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# K-12 Partnership Lesson Plan

# Brook Wilke

# *Iron in Cereal*

## Overview

Many breakfast cereals are fortified with iron, which is essential for transport of oxygen in blood throughout human bodies. The iron is simply sprayed on the cereal and can be separated by physical processes. Students in this lesson use bar magnets to extract iron from crushed up breakfast cereals. Five different cereals are used for the experiment including those with different iron concentrations based on nutritional information. Iron extracted from each cereal type is weighed and compared to the other cereals and the nutritional information on the box.

**Objectives**

At the conclusion of the lesson, students will be able to:

* Extract iron from fortified breakfast cereal
* Conduct an experiment to determine which cereals have the most iron
* Separate a mixture of cereal and water into magnetic and non-magnetic categories

**Length of Lesson**

1 hour

**Grade Levels**

Elementary

**Standards covered (NGSS)**

Disciplinary Core Ideas:

* **5-PS1-3**: make observations and measurements to identify materials based on their properties

Cross Cutting Concepts:

* Patterns

Science and Engineering Practices

* Asking questions and defining problems
* Planning and carrying out investigation
* Analyzing and interpreting data
* Engaging in argument from evidence

***Previous Michigan Standards Met:***

* **IV.2.e2 (PCM 2a):** prepare mixtures and separate them into their component parts
* **I.1.e2 (C 2):** develop solutions to problems through reasoning, observation, and investigations.
* **IV.1.e1 (PME 1):** classify common objects and substances according to observable attributes/properties

**Materials**

* 5 types of fortified cereal (2 cups of each)
* 5 liters of water
* 5 plastic or glass containers at least 2 liters in size
* 10 quart size Ziploc bags
* 5 measuring cups (1 cup size)
* 5 bar magnets
* 5 small plastic cups
* 1 super magnet
* 1 electronic scale measuring to the 0.001 gram

**Background**

### *Strategy:* *inquiry cycles*: finding and explaining patterns in data (arguments from evidence); *experimental inquiry*: predict-explain-observe-explain (POE)

### *Observations, patterns, and explanations*

### *Introduction/Anticipatory Set*

Prior to this lesson, students should have learned about magnetism and that only certain metals attract to a magnet. Many breakfast cereals are fortified with iron, an essential mineral for transporting oxygen through the human body. The iron is part of a mixture with the cereal and can be physically separated using magnetic force. Based on nutritional information, some cereals have more iron in them than others. This experiment will estimate how much iron is in each of five different breakfast cereals.

### Activities of the session

1. Divide the class into five different groups.
2. Each group will be responsible for extracting the iron from one of the five cereals.
3. For each group:
4. Measure out 2 cups of the cereal and place in a plastic Ziploc bag.
5. Close the bag and crush up the cereal using hands and desks until the cereal is finely ground.
6. Measure out 1 liter of warm water and place in the large container.
7. Pour the crushed cereal into the water.
8. Place a Ziploc bag around a bar magnet and use the magnet covered with the bag to stir the mixture of cereal and water without touching the container with the magnet.
9. Students should take turn stirring the mixture for 15 minutes as iron particles collect on the plastic bag around the magnet.
10. Remove the magnet wrapped in the bag from the mixture, keeping the iron on the bag
11. Hold the bag and magnet over a plastic cup and remove the iron particles from the outside of the bag by scraping or removing the magnet from the bag vertically.
12. The teacher will perform the same process with the super magnet for 1 minute in each of containers to collect any remaining iron.
13. Collect all iron in the separate plastic cup
14. Measure the mass of the iron collected from each of the cereals using a sensitive scale by weighing the cup empty and with the iron particles in it.

**Conclusion**

As a class, make a table of how much iron was collected from each type of cereal. Does the outcome of the experiment match with the nutritional information on the box? If not, what are some reasons that they do not match up? (These could include different serving sizes, differences in how well the cereal was crushed up, or incomplete separation of the iron from the cereal.) Could cereals contain too much iron, which might not be healthy for humans?

**Extensions and Modifications**

Students can calculate how much iron they ingest by eating cereal in an entire year by calculating how much iron is in the cereal and estimating how much cereal they eat in a year.

**Post-lesson Comments and Reflection**

*On 1/24/07, the 4th grade classes at Brandon Elementary performed this experiment. We examined Wheaties, Life, and three Spartan brand cereals (Fruit Loops, Frosted Flakes and Honey Nut Cheerios). Due to the small amounts of iron found, we were not able to quantify how much was there, but were able to estimate the amount visually. We used a white paper towel to wipe off the magnet bag, which subsequently showed the black iron. We used an extra powerful magnet to separate any extra iron in the cereal. Both classes came up with the same results. Wheaties had the most iron, Spartan Cheerios 2nd, Spartan Fruit Loops 3rd, Life 4th and Spartan Frosted Flakes Last. Very little was found in the frosted flakes. According to the box, the Wheaties and Life should have had the most iron (45% per ¾ cup serving), then Cheerios and Frosted Flakes (25% per ¾ cup serving), then Fruit Loops (25% per 1 cup serving). It would be a good idea to include a cereal that has 100% of the daily recommended value per serving as a comparison.*

*Several students made the comment that the cereal was disgusting after mixing it with water and seeing the iron. As a class, we talked about what food items naturally have iron in them and how we could find out this information.*