

Name:

SCI 105

How did lead get into Flint's Water? – Chemical Reactions

Note to the instructor

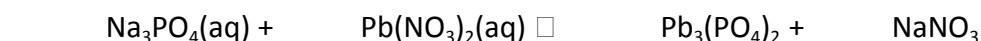
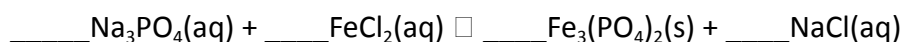
This case study is designed as an active learning unit that allows students to work individually and collaboratively to solve problems about the Flint Water Crisis. It also allows students to reflect on environmental justice issues. It covers the concepts associated with chemical reactions and water treatment and the links between politics, economics, and science. The case is designed to be useful in introductory physical science classrooms, but it can also be used to explore advanced classes if you want to incorporate socioscientific issues. Our hope is that this module represents a starting point for how to embed relevant scientific issues in STEM classrooms.

Introduction

This handout contains a series of activities that lead you to explore the Flint Water Crisis and the chemistry of the problem. You will examine the science and politics behind the crisis, which relates to chemical reactions and water treatment.

Pre – Activity

1. Determine the coefficients to balance the following chemical reactions:



2. Watch the video: <https://www.youtube.com/watch?v=872Xz63b9VU> and answer the question below. Based on any prior knowledge, what do you know about the Flint water crisis?

Flint Water Supply

1. Read the text below and answer the following questions:
 - a. Why did the governor of Flint move the city's water supply from Lake Huron to the Flint River?
 - b. What is your initial perspective on this case, and how would you propose resolving the issue?

Name:

On April 25th, 2014, officials in Flint, Michigan, held aloft glasses filled with water from the Flint River in a toast to the city's new public works project. For nearly 50 years, the city purchased treated water from Detroit, but in 2013 the City Council approved the construction of a pipeline that would bring water directly from Lake Huron into the city. The Flint River would provide the city with water until the pipeline was built.

Switching the water supply was considered, above all else, a necessary cost-cutting measure for the city. The birthplace of General Motors and a booming center of the automobile industry for much of the 20th century, Flint's financial stability began to falter in the 1980s as General Motors began outsourcing, offshoring, and automating autoworker jobs. In 2002, Michigan Governor John Engler declared a financial emergency in Flint and installed what would be a series of unelected emergency managers who were given authority to oversee the city's finances. From 2002 to 2018, these managers began laying off city workers, cutting benefits, eliminating social programs, and raising water bills in an attempt to balance the city's budget. Fatefully, the city managers also decided—without approval from the city council—to bring an end to the city's reliance on Detroit water before the completion of the Lake Huron pipeline by drawing water from the Flint River.

Almost immediately after the switch, residents began to grow worried about the smell, taste, and appearance of the water. Some started reporting sudden medical concerns such as rashes and hair loss. By the beginning of 2015, the Flint City Council voted to move the city back to water from Detroit, a decision that was denied by emergency manager Gerald Ambrose, who argued the switch back would be too costly. Upon retiring from the position, Ambrose then signed orders prohibiting other Flint officials from revising any of his past actions for at least a year.

In the meantime, scientists and doctors grew concerned with the safety of Flint's drinking water. Local and national researchers found dangerous levels of lead in the drinking water, among other pollutants, and doctors in the area began to warn parents against using tap water. In response, state regulators continued to claim the water was safe to drink, even after it was revealed that Flint's emergency managers did not add corrosion control to the Flint River water treatment process as a cost-cutting measure — a vital step to insuring lead from plumbing does not filter into tap water. The Michigan Department of Environmental Quality even tampered with research data and dismissed the results of other tests to maintain this stance that Flint's drinking water was safe.

Finally, in October 2015, a year and a half after residents were first exposed to toxic drinking water, Michigan Governor Rick Snyder ordered the city's water supply switched back to Detroit. Three months later, Snyder declared a state of emergency in the city, and began distributing bottled water and filters to residents.

As of 2019, no government officials have been convicted of any crimes related to the Flint water crisis. And while the water in Flint has been tested safe to drink, residents are living with the lifelong effects of lead poisoning, and skepticism towards authorities brought about after being told for nearly a year that water with high amounts of lead was safe to drink.

Name:

The Flint Water Crisis: What's really going on?

Please follow the instructions below to answer questions.

1. Watch an interview with Dr. Mona Hanna-Attisha, a pediatrician who was the first to discover high levels of lead in Flint's drinking water;

<https://www.c-span.org/video/?c4802313/user-clip-dr-mona-hanna-attisha-discovering-lead-flint>

- a. According to Hanna-Attisha, what types of products or processes expose people to lead?
 - b. Why does Hanna-Attisha describe lead exposure as a form of "environmental injustice"? What kinds of people are most affected by lead exposure?
 - c. Why did Hanna-Attisha "freak out" when discovering there was lead in Flint's water supply?
2. Go to Blackboard and find '[The Flint Water Crisis: What is really going on?](#)' document to answer the questions below. Read the document and then answer the questions.

You can also visit the following links for more information;

WHO Lead Poisoning

<https://teachrock.org/wp-content/uploads/Handout-2-%E2%80%9CLead-Poisoning-and-Health%E2%80%9D.pdf?x11095>

NYT Facts about Lead Exposure

<https://www.nytimes.com/2016/01/30/us/lead-poisoning.html>

NYT Scope of Harm to Children

https://www.nytimes.com/2016/01/30/us/flint-weighs-scope-of-harm-to-children-caused-by-lead-in-water.html?_r=0

- a. What contaminants are found in the tap water in Flint?
- b. What is considered safe levels of lead in human blood in parts per million (ppm)? What concentration (ppm) of lead in drinking water is considered dangerous ("action level") by the US EPA?
- c. What are the effects of water contaminants and lead on children? What are sources of lead?
- d. What happens to the Flint River water as it goes through the city's pipes? Why? (This answer needs to be explained using chemistry!)

Name:

3. Watch the video

<https://www.c-span.org/video/?c4802321/user-clip-dr-mona-hanna-attisha-onthe-flint-water-crisis#> and answer the questions below.

- a. What caused lead to get into the water? Was lead present in the Flint river, or did it get into the water in another way?
- b. How could the Flint water problem have been prevented? Watch the video <https://www.scientificamerican.com/video/corrosive-chemistry-how-lead-ended-up-in-flint-s-drinking-water1/> and explain the process of removing heavy metals from water resources.

4. We have learned about water treatment in a previous chapter. Examine the diagram in the link

<https://teachrock.org/wp-content/uploads/The-Water-Treatment-Process.png?x11095> and answer the following question;

- a. What component of the water treatment process are Hanna-Attisha and the Scientific American video referring to?
- b. What might have caused the city of Flint not to include this component in the treatment of the Flint river water?

Summary

Based on what you learned in this activity, answer the questions below.

1. Why did the Flint water crisis occur? Was it a problem that required new scientific research or technological innovation to solve? Or was it something else?
2. What implications does this crisis have for other cities across the US? What can be done to stop a water crisis from occurring in other cities? What are the obstacles cities face?

Writing Prompt

Write a short essay (200-250 words) about the following prompt. Include enough specific details to support your opinion.

The Flint water crisis reveals that science and scientific research never exists in a vacuum—it is connected with issues of politics and economics. Given this fact, do you think it is part of a scientist's responsibility to be politically and socially involved? Or, is a scientist's primary role to focus on conducting research and advancing

Name:

technologies, leaving issues of politics and economics to others? Simply put, are activism or advocacy essential parts of being a scientist?

Additional Resources

The Science of Flint Water Crisis

https://www.youtube.com/watch?time_continue=1&v=BAIXmt58iBU&feature=emb_title

How lead ended up in Flint's tap water

<https://cen.acs.org/articles/94/i7/Lead-Ended-Flints-Tap-Water.html>

Flint's water crisis and the troublemaker scientist

<https://www.nytimes.com/2016/08/21/magazine/flints-water-crisis-and-the-troublemaker-scientist.html>

The Flint water crisis yields hard lessons in science and ethics

<https://www.americanscientist.org/article/flint-water-crisis-yields-hard-lessons-in-science-and-ethics>

Corrosive chemistry

<https://www.scientificamerican.com/video/corrosive-chemistry-how-lead-ended-up-in-flint-s-drinking-water1/>

The science behind the Flint water crisis

<http://www.iflscience.com/editors-blog/science-behind-flint-water-crisis-corrosion-pipes-erosion-trust/>

Ethics lessons from the Flint water crisis

<https://www.complianceweek.com/news/opinion/ethics-lessons-from-the-flint-water-crisis#.XFh7olxKiUk>

Why is it possible that Flint River water cannot be treated to meet federal standards

<http://flintwaterstudy.org/2015/08/why-is-it-possible-that-flint-river-water-cannot-be-treated-to-meet-federal-standards/>

Flint Water Crisis: What's Being Done to Help Children Exposed to Lead

<http://abcnews.go.com/Health/flint-water-crisis-children-exposed-lead/story?id=36376739>