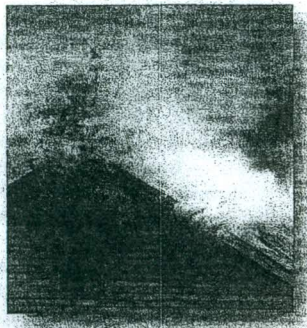


The process in which a solid changes directly to a gas is called sublimation. It occurs when the particles of a solid absorb enough energy to completely overcome the force of attraction between them. Dry ice (solid carbon dioxide, CO_2) is an example of a solid that undergoes sublimation. Sometimes snow undergoes sublimation as well. This is most likely to occur on sunny winter days when the air is very dry.

The opposite of sublimation is deposition. This is the process in which a gas changes directly to a solid without going through the liquid state. It occurs when gas particles become very cold. For example, when water vapor in the air contacts a very cold windowpane, the water vapor may change to tiny ice crystals on the glass. The ice crystals are called frost.

Section 3 Thermal Expansion

In chapter 1, you read about the physical properties of matter. One of the physical properties was based on thermal energy. Thermal energy is energy transferred in the form of heat. When molecules have thermal energy added, the molecules become more active and spread out. When they lose heat, the molecules become less active and come close together. This expansion and contraction occurs in all phases of matter. Is there thermal energy in the image to the right? If so, what phases are currently being affected by thermal energy?



Thermal expansion is the scientific term for matter expanding and contracting due to thermal energy. You may have noticed that power lines are very saggy in the summer and very tight in the winter. This is because of thermal expansion. When the heat from the Sun warms the metal molecules in the summer, the molecules spread out and cause the wires to expand and sag. The opposite is true in the winter. Is there thermal expansion in the image to the right? If so, what phases are being affected by the thermal expansion? Did you notice that the phases affected by thermal energy also were affected by thermal expansion?

Section 4 Conclusion

Energy can be added or removed from matter to make it change states between solids, liquids, and gasses. The temperature at which matter changes between solids and liquids is called the freezing or melting point. The temperature at which matter changes between liquids and gasses is called the condensation or boiling point. Sometime matter can change directly between solids and gasses without becoming a liquid. This is called sublimation or deposition.

Thermal expansion occurs when thermal energy is added to matter. This causes the matter gain energy and increase in size.

Chapter 2.3 Review Questions

Answer each question in your notebook. Remember to use complete sentences and correct grammar.

Recall

1. Describe the two phase changes that occur at the freezing point.
2. Define boiling (vaporization) and evaporation. State how the two processes differ.
3. Explain how sublimation is different from vaporization.
4. How does thermal expansion affect the volume of solids, liquids, and gasses?

Apply Concepts

5. Amelia walks outside on a cold morning, and her glasses immediately become covered in "fog." What phase change occurred on her glasses? Where did the "fog" come from?

Think Critically

6. Explain the role of energy in changes of state.
7. Each material has a unique melting, and freezing point. How can scientist use this information?