

QUESTION SET 7.1

MELTING ICE AND FREEZING WATER

TEACHING SUGGESTIONS:

You should remind students to use the elements of a good explanation when they answer the short answer/essay type questions.

STUDENT RESPONSES:

1.
 - a. Melting
 - b. Freezing or solidifying
 - c. Evaporation or boiling
 - d. Condensation or condensing
2. When ice is heated, the molecules begin to move faster and this increased jiggling causes water molecules to break apart from each other and out of their rigid array; so the ice melts into water.
3. When liquid water is cooled, the molecules slow down. When water molecules slow down, the attraction between them causes the molecules to clump together and settle into a rigid pattern. The water has frozen, or turned into ice.
4. Students should mention in their responses that in both melting and expansion, a solid substance is being heated and its molecules are jiggling faster. However, in melting, the molecules jiggle fast enough to break out of their rigid pattern, whereas in thermal expansion, the molecules remain in the rigid pattern but only move farther apart.

ACTIVITY 7.2

MELTING AND SOLIDIFYING KITCHEN SUBSTANCES

TEACHING SUGGESTIONS:

1. You should do this activity as a demonstration since it requires hot water.
2. Have the hot plate set up with a beaker of boiling water. Display the paper clip, and paraffin so the students can see them.
3. Do not put the test tubes directly from boiling water into ice water. The test tubes are likely to break. Cool the test tubes in a test tube rack first.
4. After the students have observed the demonstration, stress that pure substances were not used in this demonstration. The substances were actually mixtures.

STUDENT RESPONSES:

1. No
2. The paper clip
3. Yes
4. Olive oil
5. Students' responses will vary. Possibilities include cheese, butter, creamy peanut butter, ice cream, and frozen juice concentrate.
6. Choice of substance will vary with the student. Students should explain, regardless of the substance, that when something melts, its molecules move faster and break out of their rigid array.
7. Choice of substance will vary with the student. Students should respond that in all solidifying substances, the molecules slow down. When they do this, the attraction between the molecules causes them to clump together and form a rigid pattern or array.
8. Melting is different because when a substance melts, its molecules not only bounce a little farther apart, but they jiggle fast enough to break out of the rigid pattern that they are in as a solid.

QUESTION SET 7.3

MELTING AND SOLIDIFYING KITCHEN SUBSTANCES

TEACHING SUGGESTIONS:

This question set may be used as an evaluation tool. If you choose to use it in this way, make sure to take the Change of State poster down or cover it.

STUDENT RESPONSES:

- melting
 - freezing or solidifying
 - evaporation or boiling
 - condensation or condensing
- Students should include the idea that when a substance is heated, molecules move fast enough to break out of the rigid pattern or array.
- Student responses should mention that when a liquid is cooled, the molecules slow down. The attraction between the molecules makes them clump together and settle into a rigid pattern or array.
- The process of melting gold is very similar to the process of melting ice. In both cases the molecules move fast enough to break out of their rigid pattern. Gold, however, has stronger attractive forces between its molecules, so it melts at a much higher temperature than ice does.
- This question is similar to the last. Students should state that the freezing process is similar in both cases: Molecules slow down, move closer together, and fit together in a rigid pattern. The difference is that liquid oxygen freezes at a temperature much, much lower than water.
- melting
 - expansion
 - dissolving
 - solidifying