Chemistry of Cellphones and E-Waste

Overview

Students will disassemble early to newer models of cell phones and explore how the components differ and evolve over time. In the context of this discussion, students will explore the importance of repair and the impact of e-waste on the environment and human life.

Objectives

1. Students will be able to name at least two elements used in a cellular phone and their element type and their place in the periodic table.
2. Students will be able to describe the importance of rare earth elements in electronics and green technology, as well as the primary resource for these elements.
3. Students will be able to identify gold and copper components in a piece of electronics and describe the property of these two elements that makes them a crucial element in the manufacture of electronics.

Possible Standards of Learning

Science:
6.4a. Atoms consist of particles, including electrons, protons, and neutrons.
6.4b. Atoms of a particular element are alike but are different from atoms of other elements.
6.4c. Elements may be represented by chemical symbols.
6.4d. Two or more atoms interact to form new substances, which are held together by electrical forces (bonds).
6.5e. Compounds may be represented by chemical formulas.

Next Generation Science Standards

MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Materials

E-Waste presentation
Cellphone substances handouts
iFixit Toolkits
Cell phones for taking apart
Pencils and notebooks for recording observations

Safety

Students should wear appropriate safety attire including safety glasses. If at any point a student feels unsafe, they should stop and ask for help from an instructor.
(https://www.iFixit.com/Info/Device_Safety)

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Procedure (50 min)

1. Students will view a short presentation on the periodic table, the elements in our electronic devices, natural resources, e-waste, and human impact.
2. Facilitators will introduce the iFixit toolkits and safety procedures based on the manual provided.
3. In small groups, students will take apart one of the cell phones provided using the iFixit toolkits. Facilitators will prompt students to consider the different parts of the phone and what common elements might be present. Printed periodic tables and lists/pictures of common substances found in cellphones will be provided.
4. Groups will share with the class features of their phone, comparing across groups the changes in the technology across time.
5. Facilitators will lead a discussion about the metals students observe in the phone, the end-of-life environmental impact, and the importance of repair.

Differentiation/Variation

Material is introduced to students through multiple modes. Facilitators can physically assist some groups in taking apart items. Students can all take apart the same type of cellphone or an electronic device that is not a cellphone. Some cell phones or electronics may be simpler and easier to take apart than others (e.g. more visible screws rather than prying open a plastic casing).

References

This lesson was partly adapted from “The Chemistry of Cell Phones” retrieved from http://k12.iFixit.com/c/The_Chemistry_of_Cell_Phones.

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