Chapter 3: Molecular Compounds and Intermolecular Forces

Mini Investigation: Exploring the Properties of Oobleck, page 95
A. Oobleck has some strange physical properties. It is quite runny when allowed to sit freely. Once you hit it or move it, it becomes quite resistant to changing its shape or flow. (This is an example of a non-Newtonian fluid where the viscosity increases when the material is stirred or compressed.)

B. Answers may vary. Students’ explanations may concentrate on the shape of the starch molecules and how they fit together or tangle when compressed, or on the electrical charge of the molecules.

C. Answers may vary. Sample answer: You could vary the ratio of cornstarch to water, you could make the oobleck with water of different temperatures, and you could vary the depth of the oobleck by increasing and decreasing the size of the beaker. The independent variables would be the proportion of cornstarch and the temperature and depth of the oobleck, respectively. The dependent variable in each case would be the viscosity of the mixture.

D. It is challenging to explain what is going on at a molecular level by observing the properties of a substance because we cannot actually observe what is happening at the molecular level.

Section 3.1: Molecular Compounds

Section 3.1 Questions, page 99
1. Answers may vary. Sample answer: Two renewable resources are wood and water. Two non-renewable resources are crude oil and aluminum ore.

2. Answers may vary. Sample answers:
   (a) The canopy material for an umbrella should be waterproof, light, and flexible.
   (b) Protective packing for electronics equipment should be strong, light, and conductive.
   (c) A bathroom cleaning product should be non-toxic, water soluble, and biodegradable.
   (d) A DVD case should be strong, transparent, and long-lasting.
   (e) A juice container should be waterproof, light, and non-toxic.

3. Biodegradable materials can be broken down rapidly by the action of moisture, heat, and micro-organisms, whereas compostable materials are able to decompose naturally, resulting in a product that is able to sustain plant life.
4. Answers may vary. Sample answer: Kitchen consumer products may include items such as breakfast cereal, canned soup, juice boxes, yogurt cups, or pickles in glass containers. In small groups students will list the components of each product; produce a brainstormed list of where the materials came from and where each product will end up after its useful life; and organize their thoughts in a table or graphic organizer. For example:

The Life of Consumer Products

<table>
<thead>
<tr>
<th>Kitchen consumer product</th>
<th>Components of product</th>
<th>Origins of raw materials</th>
<th>Destination of product after its useful life</th>
</tr>
</thead>
<tbody>
<tr>
<td>individual serving of vanilla yogurt in a plastic cup</td>
<td>yogurt</td>
<td>cows on a dairy farm</td>
<td>composting facility</td>
</tr>
<tr>
<td></td>
<td>sugar</td>
<td>sugar cane or sugar beet plantation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vanilla</td>
<td>vanilla from pods from vanilla plant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>plastic container</td>
<td>processed fossil fuels</td>
<td>recycling facility or reused for another purpose (e.g., crafts)</td>
</tr>
<tr>
<td></td>
<td>paper label</td>
<td>trees</td>
<td>recycling facility</td>
</tr>
<tr>
<td>pickles in glass container</td>
<td>pickles (cucumbers)</td>
<td>vegetable farm</td>
<td>composting facility</td>
</tr>
<tr>
<td></td>
<td>glass container (silica/sand and other chemicals)</td>
<td>silica mine (or possibly from recycled glass)</td>
<td>recycling program or reused for another purpose (e.g., home canning)</td>
</tr>
</tbody>
</table>

5. Answers may vary. Sample answer:

The End Stage of Petrochemical Consumer Products

<table>
<thead>
<tr>
<th>Petrochemical consumer product</th>
<th>End stage of its life</th>
</tr>
</thead>
<tbody>
<tr>
<td>plastic bags</td>
<td>landfill or recycling</td>
</tr>
<tr>
<td>paints and varnishes</td>
<td>hazardous waste facility or landfill</td>
</tr>
<tr>
<td>synthetic fibres</td>
<td>landfill</td>
</tr>
<tr>
<td>fertilizers</td>
<td>water supply or ground</td>
</tr>
<tr>
<td>adhesives</td>
<td>landfill</td>
</tr>
<tr>
<td>candles</td>
<td>landfill</td>
</tr>
</tbody>
</table>

6. Answers may vary. Sample answer: Five different “upcycled” consumer products are bracelets made from old flip flops, lamps made from blenders, furniture made out of skateboards, backpacks made from drink pouches, and picture frames made from vinyl records.

7. Answers may vary. Sample answer: New initiatives for the development of car tires that decompose quickly include making tires using plants like sugar cane, corn, or switchgrass, and using the process of pyrolysis, a method of heating in the absence of oxygen, to decompose old tires. Uses for old tires include absorbent materials used for synthetic athletic fields, carpet underpads, play structures, and sandals.

8. The Great Pacific Garbage Patch is a region in the North Pacific Ocean where large amounts of plastic debris have concentrated due to ocean currents. The debris has a negative impact on marine wildlife because the plastics, many of which contain toxic chemicals, end up in the stomachs of marine animals, and huge numbers of birds and marine mammals die as a result. There are a few initiatives aimed at researching and cleaning up the patch. One idea is to dredge the plastic out of the water using nets and turn it over to recycling companies. Many believe that it is impossible to remove the plastic that is there, and that the most important thing to do is to stop the growth of the patch by using less plastic and recycling more of the plastic we use.
9. The Edmonton Composting Facility uses the city’s household waste and sewage sludge as resources to create compost. Turning (agitation), heat, and moisture are used to speed up the composting process.