Lab: Metallic Breakfast

FOR THE TEACHER

Summary
In this lab, students will separate iron filings from iron-fortified breakfast cereals. Students will use the recorded data to conduct percent composition calculations.

Grade Level
High or Middle School

Objectives
By the end of this lab, students should be able to
- Successfully separate a mixture.
- Collect data using an electronic scale.
- Determine percent composition of components in a mixture.

Chemistry Topics
- Mixtures
- Separating Mixtures
- Percent Composition

Time
Teacher Preparation: 20 minutes
Lesson: 60 minutes

Materials
- Iron-fortified breakfast cereals (one “healthy” and one “kids” cereal – suggestions below)
- 400-mL beaker
- Distilled water
- Magnetic stirrer with a stirring bar or another strong magnet
- Electronic balance (two-decimal reading is recommended)
- Weighing boat
- Mortar and Pestle

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.
- Food in the lab should be considered a chemical not for consumption.

Teacher Notes
- When choosing the cereals, I would recommend using General Mills Total Cereal as the “healthy” option and either Post Cocoa Pebbles or General Mills Lucky Charms as the “kids” option. These cereals will give you a big difference in the amount of iron that is collected.
• Depending on the intensity of the magnetic stirrer or magnet used, you may want to wrap it with aluminum foil to reduce the stirrer’s ability to collect the iron filings. Plastic wrap can also be used.

• Crushing the cereal with a mortar and pestle will speed up the separation process, however if you do not have a way to crush the cereal you can proceed without completing this step. In this case allow 15-20 minutes before removing the magnet from the mixture.

CROSS-DISCIPLINARY EXTENSIONS

Connect to Reading
• Have students research the history of cereal and how it came to be. Who is credited with being the first cereal company and where is it located? Is that company still in existence and producing cereal today? If so, what are some of the cereals they are producing? How different is the cereal of today when compared to the first cereal(s)? Is cereal a world-wide breakfast food or is it primarily consumed in the US?

Connect to Social Studies
• What is the daily amount of iron recommended by the FDA? What percentage of this recommended amount is given in the “kid” cereal? What percentage is given in the “healthy” cereal? What occurs if you do not ingest the daily recommended amount? What occurs if you ingest more than the daily recommended amount?

FOR THE STUDENT

Metallic Breakfast Lab

Background
Did you know that there are metals in your breakfast cereal? Today you will separate the metal from the cereal and determine just how much metal is present.

Materials
• Two of breakfast cereals
• 400-mL beaker
• Distilled water
• Magnet
• Electronic Balance
• Weighing boat
• Mortar and Pestle

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 cleanup of materials and disposal of chemicals.
• Food in the lab should be considered a chemical not for consumption.

Procedure
1. Place the magnet on the electronic balance and measure the mass of the magnetic stirrer. Record the mass and draw a simple sketch of the magnet
in the space provided.

2. Place the weighing boat on the electronic scale, and zero the scale so it reads “0.00g.” Add about 30 g of the “kid” cereal to the weighing boat. Record the actual amount in the data table.

3. Transfer the cereal to the mortar and crush it into tiny granules using the pestle.

4. Next transfer the cereal to the 400ml beaker. Add distilled water until the beaker is about halfway full.

5. Using the magnet as a stirrer, gently mix the cereal and water for about 5 minutes.

6. Retrieve the magnet and observe the black iron filings attached to it. Draw what you see in the “sketch” column of the Data Table.

7. Place this magnetic stirrer on the electronic balance to find the mass of the stirrer with the iron filings attached to it. Record the total mass in the data table.

8. Empty and the beaker as instructed by your teacher.

9. Complete steps #2-8 again using the “healthy” cereal.

Data Tables

<table>
<thead>
<tr>
<th>Item</th>
<th>Mass (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnet</td>
<td></td>
</tr>
<tr>
<td>Kid Cereal</td>
<td></td>
</tr>
<tr>
<td>Magnet with collected Iron Fillings from the Kid Cereal</td>
<td></td>
</tr>
<tr>
<td>Healthy Cereal</td>
<td></td>
</tr>
<tr>
<td>Magnet with collected Iron Fillings from the Healthy Cereal</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnet</td>
<td></td>
</tr>
<tr>
<td>Magnet with collected Iron Fillings from the Kid Cereal</td>
<td></td>
</tr>
<tr>
<td>Magnet with collected Iron Fillings from the Healthy Cereal</td>
<td></td>
</tr>
</tbody>
</table>
Analysis

1.) Calculate the amount of iron that was removed from the “kid” cereal:

2.) Calculate the amount of iron that was removed from the “healthy” cereal:

3.) Compare your answers to questions 1 & 2. Was there more iron in one of the cereals? Which one? Does this additional iron make the cereal better or worse for you to ingest?

4.) Is there any correlation between the amount of iron in a “kid” cereal and the amount of iron in a “healthy” cereal? Research at least two types of “kid” cereal and two types of “healthy” cereal types to determine if your hypothesis is correct.

5.) Many cereals are listed as being “fortified.” What does this mean? Give an example.

6.) Is cereal the only food that contains iron? What other foods contain iron? Are there other metals that we ingest? If so, what are the other metals and what foods are they found in?

7.) Determine the percent composition of the iron in each of the breakfast cereals. Pretend that there are only two ingredients in the cereal, iron and everything else. Use the formula below:

\[ \text{Percent Composition} = \frac{\text{Mass of iron}}{\text{Total mass of the cereal}} \times 100 \]