Title: It All Stacks Up!

Brief Overview:

Students will use the theme of waste disposal and recycling to address math skills such as basic operations, proportions, percents and creating and interpreting graphs and tables. Students will demonstrate their understanding of the content by creating a brochure to inform the public and/or by writing a letter urging the governor to pass a recycling law.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will represent data about recycled products on a triple line graph to make comparisons and predictions. Students will demonstrate their ability to choose an operation to solve a problem and calculate using whole numbers and decimals.

- **Mathematics as Communication**
  Students will discuss ways to recycle through a web. Students will create an informative brochure encouraging the public to recycle. Students will write a letter urging the governor to pass a recycling law.

- **Mathematics as Reasoning**
  Students will make scale drawings to compare the amount of garbage that is disposed of per household to the Empire State Building and the Statue of Liberty. Students will interpret patterns from their triple line graph through answering questions.

- **Mathematical Connections**
  Students will develop math skills through environmental concepts. Students will apply their knowledge to inform the public and write to their governor using math, science and language arts.

- **Computation and Estimation**
  Students will demonstrate their ability to solve proportions for a scale drawing and calculate basic operations concerning recycling.

- **Number Systems and Number Theory**
  Students will demonstrate their ability to use various strategies to solve problems on recycling facts.

- **Patterns and Functions**
  Students will demonstrate their ability to use tables and graphs to describe patterns in the amounts of products being recycled.

- **Statistics**
  Students will demonstrate their ability to analyze data and make decisions according to a line graph about products being recycled.

- **Measurement**
  Students will demonstrate their ability to estimate and measure to construct a scale drawing.

Grade/Level:

Grades 7 - 8

Duration/Length:

3 - 5 days

Prerequisite Knowledge:

Students should have working knowledge of the following skills (for example):

- Construct a scale drawing
- Convert units of measurement
- Basic problem solving
- Creating a line graph
- Use a graphing calculator to display the data (optional)
- Write a persuasive letter

Objectives:

Students will:

- create a scale drawing.
- complete a web based on prior knowledge of recycling.
- calculate “real” world problems using basic operations.
- analyze a data chart.
- construct a triple line graph.
- interpret data.
- design a brochure.
- write a persuasive letter.

Materials/Resources/Printed Materials:

- Large size paper/poster board
- Scissors
- Glue
- Crayons/markers
- Magazines/newspapers
- Pictures of the Empire State Building and the Statue of Liberty

Development/Procedures:

Day 1:

There is a state wide problem concerning the amount of garbage that is being disposed. The average Marylander throws away 1.1kg of garbage each day. To help students visualize this amount and understand the severity of the problem, students will make a scale drawing to compare the amount of garbage disposed in their household per year.

Have students begin by drawing the Empire State Building (448m) and the Statue of Liberty (92.9m) using a scale of 10m to 1cm on a piece of large paper. Remind students to begin their drawing close to the bottom of the page and encourage them to enhance their drawings with detail and color. Once this is completed, students will show how much garbage is collected from each member in their family. One year's worth of one person's garbage will be represented by a garbage can that reaches 60m tall. (The same scale of 10m to 1cm will be used.) Students will then stack the garbage cans on the same paper to compare the heights of all three figures.

Once students realize the severity of the problem, possible solutions will be discussed. The one solution that will be focused upon is recycling. Students will be given a web to brainstorm what items can be recycled. If students are having difficulties with recycling information, an appropriate reading article on recycling could be added to assist students in completion of their web.

The homework for Day 1 is to complete the "Fun Facts" worksheet. This worksheet provides several facts about recycling through the use of basic computation.

Day 2:

Now that students have a basic understanding of the waste disposal/recycling problem, students will be given data to create a triple line graph. The graph will represent the amount of paper, plastic and aluminum cans that were recycled from 1992 - 1997. Upon completion of the graph, students will analyze the data to find trends and make predictions.

Note: If you wish to use a graphing calculator, you will find the reference paper "Using A TI-83", after the "Fun Facts"-Answer Key. The paper shows the screens that you should have on your calculator in order to graph the lines. The homework for Day 2 is to complete "My Graph Says That" worksheet.

Day 3:

Students will begin the performance assessment, "Believe It or Not" by reading the prompt and organizing their thinking using the attached critical square. The homework for Day 3 is to complete a rough draft based on their completed square.

Day 4:

Students will take their rough draft and peer edit their work with another student. After their papers have been peer edited, they can complete a final copy of their letter to the governor. Note: Suggest using an interdisciplinary approach for the writing topics with the language arts and/or science teacher.

Performance Assessment:

Students will write a letter urging the governor to implement and enforce a state law on recycling. Contact your community service representative to see if student community service hours can be obtained for writing letters to the governor.

Extension/Follow Up:

Students will design a brochure persuading an audience to recycle. The brochure will represent calculated facts, graph trends and patterns, and reasons to recycle.

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How Does Your Trash Measure Up??

Do you know how much trash you throw out? Your trash (and other's trash) is causing a problem. The average Marylander throws away 1.1kg of garbage each day. Do you know just what that amount looks like? Well you're in luck, today you will be drawing a picture of what your trash amount "looks" like **and** how it compares to two famous structures. This activity will help you to visualize just what a problem your trash is.

Today you will draw the Empire State Building and the Statue of Liberty to scale and compare their elevation to the height of your daily trash amount.

BEFORE YOU BEGIN:

A.) **Predict** the order of your structures from largest to smallest (based on height). *Refer to steps 3-4 below to "see" how your garbage will be converted to height.*

Largest _____

_____

Smallest _____

B.) **Explain** why you chose the order above.

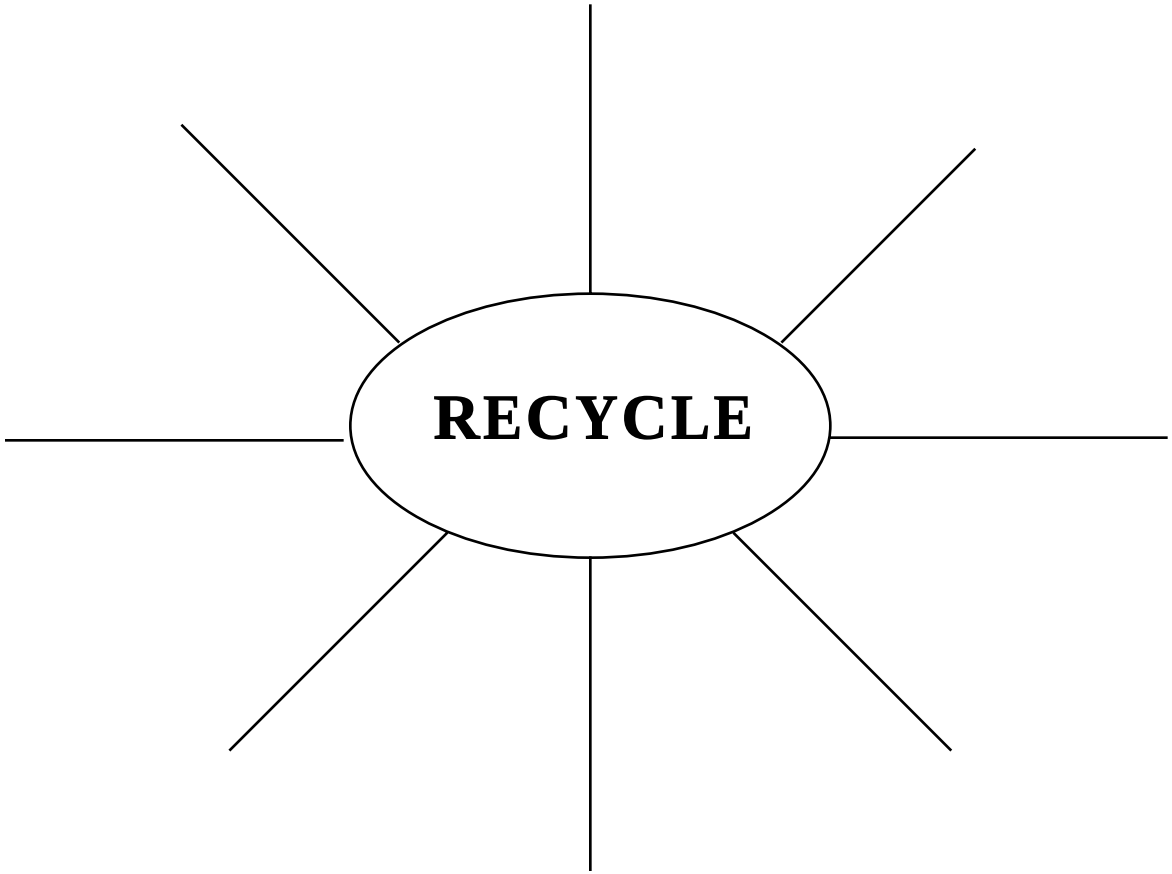
_____

_____

CONSTRUCT YOUR SCALE DRAWING:

1. Draw the Empire State Building (448m) and the Statue of Liberty (92.9m) on a large piece of paper. **Use a scale of 10m to 1cm.**
   * Begin your drawing close to the bottom of the paper.
2. Count each person in your family (those that live at home with you). How many people are in your family?_____ (including yourself)
3. Each person's garbage is equal to one garbage can 60m high.
   *Calculate how many garbage cans you will need to draw. (for ex. 5 family members = 5 garbage cans)
   *Calculate the height of your garbage cans (when stacked on top of one another) _____
   (e.g.,. (5 cans) x (60m) = 300m high)
4. Draw your stacked garbage cans next to your drawings of the Empire State Building and the Statue of Liberty. **Use a scale of 10m to 1cm.**
5. Once completed, use color and details to enhance your scale drawing.

What can we recycle?



Fun Facts

Waste, pollution, and recycling are major concerns for the environment today. Find the answers to the fun facts below to realize the magnitude of the ecology concerns.

1. One ton of recycled paper uses 64% less energy and saves 17 trees. How many trees are saved in 8 tons of recycled paper?

   _____

2. Americans buy 62 million newspapers daily and throw out 44 million. How many newspapers are not thrown out daily?

   _____

3. Approximately 240 million tires are discarded annually in the United States. How many tires is that per month?

   _____

4. Every hour Americans throw away 2.5 million plastic bottles. How many plastic bottles are thrown away in one day?

   _____

5. Every minute approximately 119,500 cans are recycled nationwide. How many cans are recycled in 7 minutes?

   _____

6. The average American throws away 3.5 pounds of trash per day. How many pounds do 12 people throw away per day?

   _____

7. In 1972, only 53 million pounds of aluminum cans were recycled. Today, we exceed that amount weekly. How many pounds do we recycle each year?

   _____

8. Americans throw away 18 billion disposable diapers a year. How many diapers is that each month?

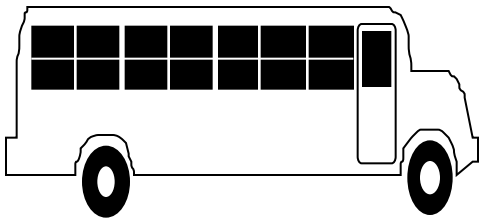
   _____

9. A five minute shower can consume 35 gallons of water. How many gallons is consumed in a 16 minute shower?

   _____

10. One 15-year old tree makes enough paper for only 700 grocery bags. How many trees will make 10,500 grocery bags?

    _____



Did you know…?

- *The weight of aluminum cans recycled in 1996 was equal to the weight of **14** aircraft carriers.*
- *Recycled plastics can be used to make carpet.*
- *Pencils can be made from recycled paper.*
- *The average American uses **650** pounds of paper a year.*
- *If every newspaper printed in the U.S. alone were later recycled, **250** million trees would be saved each year.*

Recycling on a Graph

Below is the amount of recycling per ton that Maryland has consumed in the past 6 years for Aluminum Cans, Plastic and Paper products.

Product Per Ton

Year	Aluminum Cans	Plastic	Paper
1992	526,000	178,000	865,000
1993	600,000	205,000	954,000
1994	767,000	247,000	1,002,000
1995	892,000	279,000	1,112,000
1996	984,000	235,000	1,224,000
1997	1,103,000	315,000	1,346,000
Total	4,872,000	1,459,000	6,503,000

Using the chart, create a triple line graph representing the data. The following information must be included:

- title graph appropriately
- label the horizontal and vertical axis
- increments on the vertical axis
- make sure data is evenly spaced
- a key in the top right corner
- use a ruler to connect points

My Graph Says That…

Using the triple line graph, “Recycling in Maryland”, and data from the chart, answer the following questions in complete sentences.

1. What trends can be determined from the graph? _____

_____

_____

2. In 1995, how many tons of plastic were recycled? _____

_____

_____

3. In 1995, what was the total amount of recycled products? _____

_____

_____

4. What product is recycled the most by Maryland residents? _____

_____

_____

5. Approximately how many tons of paper do you think was recycled in 1991?

_____

_____

6. Make an approximation of the amount of recycled products you think were reported in 1998.
   - Aluminum Cans _____
   - Plastic _____
   - Paper _____

BELIEVE IT OR NOT...
Performance Assessment

Would you believe that almost every state in America does not have a law regarding recycling. Even in the age where the slogan "Save the Earth" is a household phrase, only a few states have enacted a recycling law. Maryland is one of the many states that does not have a law. They do; however, have a Recycling Act.

The Act states that, "The City of Baltimore and the larger counties must recycle 20% of their solid waste, and smaller counties--those with populations of less than 150,000--must recycle 15% of their waste by 1994." (Maryland Department of the Environment) The state achieved a 29% statewide recycling rate. This translates to about 1,415,821 tons per year of materials that were directed away from the landfill, an increase from 6% in 1988 (**ONLY** 6%!!) when the Recycling Act was passed. How does this make you feel??

Throughout this unit you have been working intensely with recycling facts and figures. Using what you just read and any other information you have gathered in this unit complete the following prompt.

DEAR GOVERNOR...

Write a letter to your governor to persuade him / her to write a law regarding recycling in your state.

Before you begin, think about the condition of our environment (based on your school / neighborhood). Think about ways to recycle and what is recycled. Think about what impact a consistent recycling program would have on the environment. Finally, think about why your state needs a recycling law.

Now, write a letter to your governor persuading him / her to enact a recycling law.

Writing Prompt Critical Square

Condition of our environment	Ways to recycle / what is recycled
Impact that a recycling program would have on the environment	Why your state needs a recycling law

INFORM THE PUBLIC

Now is your chance to show what you know by informing the public about recycling. Your task is to create a tri-fold brochure that is appealing to a particular audience (i.e. your parents, your friends, elementary school children, etc.) regarding recycling. Brochures are a quick way that people, companies, etc. use to get their point across. A brochure usually contains pictures, facts, and anything else that would get an idea across to a chosen audience.

Your job is to create a tri-fold brochure informing the public (or any audience that you choose) about recycling. In your brochure be sure to include the following:

- facts about recycling (use your "Fun Facts" sheet for guidance)
- reasons to recycle (why should we recycle??)
- ideas to implement a recycling program at home and/or school.

Besides quality, your brochure will be graded on it's overall appearance (title on the brochure, pictures, color, creativity (make it unique!).

Now, create a brochure informing the public about recycling.

Use the space below to plan out your tri-fold brochure. Do not color or put 100% into planning. This space is just for your rough sketch of your brochure. When you are ready, get your final brochure paper from your teacher.

FUN FACTS-ANSWER KEY

Waste, pollution, and recycling are major concerns for the environment today. Find the answers to the fun facts below to realize the magnitude of the ecology concerns.

1. One ton of recycled paper uses 64% less energy and saves 17 trees. How many trees are saved in 8 tons of recycled paper?

   136 TREES

2. Americans buy 62 million newspapers daily and throw out 44 million. How many newspapers are not thrown out daily?

   18 MILLION

3. Approximately 240 million tires are discarded annually in the United States. How many tires is that per month?

   20 MILLION/MONTH

4. Every hour Americans throw away 2.5 million plastic bottles. How many plastic bottles are thrown away in one day?

   60 MILLION BOTTLES

5. Every minute approximately 119,500 cans are recycled nationwide. How many cans are recycled in 7 minutes?

   836,500 CANS IN 7 MIN.

6. The average American throws away 3.5 pounds of trash per day. How many pounds do 12 people throw away per day?

   42 POUNDS PER DAY

7. In 1972, only 53 million pounds of aluminum cans were recycled. Today, we exceed that amount weekly. How many pounds do we recycle each year?

   2,756 MILLION POUNDS

8. Americans throw away 18 billion disposable diapers a year. How many diapers is that each month?

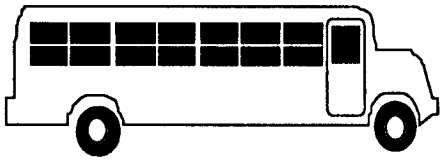
   1.5 BILLION DIAPERS

9. A five minute shower can consume 35 gallons of water. How many gallons is consumed in a 16 minute shower?

   112 GALLONS IN 16 MIN.

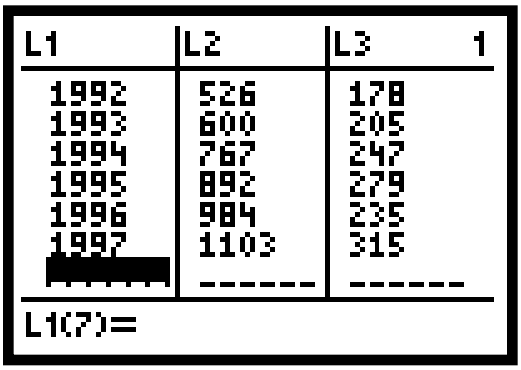
10. One 15-year old tree makes enough paper for only 700 grocery bags. How many trees will make 10,500 grocery bags?

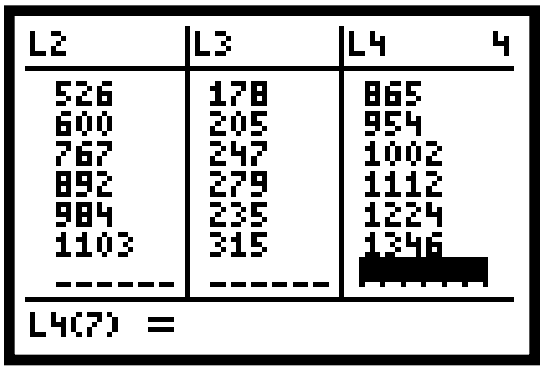
    15 TREES

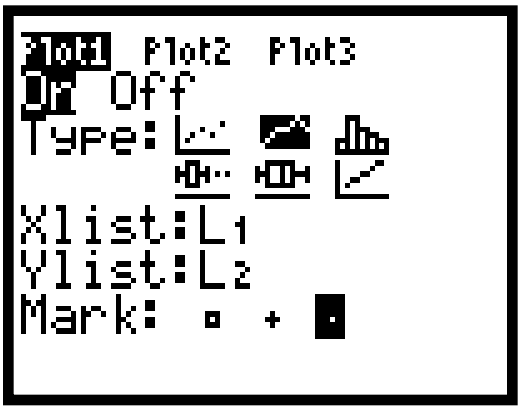


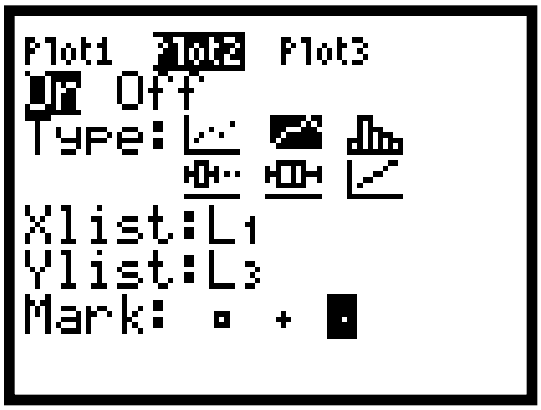
Using a TI-83

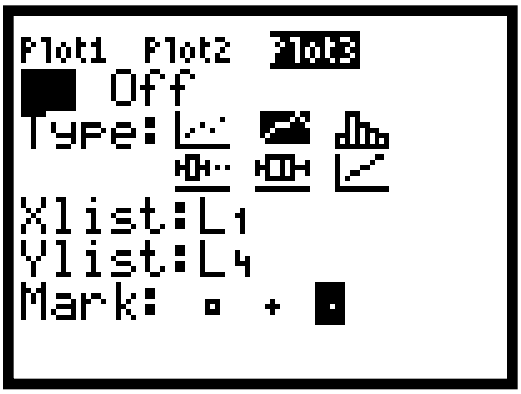
Below are the screens that you should have on your calculator in order to graph the lines.

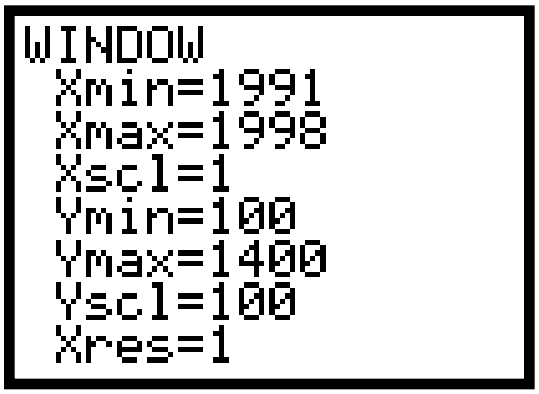




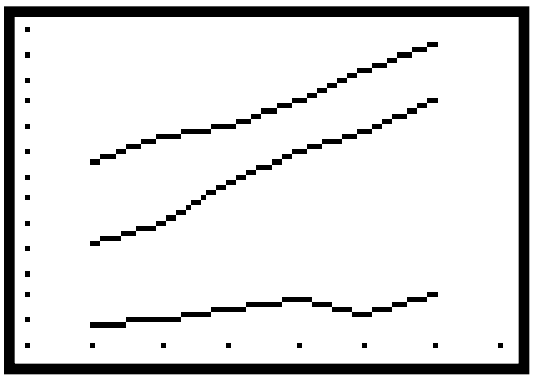








To the right is what your triple line graph should look like on your TI-83.



Recycling in Maryland Grading Scale

_____ out of 2 pt.	Appropriate Title
_____ out of 2 pt.	Axis Labeled
_____ out of 2 pt.	Increments present
_____ out of 2 pt.	Key Present and matches with lines
_____ out of 2 pt.	Evidence of Ruler used
_____ out of 2 pt.	Lines graphed correctly
_____ out of 2 pt.	Even Spacing

My Graph Says That... Grading Scale

Question	Points/Possible	Requirement
1	_____/2	Trend is determined with explanation
2	_____/2	Answer of 279,000 tons
3	_____/2	Answer of 2,283,000 tons
4	_____/2	Answer of Paper with a total 6,503,000 tons
5	_____/2	Reasonable estimation present
6	_____/3	Reasonable estimations present for each product

GOVERNOR PERSUASION PROMPT

SCORING TOOL

4 Student responds:
- to all **4** think about:
    1. condition of the environment
    2. ways to recycle/what is recycled
    3. impact a program would have on the environment
    4. why their state needs a recycling law
- with complete sentences
- by using persuasive language
- with adequate support and details

3 Student responds:
- to **3** think about listed above
- with complete sentences
- with adequate support and/or details

2 Student responds:
- to **2** think about listed above
- with complete sentences or with adequate support/details

1 Student responds:
- to **1** think about listed above

0 Student does not meet requirements

RECYCLING BROCHURE

SCORING TOOL

APPEARANCE

4 Student creates a brochure which includes:
- an appropriate title
- clear pictures
- color
- creativity

3 Student creates a brochure which includes:
- **3** of the **4** items listed above

2 Student creates a brochure which includes:
- **2** of the **4** items listed above

1 Student creates a brochure which includes
- **1** of the **4** items listed above

0 Student creates a brochure.

QUALITY

3 Student constructs a tri-fold brochure including:
- **at least 6** facts about recycling
- reasons to recycle
- ways to implement a recycling program at home and/orschool

2 Student constructs a tri-fold brochure including:
- **4-5** facts about recycling
- reasons to recycle
- ways to implement a recycling program at home **or** school

1 Student constructs a brochure including:
- **2**-**3** facts about recycling
- reasons to recycle **OR** ways to implement a recycling program

0 Student does not meet requirements.