

13.4 CHANGES OF STATE

Section Review

Objectives

- Identify the conditions necessary for sublimation
- Describe how equilibrium conditions are represented in a phase diagram

Vocabulary

- sublimation
- triple point
- phase diagram

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

The change that occurs when a solid goes directly to the gas _____ 1. _____
or vapor state without first becoming a liquid is _____ 2. _____

This change can occur because solids, like liquids, have a _____ 3. _____
_____ 2. _____ Substances that sublime include iodine and solid _____ 4. _____
_____ 3. _____ (dry ice). _____ 5. _____

A graph that shows the relationship between the states of a _____ 6. _____
substance is called a _____ 4. _____ diagram. On this diagram, a line _____ 7. _____
between two phases shows the conditions at which the phases _____ 8. _____
are in _____ 5. _____. The _____ 6. _____ is the only set of conditions at
which solid, liquid, and gas phases coexist. The triple point for
water is a temperature of _____ 7. _____ and a pressure of _____ 8. _____.

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

- _____ 9. A phase diagram gives information on changes in mass of solids, liquids, and gases.
- _____ 10. Water could be made to boil at 105°C by increasing the pressure.

- _____ 11. The sublimation point of a substance refers to the temperature and pressure at which the substance exists in all three phases of matter.
- _____ 12. Below the triple point for water, decreasing the pressure will not change water vapor to ice.
- _____ 13. Water has more than one triple point.
- _____ 14. At 101.3 kPa, the normal boiling point and melting point of water are the same.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A	Column B
_____ 15. melting	a. the change of a solid to a vapor without passing through the liquid state
_____ 16. freeze drying	b. the change of a solid to the liquid state
_____ 17. phase diagram	c. a method of removing water from food, using sublimation
_____ 18. 0.016°C, 0.61 kPa	d. graph that shows the relationship among the states of a substance
_____ 19. sublimation	e. defines the triple point for water
_____ 20. 100°C at 101.3 kPa	f. normal boiling point for water

Part D Questions and Problems

Answer the following in the space provided.

21. Explain how some solids can vaporize and then condense back to a solid without passing through the liquid state. What is the process called?

22. When the physical state of a substance changes during a phase change, what happens to the temperature of the system?
