Elements of Waste
Program Information

FIELD TRIP OVERVIEW

The *Elements of Waste* field trip is broken into two 60-minute parts. After a short, 10-minute introduction to the center and topic, one group of 35-students and chaperone/teaching assistants will join a docent for a hands-on investigation into waste and the periodic table of the elements. The other group of students and their chaperone/teaching assistants will explore the gallery space, learning about the effects our rate of consumption has contributed to the current environmental crisis. At the end of the first 60-minute period, groups will switch and experience the other part.

Laboratory Experience

Elements of Waste uses the periodic table to teach students what composes an item determines how it should be disposed. After a brief introduction, students measure and then sort through the amount of garbage thrown out daily by the average American family. Working in small groups, pick "clean garbage items" out of a bag and use a "*Waste Guide"* catalog to learn the impact each item has on our energy, water, land, and mineral resources. Students then choose whether an item should be recycled, reused, sent it to a landfill, treated it as hazardous, or figure out a way to rethink or reduce the consumption of an item. As they make their choices, students use the periodic table of elements to keep track of which elements are contained in each item of garbage. By the end of the lab experience, students will know not only the best disposal choices for several everyday items but also which elements are hazardous and which are the most numerous in the universe.

Introduction: There is No Away (5 minutes)

The introduction's objectives are to instill in students an understanding of true costs for using products and introduce students to the full range of disposal choices available. During this whole class instruction, students review the various methods there are for disposing garbage, after it has been "thrown away". Through breaking down the process by which garbage is sorted and processed, the presenter reinforces that the product and disposal choices that we make everyday can have long reaching ramifications to the planet as a whole, now and in the future.

Impact in a Bag (10 minutes)

Students receive a four-and-a-half pound bag of garbage that represents the average amount of garbage a person discards each day. After students weigh and measure their bags' mass and circumference, the presenter leads a discussion about the true costs of this amount of garbage heading to the landfill each day. In preparation for the next activity, "Impact in a Bag" ends with a brief review of the chemical elements and the periodic table.

Elements of Waste (10 minutes)

Using an interactive slideshow, the docent explains how the periodic table of the elements is organized.

Elemental Sort

Students work together to decide how to dispose of items in their garbage bags. As they work through the activity, students learn how to read the periodic table by placing colored tags on each element contained in an item. Points are earned based on the quality of choices made (e.g., sending something to the landfill looses points while rethinking using an item gains points).

Closure (5 minutes)

The lab experience concludes with a discussion of which elements were found to be most numerous in the garbage as well as how many elements were found to be hazardous. Groups successes are celebrated and the impact of their choices on the water, energy, land, and mineral resources are emphasized.

Gallery Experience

The gallery experience starts off in front of the "Magic Planet" digital video globe where students are introduced to the larger problem of our planet's environmental crisis. Following the video introduction, the docent leads the group in a brief discussion, pointing out how everyone's choices in consuming and disposing items contributes to the problem.

Following a pacing guide, the groups explore each exhibit as they complete a scavenger hunt and identify how they can alter their choices and reduce their family's impact on the planet.

ACADEMIC STRUCTURE

Outcomes, Essential Questions, and Key Concepts

Elements of Waste's instructional framework has three components: essential questions, measurable outcomes, and key concepts. These form the basis for creating links between the RUEC Lab Experience and classroom learning as well as identifying how the lab experience activities can link to the California Content Standards.

Outcomes: What will students do and know?

- Students will understand what they choose to consume and how they discard waste can greatly impact the quantity of solid waste going to landfills
- Students will understand the basic atomic structure of elements.
- Students will start to understand how the periodic table is organized.
- Students will understand that the materials that make up a waste item will determine how it can be disposed.
- Students will identify potential hazards that exist in the solid waste they discard daily.

Essential Questions: What will students think about and investigate?

CONSIDER: What do we throw away each day? What is in the stuff we throw away?

CONNECT: How do the choices we make about what we buy, use, and throw away affect the amount of energy, water, mineral resources, and land we consume?

CONSERVE: What choices can we make to reduce our impact on water, energy, mineral resource, and land?

Key Concepts: What will be covered?

The 92 natural elements

The periodic table of the elements

Atomic structure

Why waste is classified as hazardous, recyclable, compostable, and why certain items have no other option but to be sent to a landfill.

Correlation to California Academic Standards

California has two sets of academic and content standards that apply to the *Elements of Waste* field trip experience. The first set, *The California Content Standards,* apply to specific content that must be addressed at each grade level. Due to the limited duration of the field trip, only the science standards can be addressed with any meaningful connection.

The suggested school classroom activities for students to do before and after the trip have correlations to additional content areas.

Text that is in light gray is the actual standard students must meet. The black text describes how the *Elements of Waste* field trip experience helps students move towards meeting each standard.

California Content Standards

Fourth Grade

Investigation and Experimentation – 6b. Measure and estimate the weight, length, or volume of objects.

Students determine a bag of waste's circumference (implied volume) and mass using tape measure and platform scale.

Students will compare the relative volume and weight of objects and the ramifications the objects have on the environment. For example, Styrofoam packaging is lightweight but takes up an inordinate amount of volume to store in a landfill.

Fifth Grade

Physical Science 1a. Students know all matter is made of atoms, which may combine to form molecules.

Waste Elements multimedia slideshow demonstrates how each element cannot be split into a simpler substance.

Waste Guide catalog describes the primary element(s) in each.

Physical Science 1c. Students know metals have properties in common, such as high electrical and thermal conductivity. Some metals, such as aluminum (Al), iron (Fe), nickel (Ni), copper (Cu), silver (Ag), and gold (Au), are pure elements; others, such as steel and brass, are composed of a combination of elemental metals.

Students compare the atomic weight of toxic and non-toxic elements such as mercury, lead, carbon, oxygen, hydrogen, and aluminum.

Students will note that the vast majority of waste items contain hydrogen and carbon, two of the more abundant elements in the universe.

Physical Science 1d. Students know that each element is made of one kind of atom and that the elements are organized in the periodic table by their chemical properties.

Students categorize waste items according to elements and use the periodic table to classify waste items as toxic or non-toxic.

Sixth Grade

Resources – 6b. Students know different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable.

Students work with the Waste Guide catalog to determine what materials make up each item of waste.

Students understand which materials enable items to be recycled, composted, and which materials must be treated as hazardous.

Resources – 6c. Students know the natural origin of the materials used to make common objects**.**

Students work with the Waste Guide catalog to determine which materials make up each item of waste.

Investigation and Experimentation – 7b. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.

Students work with the Waste Guide catalog to collect and analyze the impact disposal choices have on the environment.

Education and the Environment Initiative (EEI)

The EEI is a second set of standards that span across content areas and address environmental issues. Although teachers are mandated to teach environmental education, there is still a lack of state-approved curricula. Below are correlations between the *Elements of Waste* field trip experience and the EEI. Again, actual text from the EEI is in gray, correlations are in black.

Principle IV – *Concept a. Students need to know that the effects of human activities on natural systems are directly related to the quantities of resources consumed and to the quantity and characteristics of the resulting byproducts.*

Students work hands on with waste items (byproducts of consumption) and identify the potential hazards of waste and how each item affects energy consumption, water consumption, mineral resource consumption, and land.

Principle IV - *Concept c. Students need to know that the capacity of natural systems to adjust to human-caused alterations depends on the nature of the system as well as the scope, scale, and duration of the activity and the nature of its byproducts.*

During the activity, students discuss how their choices for disposing items affect their "waste footprint".

Correlation to the FOSS Curriculum, 2007 Edition

Elements of Waste correlates to this FOSS Module:

***Mixtures and Solutions,* Grade 5 FOSS Module**.

In this RUEC activity, students learn that "all matter is made of very small particles called atoms and that atoms combine to form molecules and compounds". Students will use the periodic table to identify which of the 90 naturally occurring elements are in the waste typically generated on a daily basis. *Elements of Waste* would serve as an introduction or extension to the FOSS lesson *Elements.*

PREREQUESITE KNOWLEDGE

The terms and concepts listed in this section are at the root of this experience. Although students will be able to participate in the activity without previous exposure to these terms and concepts, it will enhance their understanding if you are able to explain these concepts and terms in a child-friendly manner.

Concepts:

- There are 92 naturally occurring elements in the universe.
- The periodic table of elements organizes the elements according to their atomic number.
- Atoms are composed of protons, neutrons, and electrons.
- An element's atomic number equals the number of protons contained in an atom.
- Every decision to buy, consumes, and dispose of an item carries costs in terms of water, energy, land, and mineral resources.
- The elements that make up a solid waste item determines how it can be disposed.
- Items that can be composted are decomposed and creating nutrient rich soil.

Terms:

- Atom – the smallest particle of an element that can exist either alone or in combination with other atoms.
- Compost – a mixture of once living things (such as grass or fruit) that decay back into nutrients used to fertilize.
- Consumption – the act of using an item or resource.
- Decompose – to separate into smaller and simpler parts.
- Electron – a tiny particle that has a negative charge and orbits the nucleus of an atom.
- Element – one of the more than 92 naturally occurring substances that consist of atoms of only one kind and cannot be separated into simpler substances.
- Hazardous – dangerous.
- Impact – to have a strong effect.
- Landfill – a specially constructed area for disposing trash.
- Neutron – a tiny particle that does not carry a charge and makes up part of an atom's nucleus.
- Proton – a tiny particle with a positive charge that makes up part of an atom's nucleus.

- Recycle – the process in which materials from waste are reused to make new materials.
- Reduce – the act of cutting back consuming certain items or resources.
- Rethink – the act of considering whether consuming a certain item or resource is necessary or wasteful.
- Reuse – the act of using an item or packaging over and over again for the same or different function until it can no longer be used.

TIPS TO GIVE VOLUNTEER TEACHING ASSISTANTS (Chaperones)

Roles & Responsibilities:

- Assist TechTeam instructor with distributing materials and getting your assigned group's attention.
- Monitor whether students are following instructions.
- Assign students tasks so that everyone has a chance to participate.
- Ask questions and model that it's fine not to know an answer or solution.

Tips for a Successful Activity:

- Help your group of students carefully consider each option for disposing an item before they make their decision
- Allow students to make mistakes or even purposely choose an incorrect option for disposing an item.
- The periodic table is organized from left to right by an element’s atomic number (the number of protons and neutrons) each element’s atomic number is listed in the Waste Guide.
- Make sure the color-coded magnetic squares students place on the periodic table remain there until the students are finished with the activity