences) about the results of your experiment:

   After completing this experiment we conclude that _________ has the most iron because we can see from our data...
   ...Based on our results we think the best cereal for Iron Man to eat for breakfast is _______