

## Ener - G

**Grade Level:** Grade 3 – 5

**Content area(s):** Math, Fine Arts

**Classroom Time:** Including movie – 180 minutes/without movie – 90 minutes

**Purpose:**

To visualize the amount of waste created, review percents, practice using large numbers and to problem solve by creating an imaginary solution.

**Skills Addressed:**

Math Skills: Place value, percents, multiplication, large numbers, model problem solving

Visual Arts Skill: Use media to communicate story or problem

**Supplies:**

Movie “Wall – E”, attachments printed, pencil/pen, recycled material, calculators,

**Lesson Process:**

Warm-up –

- A. Watch the movie “Wall – E”
- B. Ask students the following questions:
  1. Where do you put your trash? – *Ex. Trash can, on the floor, on the ground, burn it, etc...*
  2. Where does the trash go when it is collected in the garbage trucks? – *Ex. The landfill, recycling plant, the dump...*
  3. What do others in the United States do with their trash? – *Compost, landfill, deposit it into the ocean, etc..*
  4. What do people in other countries do with their trash? – *Ex. Barcelona, Spain processes 60% of the land waste into compost and gases produced without oxygen which is used to generate electricity and recycles 5%.*
  5. What was Wall-E’s job? – *To compact the trash*
  6. Why did they come back to earth?
  7. What did you learn from the movie?
  8. How long do you think it takes a plastic cup to decompose? - *Correct answer 250 years*
- C. Ask the students to describe a landfill. – *A landfills are located where clay deposits and land features protect the surrounding environment. The bottoms are lined with clay and plastic to protect the soil from liquid waste.*

Lesson procedure –

- A. Show the students the pie chart. *Attachment 1 – What we do with our trash?*
- B. Explain the chart – *A circle equals 100%. 55% of our trash or most of it is deposited in a landfill while only 31% is recycled and 14% is burned.*

C. Ask the students the following questions:

- Where does most of our trash go? - *Landfill*
- What type of trash is burned? – *Wood, papers, etc...*
- What type of trash is recycled? - *Paper, plastic, glass, aluminum, etc...*
- What type of trash goes to the landfill? – *Diapers, used paper towels, etc...*

D. Have the students create a chart on their paper. Fill in the chart to review percentages.

Percentage	Decimal	Fraction
25%	.25	$\frac{25}{100} = \frac{1}{4}$
50%	.5	$\frac{50}{100} = \frac{1}{2}$
33%	.33	$\frac{33}{100}$
75%	.75	$\frac{75}{100} = \frac{3}{4}$
100%	1	$\frac{100}{100} = 1$
55%	.55	$\frac{55}{100} = \frac{11}{20}$
31%	.31	$\frac{31}{100}$
14%	.14	$\frac{14}{100} = \frac{7}{50}$

E. Students complete the handout. (Attachment 2)

F. Students design and sketch a “robot” as a means to reduce and clean up the trash in the landfill.

G. Students create a model their robot out of recycled materials.

H. In addition to creating the robot, the students will write an explanation on how the “robot” functions. (Robot Rubric – Attachment 3) The explanation will include information pertaining to

I. Students complete the second handout with respect to their “robot” – Attachment 4

Student assessment or final product to be developed:

- A. Class discussion
- B. Handout
- C. Robot
- D. Second handout

Extension activities (optional)

- A. Define carbon footprint - *is a measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide*

- B. Ask students to bring in the following information in order to fill out the chart below.  
(Attachment 5)

<i>Item</i>	<i>Totals</i>
Number of people in household	
Number of vehicles	
Vehicle 1 – Number of miles driven per week	
Vehicle 2 – Number of miles driven per week	
Vehicle 3 – Number of miles driven per week	
Vehicle 1 – Miles per gallon	
Vehicle 2 – Miles per gallon	
Vehicle 3 – Miles per gallon	
Airline miles per month	
Electricity – kwh per month	
Natural gas – therms per month	
Heating oil – gallons per month	
Propane – gallons per month	
Percent electric company is green	

- C. Students use the carbon footprint calculator <http://www.safeclimate.net/calculator/> or <http://earthwiseenvironmentalsolutions.com/index-3.html> to determine their families carbon footprint
- D. Students complete handout – Attachment 6
- E. ELA lesson, *Inky*, on the Project GRAD Houston website
- F. Science lessons, *Where Does it End?*, *A Voice for the Environment*, *Outdoor Beauty*, on the Project GRAD Houston website

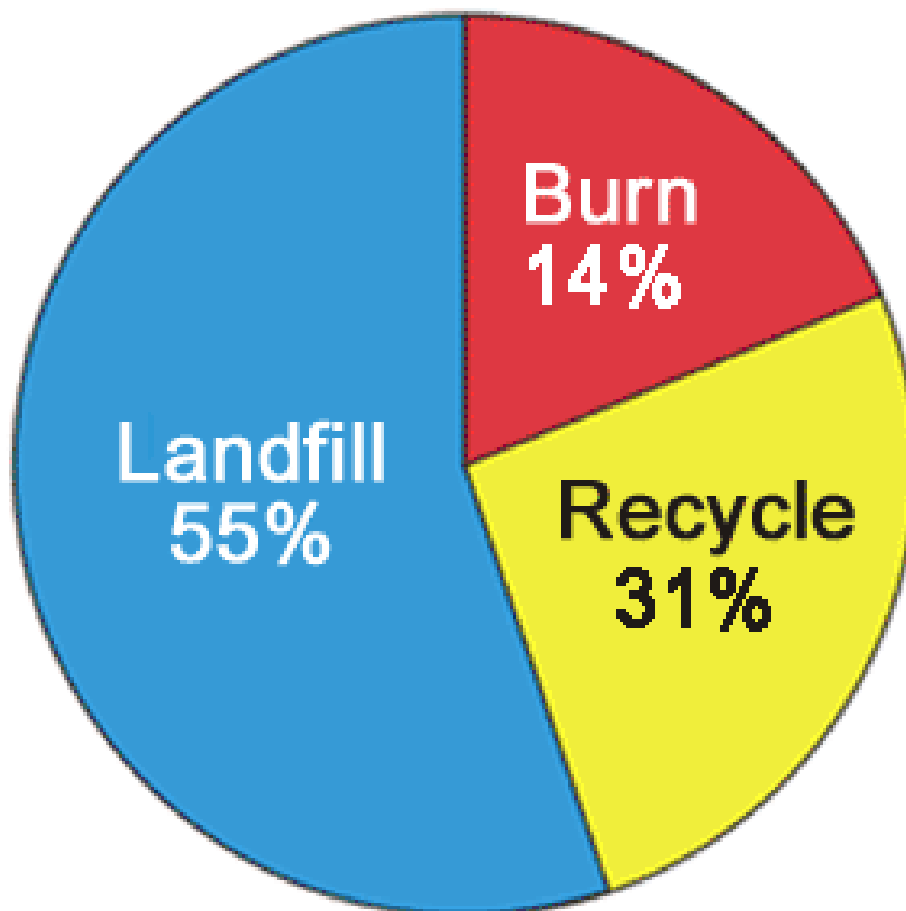
Website links

<http://www.eia.doe.gov/kids/energyfacts/saving/recycling/solidwaste/landfiller.html>,

[http://educators.btnep.org/client\\_files/editor\\_files/ACTIVITY%203-04%20Updated%206.1.06%20Keep%20It%20Above%20Board%20\\_2,%20%20FINAL.pdf](http://educators.btnep.org/client_files/editor_files/ACTIVITY%203-04%20Updated%206.1.06%20Keep%20It%20Above%20Board%20_2,%20%20FINAL.pdf),

<http://garbage.wikidot.com/garbage3>, <http://www.dnr.state.wi.us/org/caer/ce/ee/teacher/tontrash.htm>

# WHAT WE DO WITH OUR TRASH



## How much trash do you create?

Name \_\_\_\_\_ Date \_\_\_\_\_

1. People accumulate approximately 4.4 pounds of trash daily. How many ounces does each person accumulate per day? \_\_\_\_\_ How many tons of trash does a person accumulate in a year? \_\_\_\_\_

2. Calculate the pounds of trash for each category to fill in the chart.

Category	Number of people	Pounds of trash per day	Pounds of trash per week	Pounds of trash per month (4wks)	Pounds of trash per year	Tons of trash per year
Single	1	4.4	30.8	123.2	1,478.4	0.74
Family	4					
School	400					
City	185,107					
State	938,466					
Nation - USA	308,000,000					

3. Find the following percents:

A. What percent of the families tons of trash per year is created by one person? \_\_\_\_\_

B. What percent of a school's tons of trash is created by one person? \_\_\_\_\_

4. If 10% of the trash is recycled, calculate the number of pounds recycled and fill in the chart.

Category	Pounds of trash per day	Pounds of recycle per day	Pounds of recycle per month (4wks)	Pounds of recycle per year	Tons of recycle per year
Single	4.4	.44	1.76	21.12	0.01
Family					
School					
City					
State					
Nation - USA					

5. Find the following percents:

A. What percent of the families tons of recycle per year is created by one person? \_\_\_\_\_

B. What percent of a city's tons of recycle is created by a school? \_\_\_\_\_

6. At least  $\frac{2}{3}$  of waste thrown away is edible and safe to eat. Fill in the chart showing the amount of edible trash taken to a landfill.

Category	Pounds of trash	Edible trash
Single	4.4	$2.93333 = \frac{44}{15}$
Family		
School		
City		
State		
Nation - USA		

7. If each person recycled  $\frac{1}{4}$  of their trash each day,  
 A. How much trash would be transformed into recycling each day from the following?

Single = \_\_\_\_\_

Family = \_\_\_\_\_

School = \_\_\_\_\_

City = \_\_\_\_\_

State = \_\_\_\_\_

Nation = \_\_\_\_\_

- B. How much trash would be left for the following?

Single = \_\_\_\_\_

Family = \_\_\_\_\_

School = \_\_\_\_\_

City = \_\_\_\_\_

State = \_\_\_\_\_

Nation = \_\_\_\_\_

## How much trash do you create? - KEY

1. People accumulate approximately 4.4 pounds of trash daily. How many ounces does each person accumulate? 70.4 ounces = 4.4 \* 16 (1 pound = 16 ounces)
2. Calculate the pounds of trash for each category and fill in the chart.  
(Number of people \* 4.4 pounds, wk = per day \* 7, month = per wk \* 4, year – month \* 12, tons = year / 2000)

Category	Number of people	Pounds of trash per day	Pounds of trash per week	Pounds of trash per month (4wks)	Pounds of trash per year	Tons of trash per year
Single	1	4.4	30.8	123.2	1,478.4	0.74
Family	4	17.6	123.2	492.8	5913.6	2.96
School	400	1760	12,320	49,280	591,360	2965.68
City	185,107	814,471	3,257,884	13,031,536	28,904,750	14,452,375
State	938,466	4,129,250	28,904,750	115,619,000	1,287,428,000	643,714,000
Nation - USA	308,000,000	1,355,200,000	9,486,400,000	37,946,600,000	455,347,200,000	227,673,600,000

3. Find the following percents:
  - A. What percent of the families tons of trash per year is created by one person? 25%
  - B. What percent of a school's tons of trash is created by one person? 0.02%
4. If 10% of the trash is recycled, calculate the number of pounds recycled and fill in the chart.

Category	Pounds of trash per day	Pounds of recycle per day	Pounds of recycle per month (4wks)	Pounds of recycle per year	Tons of recycle per year
Single	4.4	.44	1.76	21.12	0.01
Family	17.6	1.76	7.04	84.48	0.04
School	1760	176	704	8448	4.22
City	814,471	81,447.08	325,788.32	16,940,992	8470.50
State	4,129,250	412,925	1,651,700	85,888,400	42,944.20
Nation - USA	1,355,200,000	135,520,000	542,080,000	6,504,960,000	3,252,480

5. Find the following percents:
  - A. What percent of the families tons of recycle per year is created by one person? 25%
  - B. What percent of a city's tons of recycle is created by a school? .05%

6. At least  $\frac{2}{3}$  of waste thrown away is edible and safe to eat. Fill in the chart showing the amount of edible trash produced per day.

Category	Pounds of trash per day	Edible trash per day
Single	4.4	$2.93333 = \frac{44}{15}$
Family	17.6	$11.73333 = \frac{176}{15}$
School	1760	$1173.33333 = \frac{3520}{3}$
City	814,471	$542,980.53 = \frac{8144708}{15}$
State	4,129,250	$2,752,833.2 = \frac{13,764,166}{5}$
Nation - USA	1,355,200,000	903,466,660

7. If each person recycled  $\frac{1}{4}$  of their trash each day,
- A. How much trash would be transformed into recycling each day from the following?
- Single =  $.4 \text{ lbs}$   
 Family =  $.4 * 4 = 1.6 \text{ lbs}$   
 School =  $.4 * 400 = 160 \text{ lbs}$   
 City =  $.4 * 185,107 = 74,042.8 \text{ lbs}$   
 State =  $.4 * 938,466 = 375,386.4 \text{ lbs}$   
 Nation =  $.4 * 308,000,000 = 123,200,000 \text{ lbs}$
- B. How much trash would be left for the following?
- Single =  $4.4 - .4 = 4 \text{ lbs}$   
 Family =  $17.6 - 1.6 = 16 \text{ lbs}$   
 School =  $1760 - 160 = 1600 \text{ lbs}$   
 City =  $814,471 - 74,042.8 = 740,428.2 \text{ lbs}$   
 State =  $4,129,250 - 375,386.4 = 3,753,863.6 \text{ lbs}$   
 Nation =  $1,355,200,000 - 123,200,000 = 1,232,000,000 \text{ lbs}$

# Robot Rubric

Names \_\_\_\_\_

(1 = attempt, 2 = Attempted but not completed, 3 = completed, 4 = Completed with extra features, 5 = very detailed, elaborate, exceeds expectation)

Points	Sketch	Robot	Explanation	Accomplishes objective	Creativity/Originality
1 Point					
2 Points					
3 Points					
4 Points					
5 Points					
<b>Total Points</b>					

Final Total \_\_\_\_\_

## Robot Statistics

Name \_\_\_\_\_

Date \_\_\_\_\_

1. Ecoville's landfill serves a city of 200,000 people who each create 4.4 pounds of trash per day. In one day how many pounds of trash is produced? \_\_\_\_\_ pounds
  
2. Your robot recycles 20% of the trash produced per day, how many pounds of Ecoville's trash does your robot recycle per day? \_\_\_\_\_ pounds
  
3. You created a new improved robot. What percent of the trash can your robot now recycle?  
\_\_\_\_\_
  
4. How many pounds of Ecoville's trash does your robot now recycle? \_\_\_\_\_
  
5. Explain how your robot recycles the trash and what the recycled trash is used for.

## Robot Statistics - *KEY*

1. Ecoville's landfill serves a city of 200,000 people who each create 4.4 pounds of trash per day. In one day how many pounds of trash is produced? *880,000* pounds
2. Your robot recycles 20% of the trash produced per day, how many pounds of Ecoville's trash does your robot recycle per day? *176,000* pounds
3. You created a new improved robot. What percent of the trash can your robot now recycle? *Answers will vary. 25%, 30%, 50% etc.*
4. How many pounds of Ecoville's trash does your robot now recycle? *Answers depend on the percentage selected.*  
*25% - 220,000 pounds*  
*30% - 264,000 pounds*  
*50% - 440,000 pounds, etc.*
5. Explain how your robot recycles the trash and what the recycled trash is used for.  
*Explanations will vary. Note whether or not the process creates more pollution which wouldn't be a solution.*  
*Ex: The trash will be put into an opening at the top of the robot. The robot will then compact the trash into small cubes. Each cube is then put on a table for three days exposed to the sun. After the three days the cubes are sliced into thin pieces to be used as flooring or walls in houses.*

## Optional – Carbon Footprint

<i>Item</i>	<i>Totals</i>
Number of people in household	
Number of vehicles	
Vehicle 1 – Number of miles driven per week	
Vehicle 2 – Number of miles driven per week	
Vehicle 3 – Number of miles driven per week	
Vehicle 1 – Miles per gallon	
Vehicle 2 – Miles per gallon	
Vehicle 3 – Miles per gallon	
Airline miles per month	
Electricity – kwh per month	
Natural gas – therms per month	
Heating oil – gallons per month	
Propane – gallons per month	
Percent electric company is green	

## My Carbon Footprint

Name \_\_\_\_\_ Date \_\_\_\_\_

1. List 5 ways to decrease or offset your carbon foot print.

- A. \_\_\_\_\_
- B. \_\_\_\_\_
- C. \_\_\_\_\_
- D. \_\_\_\_\_
- E. \_\_\_\_\_

2. Michael calculated the number of pounds of carbon dioxide he created in a year to be 1507 pounds which required 292 trees to remove the carbon dioxide. If he decreases the number of pounds of carbon dioxide produced by 10%, the number of trees needed to compensate is decreased by 15%. Determine the amount of carbon dioxide is Michael producing and how many trees are required to compensate.

Carbon dioxide \_\_\_\_\_ pounds, Trees \_\_\_\_\_

3. Switching to green energy will create a savings of 46%. If the original cost of energy is \$2018, what will the cost be after switching to green energy?

Savings \_\_\_\_\_, Green energy cost \_\_\_\_\_

## My Carbon Footprint - *KEY*

1. List 5 ways to decrease or offset your carbon foot print.

*Examples:*

- A. *Adjust thermostat*
- B. *Use energy efficient light bulbs*
- C. *Turn the lights off*
- D. *Bring your own bags when shopping*
- E. *Eat locally*
- F. *Walk, ride bike, etc. instead of driving a car*
- G. *Carpool*

2. Michael calculated the number of pounds of carbon dioxide he created in a year to be 1507 pounds which required 292 trees to remove the carbon dioxide. If he decreases the number of pounds of carbon dioxide produced by 10%, the number of trees needed to compensate is decreased by 15%. Determine the amount of carbon dioxide Michael is producing and how many trees are required to compensate.

*Carbon dioxide:  $1507 * .90 = 1356.3$  pounds*

*Trees  $292 * .85 = 248.2$  trees*

Carbon dioxide 1356.3 pounds, Trees *248.2*

3. Switching to green energy will create a savings of 46%. If the original cost of energy is \$2018, what will the savings be after switching to green energy? What will be the new energy bill be?

*$\$2018 * .46 = \$928.28$*

*$\$2018 - 928.28 = \$1089.72$*

Savings  *$\$928.28$* , Green energy cost  *$\$1089.72$*

## National Standards

### Math

*Understand numbers, ways of representing numbers, relationships among numbers, and number systems*

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

*Understand meanings of operations and how they relate to one another*

- understand various meanings of multiplication and division;
- understand the effects of multiplying and dividing whole numbers;
- select appropriate methods and tools for computing with whole numbers from among mental computation, estimation, calculators, and paper and pencil according to the context and nature of the computation and use the selected method or tools.

*Use mathematical models to represent and understand quantitative relationships*

- model problem situations with objects and use representations such as graphs, tables, and equations to draw conclusions.

*Understand measurable attributes of objects and the units, systems, and processes of measurement*

- carry out simple unit conversions, such as from centimeters to meters, within a system of measurement;
- understand that measurements are approximations and how differences in units affect precision;

*Instructional programs from pre-kindergarten 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;

*Instructional programs from pre-kindergarten through grade 12 should enable all students to—*

- recognize and apply mathematics in contexts outside of mathematics

### Visual Arts

#### [NA-VA.K-4.1](#) UNDERSTANDING AND APPLYING MEDIA, TECHNIQUES, AND PROCESSES

- Students use different media, techniques, and processes to communicate ideas, experiences, and stories
- Students use art materials and tools in a safe and responsible manner

#### [NA-VA.K-4.2](#) USING KNOWLEDGE OF STRUCTURES AND FUNCTIONS

- Students use visual structures and functions of art to communicate ideas

#### [NA-VA.5-8.2](#) USING KNOWLEDGE OF STRUCTURES AND FUNCTIONS

- Students select and use the qualities of structures and functions of art to improve communication of their ideas

#### [NA-VA.5-8.3](#) CHOOSING AND EVALUATING A RANGE OF SUBJECT MATTER, SYMBOLS, AND IDEAS

- Students integrate visual, spatial, and temporal concepts with content to communicate intended meaning in their artworks
- Students use subjects, themes, and symbols that demonstrate knowledge of contexts, values, and aesthetics that communicate intended meaning in artworks

#### [NA-VA.5-8.6](#) MAKING CONNECTIONS BETWEEN VISUAL ARTS AND OTHER DISCIPLINES

- Students describe ways in which the principles and subject matter of other disciplines taught in the school are interrelated with the visual arts

## TEKS Objectives

### Math

*Number, operation, and quantitative reasoning.* The student uses place value to communicate about increasingly large whole numbers in verbal and written form, including money. The student is expected to: (A) use place value to read, write (in symbols and words), and describe the value of whole numbers through 999,999

*Number, operation, and quantitative reasoning.* The student recognizes and solves problems in multiplication and division situations. The student is expected to: use models to solve division problems and use number sentences to record the solutions.

*Patterns, relationships, and algebraic thinking.* The student uses lists, tables, and charts to express patterns and relationships. The student is expected to: (A) generate a table of paired numbers based on a real-life situation such as insects and legs; and (B) identify patterns in a table of related number pairs based on a real-life situation and extend the table.

*Underlying processes and mathematical tools.* The student applies Grade 3 mathematics to solve problems connected to everyday experiences and activities in and outside of school. The student is expected to: (A) identify the mathematics in everyday situations; (B) use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness; *Number, operation, and quantitative reasoning.* The student describes and compares fractional parts of whole objects or sets of objects. The student is expected to: relate decimals to fractions that name tenths and hundredths using models.

*Number, operation, and quantitative reasoning.* The student multiplies and divides to solve meaningful problems involving whole numbers. The student is expected to: represent multiplication and division situations in picture, word, and number form

*Measurement.* The student selects and uses appropriate units and procedures to measure weight and capacity. The student is expected to: (A) estimate and measure weight using standard units including ounces, pounds, grams, and kilograms; and (B) estimate and measure capacity using standard units including milliliters, liters, cups, pints, quarts, and gallons.

*Number, operation, and quantitative reasoning.* The student uses fractions in problem-solving situations. The student is expected to: use models to relate decimals to fractions that name tenths, hundredths, and thousandths.

*Underlying processes and mathematical tools.* The student applies Grade 5 mathematics to solve problems connected to everyday experiences and activities in and outside of school. The student is expected to: (A) identifies the mathematics in everyday situations; use tools such as real objects, manipulative, and technology to solve problems.

*Underlying processes and mathematical tools.* The student communicates about Grade 5 mathematics using informal language. The student is expected to: (A) explain and record observations using objects, words, pictures, numbers, and technology; and (B) relate informal language to mathematical language and symbols.

*Underlying processes and mathematical tools.* The student uses logical reasoning to make sense of his or her world. The student is expected to: (A) make generalizations from patterns or sets of examples and non-examples