

Title: Recycling Electronics	Grade: 7	BIG Idea:
	Author(s): Hope Phillips	Representing Data

Real-World Connection:

According to the EPA’s 2009 Municipal Solid Waste Characterization Report, “electronics – including TVs and other video equipment, computers, assorted peripherals, audio equipment, and phones – comprise approximately one to two percent of the municipal solid waste stream.” According to a 2009 Environmental Protection Agency (<http://www.epa.gov/osw/consERVE/materials/ecycling/manage.htm>) report, the “presence of substances of concern in some electronics merits greater consideration for safe end-of-life management.” Additionally, there exists “opportunities for resource recovery through improved collection and recycling.” Below is data for this task.

Management of Used and End-Of-Life Electronics in 2009

	Ready for End-of-Life Management (million of units)	Disposed (million of units)	Collected for Recycling (million of units)	Rate of Collection for Recycling (by weight)
Computers	47.4	29.4	18	38%
Televisions	27.2	22.7	4.6	17%
Mobile Devices	141	129	11.7	8%

How Students will Experience the Connection: highlight in yellow all that apply

- | | | |
|---|---------|---------|
| Video Clip (Futures’ Video – <i>Recycling Computers</i>) | Photo | Podcast |
| Print Media (article, ad, etc.) | Vodcast | Other |

GPS Standards:

M7D1. Students will pose questions, collect data, represent and analyze the data, and interpret results.

M7D1f. Analyze data using appropriate graphs, including...bar graphs.

Skills to Maintain from 6th Grade

M6N1. Use fractions, decimals, and percents interchangeably.

M7P3. Students will communicate mathematically

M7P5. Students will represent mathematics in multiple ways.

Objectives:

- Students will create a stacked bar graph from a data table.
- Students will predict the percentage of each – **a)** recycled electronics and **b)** disposed electronics.

Materials:

Futures' Video – *Recycling Computers* (enhances lesson, but *not* required)
www.thefutureschannel.com

Data Handout -- Management of Used and End-Of-Life Electronics in 2009
Graph Handout – vertical and horizontal axes pre-labeled
Colored pencils – two different colors; for each student

Related Task:

Show the video entitled *Recycling Computers*. Discuss what happens to electronics that are no longer used. Ask students to predict which of three types of electronics – cell phones, televisions, or computers – are recycled the most and why.

Project and pass out a copy of the *Management of Used and End-Of-Life Electronics in 2009* handout. The information in the last column has been deleted purposefully for students to determine. Students may have difficulty interpreting the tabular data because they do not know that 47.4 million, for example, is 47,400,000. This may have to be an auxiliary discussion before proceeding with the graphing part of the lesson.

Ask students what kind of graph would best represent this data? A bar graph is a logical choice because it represents categorical data. A stacked bar graph, instead of a double bar graph, allows students to easily see the percent/fraction of the total that is recycled and disposed. The total length of a bar is the sum of the *disposed* plus *recycled* electronics (the total units ready for end-of-life management).

Guide students through the thinking to know the different ways they can approach the drawing of each stacked bar. The two options are – **1)** Draw the bar for either *disposed* or *recycled* and then add on to its height the height of the other; or **2)** Draw the total height and

then draw the height of either *disposed* or *recycled*. Students should work in pairs so they can compare the length of their bars as a way to informally check their work.

Address with students the following issues:

- Determine which characteristic (*disposed* or *recycled*) will be the bottom of the stacked bar and which will be the top; consistency is important for ease of interpreting results
- Determine which color (use colored pencils) to designate *disposed* and *recycled*; again, consistency is important for ease of interpreting results
- Discuss the importance of including a key or legend for the color coding
- Label the axes
- Title the graph

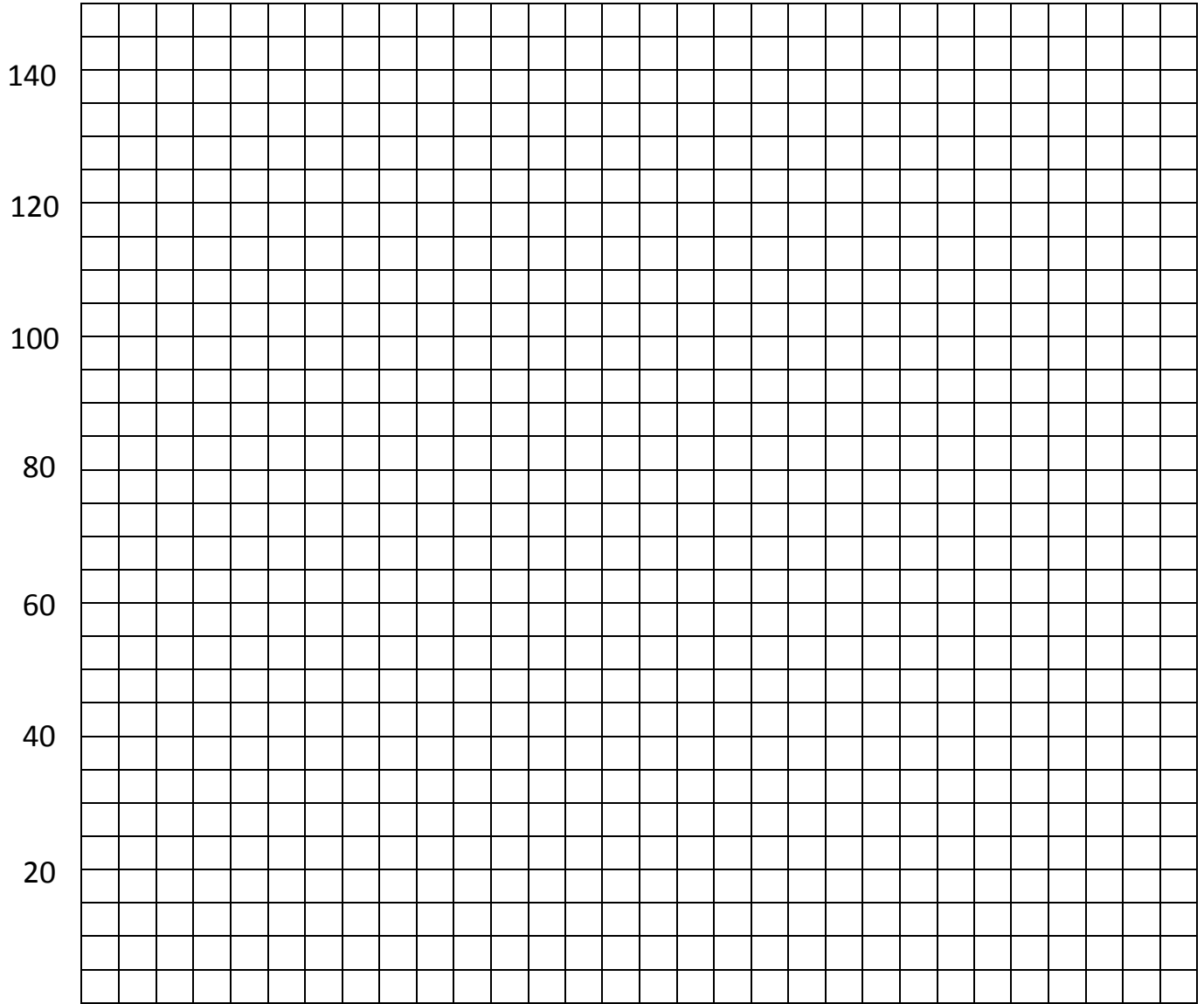
Lead a class discussion about the pros and cons of a graphical representation versus a tabular representation of data. Ask students to estimate the fraction and/or percentage of each recycled electronic to the total for that electronic by looking at the height of *recycled* to the total height of the bar. Speculate, for example, why a larger percentage of televisions are recycled than cell phones.

EXTENSION: Cut out each of the three bars. Then, cut out each *recycled* bar and *disposed* bar separately. Tape, without overlapping, the *recycled* bars together, along with the *disposed* bars to make a non-overlapping circle. The shaded side should be the **inside** part of the circle, not the outside. Place circle on a piece of paper. Place a point to represent the center of the circle. Sketch the circle on the paper. Draw in the sectors representing *recycled* and *disposed*. Discuss the percentages suggested by the circular drawing. Compare these to the actual percentages from calculations using the data table.

Learn More:

<http://www.epa.gov/osw/conserves/materials/ecycling/manage.htm>

Number of units (millions)



TVs

COMPUTERS

CELL
PHONES

ELECTRONICS

EPA Data – source

<http://www.epa.gov/osw/conserve/materials/ecycling/manage.htm>

Consumer electronics – including TVs and other video equipment, computers, assorted peripherals, audio equipment, and phones – comprise approximately one to two percent of the municipal solid waste stream, as tracked in the [Municipal Solid Waste Characterization Report](#), but they garner a great deal of interest for several reasons:

- Rapid growth and change in this product sector leading to a growing number of products needing appropriate end-of-life management;
- The intensive energy and diverse material inputs that go into manufacturing electronics represent a high degree of embodied energy and scarce resources;
- The presence of substances of concern in some electronics that merits greater consideration for safe end-of-life management; and
- The opportunities for resource recovery through improved collection and recycling.

To better track the sales, use, storage, collection, and disposal of electronics, EPA conducted an analysis of select electronic products from residential and commercial/institutional users:

Key Findings on the Management of Select Electronic Products in the US in 2009

- Sales of new electronic products are driving increases in use, storage and end-of-life management of electronics. We estimate that 438 million electronic products were sold in 2009, which represents a doubling of sales from 1997, driven by a nine-fold increase in mobile device sales.
- Estimated product weights have all decreased over the years as products have become smaller and lighter, except for flat panel TVs which have increased in weight as screen size has increased.

- An estimated 5 million short tons of products were in storage in 2009, with CRTs (monitors & TVs) being stored at the highest rates.

Residential households store 5 times more computer products (by weight) than commercial establishments.

- Approximately 2.37 million short tons of electronics were ready for end-of-life management, representing an increase of more than a 120% compared to 1999.

CRTs (TVs and monitors) comprise nearly half (47%) of all electronics ready for end-of-life management.

Approximately 141 million mobile devices were ready for end-of-life management in 2009, more than any other type of product, yet by weight, they represent less than 1% of discarded electronics.

- 25% of electronics were collected for recycling, with computers collected at the highest rate (38%).

Management of Used and End-Of-Life Electronics in 2009

	Ready for End-of-Life Management (millions of units)	Disposed (millions of units)	Collected for Recycling (millions of units)	Rate of Collection for Recycling (by weight)
Computers	47.4	29.4	18	
Televisions	27.2	22.7	4.6	
Mobile Devices	141	129	11.7	