Jonathan Tam

USC East Asia: Origins to 1800
Lesson Plan

Lesson Sequence

Grade	Content Areas Being Integrated
10th, Chemistry	Soil Toxicology in China

	Astronomy Discipline
Key Content Standards	*CCSS.ELA-Literacy.RST.11-12.3* *Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.* *CCSS.ELA-Literacy.RST.11-12.8* *Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.* *SCI.9-12.HS-ESS3-1* *Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.* *SCI.9-12.HS-ESS3-6* *Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.*

Learning Objective	*Students will be tasked with learning about soil pollution as an issue in China as well as propose solutions for soil pollution after identifying most harmful pollutants*
Prior Knowledge	*Students know the basic principles of graphing data and drawing data-driven scientific conclusions. Students also have some basic understanding laboratory protocols.*
Differentiation	*All vocabulary will be posted to the side for students to refer to throughout the learning segment. Organizers will be differentiated to reduced cognitive demand of online reading and research. Discussion structures will allow students to test and build ideas before sharing them to the whole class. Readings will be modified to be more accessible to learners.*
Concepts	*Bacteria, Chemical vs. Biological, Coliforms, Epidemiology, Containment, Superfund, Routes of Exposure*

Materials / Resources
Laptop, Tox Town, Graphic Organizers on Tox Town, Chemplates, General Laboratory Equipment, Soil

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Lesson (1 of 3): Tox Town and Introduction to Toxicology

Lesson / Activity Description		
Prior Knowledge	**Teacher has set norms and culture for participation and class structure.**	**Students have prior knowledge of some basic chemicals, but not how the affect human life.**
Sequence	**Teacher does:**	**Students do:**
Engage	Teacher prompts students to take out their notebook and answer, "In what ways can our environments impact our health?" Teacher provides the warm up on the front projector screen and gives students a few minutes to have the questions copied and answered. Teacher invites students to share responses in pairs and to share ideas in a structured class discussion.	Students take out their notebooks and answer the warm up question. Students share responses in pairs and then bring ideas to the rest of the class.
Explore	Teacher informs class that this week's lesson will explore the idea of pollution in particular and its influence on buildings, water and other environmental conditions. We'll be looking this week on signs of a chemical contamination where the impact is much more than one person and can affect the longevity of human life. Teacher prompts students to open their laptops to Tox Town, an online simulation and to answer the following: *https://toxtown.nlm.nih.gov/* ***Questions:*** 1. Can a substance have multiple routes of exposure? 2. What factors contribute to the effect an environmental toxin has on the human body? 3. Were there any environmental concerns investigated during this activity that surprised you? Explain your reasoning. 4. What can you do in your daily life to minimize exposure to harmful substances? Reference at least two specific exposures you noted on your 24 hour log.	Students participate in class discussion to prompt thinking on what we know about environmental pollution. Students check out laptops to access Tox Town module and begin to answer questions on exposures that are readily available in local environments
Explain	T reviews Tox Town questions with the class and introduces a longstanding issue in Los Angeles - pollution in the soil. Teacher	Students check answers on Tox Town module and transition to understanding Los Angeles at

	provides definitions for superfund and explains to students that it has long been a solution sought in Los Angeles. Teacher provides a digital map for students to analyze and splits map into parts for students to analyze. Teacher tasks students to take their map and provide a brief explanation of the environmental danger of their region in Los Angeles. On the other side of the explanation, Teacher tasks students to produce a flyer warning against the dangers of region.	Tox Town, and the chemicals that affect our living.
Exit Ticket (Elaborate)		On an Exit Ticket, students will create a warning flyer against areas that dangerous and detrimental to Los Angeles inhabitants.

Lesson (2 of 3): Soil Pollution in China

Lesson / Activity Description		
Sequence	**Teacher does:**	**Students do:**
Engage	Teacher prompts students to take out their notebook and answer, "What specific chemicals do you think are readily outside of our homes and are dangerous to life?" Teacher provides the warm up on the front projector screen and gives students a few minutes to have the questions copied and answered. Teacher invites students to share responses in pairs and to share ideas in a structured class discussion.	Students take out their notebooks and answer the warm up question. Students share responses in pairs and then bring ideas to the rest of the class.
Elaborate	Teacher introduces the Radon Leaking through video to explain dangers of Soil Pollution. Teacher also introduces the Flint, Michigan crisis and its propose solution. Chemicals are all around us and we constantly live in a dosage of them. Managing that dosage determines our survival. Teacher transitions towards a larger international issue in East Asia - one that will cost trillions of dollars to repair and decades to adjust to - an uncontained soil pollution crisis. Teacher prompts students to perform a pair	Students learn about Radon Leaking and the Flint, Michigan crisis through videos and recognize dosage as the key to survival

	reading with a group of three students and to use annotation guides (*, !, ?) to drive a discussion afterwards. Paired Readings are performed on: *China's Cadmium Rice by Tatlow* *https://rendezvous.blogs.nytimes.com/2013/05/20/cadmium-rice-is-chinas-latest-food-scandal/* *China's Soil Pollution Survey* *https://www.ft.com/content/76fab472-0b6f-11e6-b0f1-61f222853ff3* *China's Hairy Crab Scandal* *https://www.ft.com/content/df0c7b9a-abc4-11e6-9cb3-bb8207902122*	Students annotate readings with their partners and summarize understanding at their tables.
Evaluation	Teacher introduces task: to analyze samples of Chinese soil taken across 6 locations in China. Students will first need to understand common chemicals that contaminate soil and write a report that explains the hazard to local Chinese government. Teacher provides an organizer for researching the chemicals and tasks students to write the long and short term health effects of: *mercury*, *lead*, *radon*, *chlorine*, *chromium*, *cadmium*, *copper*, *cyanide*, *nitrates*, *phosphates*, *silica*, *sulfide*, *ammonium nitrate*, *iron*.	Students complete an organizer on the long and short term health effects of different common chemical contaminants.

Lesson (3 of 3): Chemical Tests and Environmental Report

Lesson / Activity Description		
Sequence	**Teacher does:**	**Students do:**
Laboratory Activity	Teacher sets up stations for each of the chemicals to be tested and assigns each group of students a different soil sample (generated in-situ) from a different province in china: Guangdong, Hubei, Hunan, Jiangxi, Fujian and Zhejiang. Teacher tasks students to generate a report addressed to local government verifying the verdict of the chemical test.	Students will need to complete each of the 14 chemical tests with their soil sample and discern a verdict as to whether the chemical is present in their sample. Students will need to translate a letter to local government that provides the data and information on the short / long term health effects.

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Lesson 1: Tox Town Instructions

“Tox Town” is an interactive guide to commonly encountered toxic chemicals, environmental health risks, and the public's health. Your teacher will assign you to one of the five neighborhoods in Tox Town. These neighborhoods include a city, a farm, a town, a port, and the US-Mexico Border. Within each neighborhood, you can click on locations where you live, work, and play to learn more about many well-known toxic chemicals found in these locations. For example, you can visit a school and learn about the potential chemical hot spots inside and outside the building. Please note that the chemicals listed for a location are only suggestions of what MIGHT be found in a school, factory, farm, etc.

1. Visit the U.S. National Library of Medicine’s Tox Town website, available from http://www.toxtown.nlm.nih.gov/index.php

2. Click on your assigned neighborhood.

3. Explore the neighborhood. As you explore, take notes in your laboratory journal detailing at least three locations found within your neighborhood. For each of these locations, make sure to answer the following questions:
- Why is this location an environmental health concern?
- What potential chemicals are found at this location?
- Why are these chemicals dangerous to human health?

4. Join with classmates who were assigned the other four neighborhoods and share your findings. Take notes in your laboratory journal as they report their findings with you.

5. Work with your assigned partner(s) to create a map similar to Tox Town that showcases all of the environmental concerns. You may use software/application to help you create your map.

6. Note that the route of exposure describes the way a chemical/toxin enters the body. There are three ways environmental toxins enter the body: absorption through the skin, inhalation, and/or ingestion.

7. For each environmental concern identified on your map, brainstorm the routes of exposure for each. Add designations such as “AB, IH, or IG” to the map to denote the most likely routes.

8. For the next 24 hours, keep a log of any potentially hazardous substances you come into contact with.

9. Answer the Conclusion questions.

Lesson 2: Annotation Guideline

* A Key Idea to the Article
! Something That Caught My Attention
? Something That I Have a Question About

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Lesson 2 / 3: Chemical Log Procedure

You'll be studying a sample of water from China and writing a translated scientifically-informed letter to the local government with any findings you may identify in testing the water. 15 tests need to be performed on the water for 15 chemicals and your report should detail the presence or lack of each chemical.

1. Obtain a Chemical Log from your teacher.

2. Obtain a water sample from either Guangdong, Hubei, Hunan, Jiangxi, Fujian and Zhejiang.

3. Wear safety glasses, lab apron, and gloves when performing the chemical tests. Many of the chemicals you will be working with are harmful and can damage your skin. Be careful not to spill the reagents on the table or to splash them on your skin.

3. Quickly read through the procedure found on the Student Resource Sheet to familiarize yourself with what you will be doing and the contaminants you will be trying to detect in the water samples.

4. Read the instructions carefully and use the exact amounts of each reagent specified in the instructions. Do not mix the chemicals or combine them in any way other than as directed in the directions.

5. Ensure that all test tubes and Chemplates™ are clean and dry before beginning any of the tests.

6. Measure drops of each solution by holding each bottle upside down and slowly squeezing until single drops are released. Do not hold the bottles at an angle because the size of the drops will vary with the angle. Likewise, do not squeeze the bottles too quickly or too hard, or the amount of solution added will be immeasurable.

7. Follow the directions on your Resource Sheet to complete all 14 tests on both the Williams' well water sample and your local water sample. The tests for the contaminants can be completed in any order. Notice that some of the reactions require a longer incubation time than others.

8. Follow your teacher's instructions regarding how to complete the various tests within the class period and how to dispose of the completed test samples.

9. Stop a test when color appears indicating the presence of the contaminant. The listed times are maximum incubation times. If no color appears by the end of the incubation time, the contaminant was not detected.

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Lesson 2 / 3: Chemical Log

	Short Term Effects on Human Health	Long Term Effects on Human Health	Contaminant Present in Water Sample (Y/N)
Mercury			
Lead			
Radon			
Chlorine			
Chromium			
Cadmium			
Copper			
Cyanide			
Nitrates			
Phosphates			
Silicate			
Sulfide			
Ammonium Nitrate			
Iron			