**Subject area/course**: Science/Biology

**Grade level/band**: 9-11

**Task source**: Summit Public Schools

**Bioremediation**

**STUDENT INSTRUCTIONS**

1. **Task context**:

Excited for the new iPhone 6? Have you heard the rumors about the iWatch? Don’t you wish you had a pair of Google glasses? Already tired of your Galaxy S5? Before you run off to the store to buy the latest and greatest smart phone, you should pause and take a moment to think about where your new phone is coming from and what you are going to do with your old phone. 140 million cell phones are thrown out worldwide each year and those phones contain hundreds of chemicals that are toxic to humans and damage our environment.

For this task, you will work as a team of researchers at the Silicon Valley Environmental Protection Agency (EPA). Executives from Apple and Google have come to you for research and a plan to clean up the toxins from the millions of old cell phones, computers, and TVs that have been dumped in landfills in Daly City, Redwood City, and San Jose. In order to develop a cleanup plan you will first need to design and conduct an experiment using Fast Plants to remove e-waste toxins from the landfills.

1. **Final product**:

The three parts of this task will develop your abilities to prepare for and contribute to a Socratic Seminar, to design and collect data in an experiment, to organize and analyze your data, and to write conclusions and recommendations based on evidence.

Part 1: Socratic Seminar on E-Waste

* Complete Socratic Seminar preparation graphic organizer (Item B) using readings and videos (see list below and Item A)
* Participate in Socratic Seminar by asking questions and responding to questions using evidence from readings and videos

Part 2: Design & Conduct Experiment

* Research and write a research question and hypothesis for experiment
* Conduct experiment over several weeks
* Organize data from experiment in data table

Part 3

* Analyze patterns in data from experiment
* Write a conclusion based on the evidence from the experiment
* Make recommendations to Apple and Google about the best way to clean up e-waste in landfills

**Additional Information**

1. **Knowledge and skills you will need to demonstrate on this task:**

* Conduct sustained research projects to answer a question (including a self-generated question) or solve a problem, narrow or broaden the inquiry when appropriate, and demonstrate understanding of the subject under investigation.
* Integrate and synthesize multiple sources of information (e.g., texts, experiments, simulations) presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to address a question, make informed decisions, understand a process, phenomenon, or concept, and solve problems.
* Use oral and written communication skills to learn, evaluate, and express ideas for a range of tasks, purposes, and audiences. Develop and strengthen writing as needed by planning, revising, editing, and rewriting while considering the audience.
* Interpersonal skills, including the ability to work with others, to participate effectively in a range of conversations and collaborations.

1. **Materials needed:**

Documents:

* Item A. Socratic Seminar E-Waste
* Item B. Graphic Organizer – Socratic Seminar
* Item C. Background Info and Experiment Brainstorm
* Item D. Research Question Hypothesis
* Item E. How to Write a Procedure
* Item F. Lab Report Analysis
* Item G. Lab Report Conclusion
* Item H. Lab Report Outline

Suggested readings (texts and videos) include:

Videos

* E-waste Hell (Ghana): <https://www.youtube.com/watch?v=dd_ZttK3PuM>
* Story of Stuff: Electronics: <http://storyofstuff.org/movies/story-of-electronics/>
* 60 Minutes: Electronic Wasteland: <https://www.youtube.com/watch?v=SCGEvOmKo98>
* Citizens at Risk (India): <https://www.youtube.com/watch?v=jkndVAwBf_k#t=97>

Texts

* E-waste Problem Overview: <http://www.electronicstakeback.com/resources/problem-overview/>
* Body Burden Diagram: <http://svtc.live2.radicaldesigns.org/wp-content/uploads/Body-Burden-pdf>
* E-Waste Dumping Map: <https://infrarati.files.wordpress.com/2010/08/ewastemap2.jpg>
* E-waste In Landfills: <http://www.electronicstakeback.com/designed-for-the-dump/e-waste-in-landfills/>
* Cell Phone Recycling: <http://www.eoearth.org/view/article/150977/>
* E-waste Recycling in Prisons: <http://www.electronicstakeback.com/global-e-waste-dumping/prison-recycling/>
* Facts & Figures on E-waste Recycling: <http://www.electronicstakeback.com/wp-content/uploads/Facts_and_Figures_on_EWaste_and_Recycling.pdf>
* State Legislation-E-Waste: <http://www.electronicstakeback.com/promote-good-laws/state-legislation/>
* Toxic Sweatshops (E-waste Recycling in Prisons): <http://www.electronicstakeback.com/wp-content/uploads/ToxicSweatshops1.pdf>
* Exporting Harm (The High-Tech Trashing of Asia): <http://svtc.org/wp-content/uploads/technotrash.pdf>
* The Digital Dump (Exporting Re-use and Abuse to Africa): <http://svtc.org/wp-content/uploads/TheDigitalDump.pdf>
* More Reports by Silicon Valley Toxics Coalition: <http://svtc.org/resources/reports/>

1. **Time requirements:**

* Step 1: Graphic Organizer: Socratic Seminar Prep and Step 2: Socratic Seminar: E-Waste: approximately 2 weeks
* Step 3: Brainstorm: Experiment Design; one week
* Step 4: Lab Report: Research Question & Hypothesis: one week
* Step 5: Plant Fast Plants: one week
* Step 6: Lab Report: Procedure: one week
* Step 7: Add Toxins to Fast Plants: one week
* Step 8: Lab Report: Data Table: two weeks
* Step 9: Take Final Measurements of Fast Plants: one week
* Step 10: Lab Report: Analysis: one week
* Step 11: Lab Report: Conclusion: one week
* Step 12: Project Checklist and Peer Review: one week
* Step 13: Submit Project

1. **Scoring:**

Your work will be scored using the Summit Public Schools Bioremediation Rubric. You should make sure you are familiar with the language that describes the expectations for proficient performance.