Question Set 8.1: Explaining Evaporation

1. Student responses will vary. They may include puddles after a rainfall, morning dew, water evaporating from lakes, and so on.

2. Although choice of situation will vary, student responses should be consistent with the Science Book's explanation of evaporation. Adequate responses include the following ideas: Liquid water is changing to gaseous water or water vapor. The molecules in the liquid water are sliding past and bumping into each other, and as they do so, some of the molecules gather up enough speed to escape from the liquid water's surface into the air.

3. Dry air. The air has more room for water molecules when the air is dry; therefore, water molecules can escape faster from the towel.

   (This is an adequate explanation for this unit. Actually, if the air is humid, some of the water molecules in the air condense back onto the towel.)

4. Open. If you close the door, the molecules can only escape out from the towel as far as the bathroom door. The air will quickly become humid, and the towel will not be able to dry out any further.

5. (a) The temperature of the water decreases or gets colder because the fastest moving molecules are leaving the water. Water with fast moving molecules is hotter than water with slower moving molecules.

   (b) The faster moving molecules are leaving the water on your head and going into the air, leaving the slower moving water molecules behind. Therefore, your head feels cool.

Question Set 8.2: Where does the water in the air come from?

Student Responses:

1. Your mouth, throat, and lungs. If we trace the water back farther inside your body, it comes from the process of cellular respiration, where food is combined with oxygen to release energy. Water and carbon dioxide are the products of cellular respiration.

2. When you breathe in and out, some of the water molecules on the surface of your lungs, throat, and mouth move fast enough to escape into the air. The air that you breathe out, therefore, is very humid or has a lot of water molecules in it.

3. You can't see the water in the air because water vapor is invisible. The water molecules are too small to see and too far apart in the gas state.

4. Billions of gallons of water evaporate from the oceans everyday and mix with the air.

5. Substances: Liquid water is constantly changing to water vapor at the surface of the ocean. Another way to say this is that water is constantly *evaporating* from the surface of the ocean.

   Molecules: Some water molecules are moving fast enough to escape the liquid water at the surface of the ocean. Since the water molecules move into the air and the air molecules are constantly moving, the air molecules and water molecules intermingle or mix.

6. (a) solidifying
   (b) evaporating
   (c) expanding
   (d) contracting
   (e) evaporating
   (f) melting
   (g) dissolving

Activity 8.3: Alcohol Evaporation Race

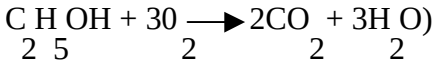
Student Responses:

1. Student responses will vary. Students may find it easier to calculate elapsed time by "counting forward" from the starting time to the finishing time.

2. Student responses will vary. They may have thought of blowing on the a;cohol, fanning it, spreading it out, or stirring it.

3. Students should include the following ideas in their responses: Alcohol molecules in liquid alcohol slide around and bump into each other. Some of the molecules are moving fast enough to escape from the surface of the liquid, thus, the liquid changes to gas. The alcohol molecules mix in with the air.

4. Student answers will vary. They may include any of the methods describe above, and they may also mention heating the alcohol. (Burning the alcohol is not an acceptable answer, as burning destroys the molecules. The chemical reaction for this is:



Question Set 8.4

Student Responses:

1. a. evaporated

   b. Some of the molecules of oobleck would have been moving fast enough to escape the surface of the liquid oobleck. Eventually all of the oobleck molecules would have mixed in with the air.

   c. The air should show at least two different molecules that make up air, with oobleck molecules mixed in.

2. The heat from the sun makes the water molecules move faster. The molecules move around and bump into each other until some of the molecules speed up enough to escape the water droplet. This process continues until liquid water changes to water vapor.

3. Student responses should include the following ideas: In evaporation, individual molecules are escaping from the surface of the liquid into the air where their motion becomes freer and more random. In boiling, molecules move faster at the bottom of a heated container. They eventually move fast enough to change to a gas and group together to form bubbles, which rise to the top and escape. Also, water only boils when it is heated; water does not have to be heated to evaporate.

4. a. molecules of the vinegar; vinegar gas

   b. Faster moving molecules escaped from the surface of the vinegar and spread through the air.

   c. The vinegar molecules that escaped from the liquid mixed in with and spread throughout the air, since molecules are always moving.