Packaging Preferences

How Does Packaging Contribute to Waste?

Concept
Some types of packaging are better for the environment than others.

Objective
Students will evaluate the environmental impact of different packaging types.

Method
Students will graph environmental costs of different containers.

Materials
Attached worksheets

Subjects
Mathematics, Social Studies, Science

Skills
Evaluating, gathering information, graphing data, researching

Time
One class period; one year-long project

Vocabulary
Thermoplastic, thermosetting, polymer, biodegradable, photodegradable

Resources
George Pess, Thermoplastics in The Post-consumer Waste Stream; articles on plastics

3R’s of the Common Core
Parallel Activities
K-3, Egg Cartons
4-6, The Story of …
7-8, Potato Cakes
Information
Packaging
Resources
Green Consumption, Consumerism and Sustainable Development
Solid Waste and Recycling

Background
Plastics currently comprise about 12.7% of our solid waste stream, a figure that is steadily increasing. Plastics are not biodegradable or easily recycled, they are made from nonrenewable fossil fuels and some plastic produce toxins when burned. There are hundreds of different types of plastics in use today. Once they enter the waste stream, they are often contaminated with food and other substances and are practically impossible to identify and separate for recycling. PET soda bottles and milk and cider jugs as well as detergent and waste oil containers are beginning to find markets for recycling because they are made from one kind of plastic and are easily identifiable. But recycling for other plastic films, food container lids, wraps and tapes is still not easy. Most plastics are made primarily from hydrogen and carbon elements extracted from natural gas and crude oil.

“Biodegradable plastic are made by fermentation of natural substances such as sugar and other carbohydrates. One firm has produced biodegradable plastic with the help of a vigorous strain of bacteria found in canals. The bacteria are cultivated in vats and fed a sugary diet on which they thrive. In doing so they multiply and produce biological plastic rather like mammals make fat in their bodies as they grow. The plastic is extracted in fermentation vessels and is then dried and sold as granules. This plastic is readily broken down by algae, fungi or bacteria in the soil. A bag made from it will disappear within twelve or fifteen months or indeed within only three or four months if it is placed in a compost heap.”

- John Seymour and Herbert Girardet

Leading Question
How have beverage containers changed over the years?

Procedure
Introduce the lesson and provide the background information. Distribute The Choice Is Clear worksheet. Have students read the information and create six bar graphs. Students will analyze the data to draw conclusions about the best beverage containers to use. Students will display bar graphs and concluded findings on a poster to be shared in class.
Evaluation
What kind of containers are best for the environment?

Classroom Activities
A. Have students complete The Restaurant Garbage Counter worksheet as a homework assignment. Compare results from different restaurants. How can we encourage less packaging waste?
B. Send a letter to the restaurant with class suggestions for waste reduction and recycling.
C. Conduct a year-long research project to compare the decomposition time of biodegradable plastic bags and regular plastic bags. Set a goal and predict outcomes. Create a lab record worksheet to track the experiment taking into account the effects of sun, temperature, humidity, water, etc. Keep a journal of observations, questions and predictions. Analyze and interpret the records. Share the documentation and conclusions of this research project in class.

Common Core Alignments

GRADE 9-10
CC.W.9-10.4
Writing:
Production & Distribution of Writing
CC.WHST.9-10.7
Writing in History/Social Studies, Science & Technical Subjects:
Research to Build & Present Knowledge
CC.HSS.ID.1
Mathematics:
Statistics & Probability

GRADE 11-12
CC.W.11-12.4
Writing:
Production & Distribution of Writing
CC.WHST.11-12.7
Writing in History/Social Studies, Science & Technical Subjects:
Research to Build & Present Knowledge
CC.HSS.ID.1
Mathematics:
Statistics & Probability
The Choice is Clear

Your grandparents may well remember when milk and soda came in glass bottles. The empty bottles were returned to the store. When the store collected enough bottles, they were trucked back to the bottling company. Sterilization guaranteed there would be no germs left on the bottles. Then each bottle was refilled and sent back to the store. Some bottles made this trip as many as 20 times. When the bottle broke or became too badly scratched, the glass was melted down and reformed.

In the 1970s things began to change. Milk started appearing on grocery store shelves in wax cartons and plastic jugs. The soda industry switched to plastic containers. Businesses made this choice based on cost. They found it cheaper to make millions of plastic bottles than to reuse glass ones. Perhaps, for the manufacturer, it does cost less. But what about us? We pay for this through energy and water consumed. Air pollution and increased solid wastes are also part of our cost.

Study the chart below. Use the information to create six bar graphs.

<table>
<thead>
<tr>
<th></th>
<th>Plastic</th>
<th>Glass</th>
<th>Aluminium</th>
<th>Cardboard/Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average container size</strong></td>
<td>16.9 ounces</td>
<td>12 ounces</td>
<td>12 ounces</td>
<td>32 ounces</td>
</tr>
<tr>
<td><strong>Average container weight</strong></td>
<td>18-20 grams</td>
<td>210 grams</td>
<td>14.9 grams</td>
<td>47 grams</td>
</tr>
<tr>
<td><strong>Recycling rate of packaging (2012)</strong></td>
<td>13.8%</td>
<td>34.1%</td>
<td>38%</td>
<td>76.1%</td>
</tr>
<tr>
<td><strong>MMTCO2E</strong>*</td>
<td>217</td>
<td>1</td>
<td>6.3</td>
<td>85</td>
</tr>
<tr>
<td><strong>Equivalent of cars taken off the road</strong></td>
<td>454 thousand</td>
<td>210 thousand</td>
<td>1.3 million</td>
<td>17.5 million</td>
</tr>
<tr>
<td><strong>Recycling 1 ton saves:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>kWk energy</strong></td>
<td>5,774</td>
<td>42</td>
<td>14,00</td>
<td>390</td>
</tr>
<tr>
<td><strong>Gallons of oil</strong></td>
<td>685</td>
<td>5</td>
<td>1,663</td>
<td>46</td>
</tr>
<tr>
<td><strong>Btu's of energy</strong></td>
<td>98 million</td>
<td>714,286</td>
<td>237 million</td>
<td>6.6 million</td>
</tr>
<tr>
<td><strong>Cubic yards of landfill space</strong></td>
<td>30</td>
<td>2</td>
<td>10</td>
<td>9</td>
</tr>
</tbody>
</table>

*Millions of metric tons of CO₂ Equivalent


The Restaurant Garbage Counter

There certainly are a lot of quick food restaurants around. The food is served quickly and you don’t have to do any dishes. All you have to do is pay the bill. You really pay twice. One price is the money you pay at the cash register. The other cost is harder to calculate. It is an environmental cost. Fast food restaurants produce a lot of waste material. It has to be disposed of. You should understand the problem. You should know about the wastes that you cause in these restaurants.

Here’s what to do:
1. Write down each thing you receive when your order is filled.
2. Identify each item as either food or non-food.
3. For each non-food item, identify the material of which it is made.
4. State whether the material comes from a renewable or a nonrenewable resource.
5. Think about the waste that you produce.

Sample Grid:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FOOD</th>
<th>NON-FOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Made of</td>
<td>Renewable</td>
</tr>
<tr>
<td>Paper Bag</td>
<td>Paper</td>
<td>x</td>
</tr>
<tr>
<td>Box</td>
<td>Paper</td>
<td>x</td>
</tr>
<tr>
<td>Paper Napkin</td>
<td>Paper</td>
<td>x</td>
</tr>
<tr>
<td>Plastic Fork</td>
<td>Petroleum</td>
<td>x</td>
</tr>
<tr>
<td>Plastic Knife</td>
<td>Petroleum</td>
<td>x</td>
</tr>
<tr>
<td>3 Chicken Pieces</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>1 Paper Container (salt)</td>
<td>Paper</td>
<td>x</td>
</tr>
<tr>
<td>Salt</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>1 Plastic Container (vinegar)</td>
<td>Petroleum</td>
<td>x</td>
</tr>
<tr>
<td>Vinegar</td>
<td>x</td>
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<tr>
<td>French Fries</td>
<td>x</td>
<td></td>
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<tr>
<td>1 Plastic Glass</td>
<td>Petroleum</td>
<td>x</td>
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<tr>
<td>1 Plastic Lid for Glass</td>
<td>Petroleum</td>
<td>x</td>
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<tr>
<td>Paper Wrapping (straw)</td>
<td>Paper</td>
<td>x</td>
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<tr>
<td>Soft Drink</td>
<td>x</td>
<td></td>
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<tr>
<td>Straw (plastic)</td>
<td>Petroleum</td>
<td>x</td>
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<tr>
<td>Foil Container (tart)</td>
<td>Aluminum</td>
<td>x</td>
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<tr>
<td>Tart</td>
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Name: ______________________________________________________ Date: _________________________
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