



**Lesson Title:** 3D Pollution Pie

**Tagline:** Make a 3D pie graph to show types of waste and how much each is generated each year in the USA

**Grade Range:** Grades: 4-6

Please make changes to lessons and appendices as desired to fit the needs of your classroom.

**Supports Subject Area(s) of:**

Science/environmental

Math

Social Studies

**Lesson duration** 1 to 5 days

**Standards:** See complete list at end of lesson

**Options for Assessment:** Check student understanding through varied methods depending on subject.

**Objectives:**

- Students will investigate research materials
- Students will compare and contrast waste management from year to year
- Students will depict waste management for one year in a pie graph (Appendix A)
- Students will explain percentages of waste and impact on environment
- Students will compare and contrast waste materials and identify those that are recyclable and those that are not
- Students will create a 3D Pie Chart depicting a year's worth of waste for USA

**Materials:**

- Elmer's Glue All or Elmer's Extreme School Glue stick
- Elmer's corrugate board
- X-ACTO Knife
- Ribbon
- Markers
- Any items collected to depict waste materials
- Appendix A
- Computer/Internet
- Smart Board (optional)
- Video conferencing (optional)
- Research materials (printed or read from USA EPA website)  
<http://www.epa.gov/wastes/nonhaz/municipal/pubs/msw2009rpt.pdf> page 13 of 198  
<http://www.epa.gov/wastes/nonhaz/municipal/pubs/msw95.pdf> page 10 of 144

### Directions for pictured project:

- Using an X-ACTO knife, cut a large circle from Elmer's corrugate board
- Copy Appendix A, two for each child and/or front/back or students can create on word processor
- Students collect materials to be used to make their 3D pie chart

### Lesson Steps:

#### Introduction:

- Using a Smart Board or individual computers, bring up EPA websites that depict Municipal Solid Waste. If you do not have access to a Smart Board computers, you can print the information you need from these websites
- Investigate together the websites
- Possible Discussion (but certainly not limited to!) questions and topics:

Why do you think the EPA conducts these reports?

Can you find the oldest study?

Can you find the most up to date study?

What can you conclude from looking at this pie chart?

Compare and Contrast data of 1994 and 2009

What was the total MSW in weight in 1994?

What was the total MSW in weight in 2009?

How much more MSW in weight was there in 2009 than 1994?

What was the largest component generated in 1994?

What was the largest component generated in 2009?

What was the smallest component generated in 1994?

What was the smallest component generated in 2009?

By what percent did paper increase from 1994 to 2009?

There are 8 categories in 1994 and 9 in 2009. What category is missing in 1994 that is shown in 2009 and what category do you think the data is absorbed into in the 1994 chart? Explain your answer.

Looking at the generation and recovery charts for 1994 and 2009, what 3 items had the highest rate of recovery?

1994

2009

Etc...

### Activity:

Students work together or individually to create two pie charts using the EPA website and two copies of Appendix A. Groups of students should choose data from different years so that when charts are finished pie charts can be compared and contrasted over the years. After completing Appendix A, a compare and contrast to two different years, each group of students choose one year to depict in pie graph form. Again, have as many different years represented as possible.

To create pie chart students use the corrugate circles. Glue ribbon to section off percentages of each category. Students will need to find things from around the classroom and may need to bring in objects from home to add to their pie chart. Use Elmer's Glue All or Elmer's Extreme School Glue Stick to glue objects to corrugate board.

Students should create five or more questions, along with an answer key, to accompany their pie chart.

Check Understanding: Use formative assessments such as checking student and group progress, answering and asking questions as students work through the process. Check student understanding as they compare and contrast pie charts and discuss ratios, percentages and other mathematical comparisons through the days of working on this project.

### Wrap it Up

Set up a video conferencing interview with an employee from government or local EPA officials. Students should prepare questions ahead of time based on data collected from the research materials. Share some of the pie charts and findings with EPA official.

### Extension

Students should also create a paragraph summarizing findings from the data they studied. Students can glue this to the back of their pie chart. The expectations for this information could vary by ability. Use other charts and graphs included in these EPA reports for more great math activities and environmental studies.

### Standards

K-4 National Science Standards

NS.K-4.1 Science as Inquiry: Abilities necessary to do scientific inquiry , Understanding about scientific inquiry

NS.K-4.2 Properties of objects and materials

NS.K-4.5 Abilities to distinguish between natural objects and objects made by humans

5-8 National Science Standards

NS.5-8.2 Properties of objects and material

NS.5-8.6 Populations, resources, and environments

Fifth Grade Math Common Core Standards

Measurement and Data 5.MD

## Sixth Grade Math Common Core Standards

### Ratios and Proportional Relationships 6.RP

3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

- a. Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios
- c. Find a percent of a quantity as a rate per 100

This lesson adheres to the following National Standards National Council of Teachers of Mathematics

Grades 3-5 Expectations: In grades 3-5 all students should-

- understand the place-value structure of the base-ten number system and be able to represent and compare whole numbers and decimals;

### Data Analysis and Probability

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them

Grades 3-5 Expectations: In grades 3-5 all students should-

- design investigations to address a question and consider how data-collection methods affect the nature of the data set;
- collect data using observations, surveys, and experiments;
- represent data using tables and graphs such as line plots, bar graphs, and line graphs;
- recognize the differences in representing categorical and numerical data.

### Reasoning and Proof

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Recognize reasoning and proof as fundamental aspects of mathematics
- Make and investigate mathematical conjectures
- Develop and evaluate mathematical arguments and proofs
- Select and use various types of reasoning and methods of proof

### Communication

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Organize and consolidate their mathematical thinking through communication
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others
- Analyze and evaluate the mathematical thinking and strategies of others;

- Use the language of mathematics to express mathematical ideas precisely.

## Connections

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Recognize and use connections among mathematical ideas
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
- Recognize and apply mathematics in contexts outside of mathematics

## Representation

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Create and use representations to organize, record, and communicate mathematical ideas
- Select, apply, and translate among mathematical representations to solve problems
- Use representations to model and interpret physical, social, and mathematical phenomena

## Social Studies National Standards

K-4

NSS-C.K-4.1 What is *Government* (in relation to recycling and environmental issues)

### **What is Government and What Should It Do?**

- What is government?
- Where do people in government get the authority to make, apply, and enforce rules and law and manage disputes about them?
- Why is government necessary?
- What are some of the most important things governments do?
- What are the purposes of rules and laws?
- How can you evaluate rules and laws?
- What are the differences between limited and unlimited governments?

Why is it important to limit the power of government?

NSS.C.K-4.5

### **What are the Roles of the Citizen in American Democracy?**

- What are important responsibilities of Americans?
- What dispositions or traits of character are important to the preservation and improvement of American democracy?
- How can Americans participate in their government?
- What is the importance of political leadership and public service?

NSS-USH.K-4.1

Living a working Together in Families and Communities, Now and Long Ago

Understands family life now and in the past, and family life in various places long ago

Understands the history of the local community and how communities in North America varied long ago

NSS-USH.K-4.2

The History of the students' own state or region

Understands the people, events, problems, and ideas that were significant in creating the history of their state

Social Studies National Standards 5-8<sup>th</sup> Grade

NSS.C.5-8.1 (as related to recycling/environmental issues)

What is civic life? What is politics? What is government? Why are government and politics necessary? What purposes should government serve?

NSS.C.5-8.5 Role of Citizen

**What are the Roles of the Citizen in American Democracy?**

- What is citizenship?
- What are the rights of citizens?
- What are the responsibilities of citizens?

How can citizens take part in civic life?

Appendix A

Pollution Pie

