1. Use any one of the phase changes to explain what is meant by dynamic equilibrium.

2. How is the molar heat of sublimation related to the molar heats of vaporization and fusion?

3. What can we learn about the intermolecular forces in a liquid from the molar heat of vaporization?

4. Define boiling point. How does the boiling point of a liquid depend on external pressure?

5. The molar heats of fusion and sublimation of molecular iodine are 15.27 kJ/mol and 62.30 kJ/mol, respectively. Estimate the molar heat of vaporization of liquid iodine.

6. The following compounds, listed with their boiling points, are liquid at \(-10^\circ\text{C}\): butane, \(-0.5^\circ\text{C}\); ethanol, 78.3°C; toluene, 110.6°C. At \(-10^\circ\text{C}\), which of these liquids would you expect to have the highest vapor pressure? Which the lowest? Explain.

7. A phase diagram of water is shown to the right.
   a. Label the regions
   b. Explain how water phase diagram differs from those of most substances. What property of water causes the difference?
   c. Predict what would happen as a result of the following changes
      i. Starting at A, we raise the temperature at constant pressure
      ii. Starting at C, we lower the temperature at constant pressure
      iii. Starting at B, we lower the pressure at constant temperature

8. The phase diagram of sulfur is shown to the right.
   a. How many triple points are there?
   b. Monoclinic and rhombic are two allotropes of sulfur. Which is more stable under atmospheric conditions?
   c. Describe what happens when sulfur at 1 atm is heated from 80°C to 200°C.

9. Which phase diagram corresponds to a substance that will sublime rather than melt as it is heated at 1 atm?
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10. Referring to phase diagram of carbon dioxide given in the PowerPoint, determine the stable phase of carbon dioxide at:
   a. 4 atm and −60°C
   b. 0.5 atm and −20°C

11. A beaker of water is placed in a closed container. Predict the effect on the vapor pressure of the water when (a) its temperature is lowered (b) the volume of the container is doubled (c) more water is added to the beaker.

12. Given the phase diagram of carbon shown, answer the following questions:
   a. How many triple points are there and what are the phases that can coexist at each triple point?
   b. Which has a higher density, graphite or diamond
   c. Synthetic diamond can be made from graphite. Using the phase diagram, how would you go about making diamond?

13. Why do citrus growers spray their trees with water to protect them from freezing?

14. The compound dichlorodifluoromethane (CCl₂F₂) has a normal boiling point of −30°C, a critical temperature of 112°C, and a corresponding critical pressure of 40 atm. If the gas is compressed to 18 atm and 20°C, will the gas condense? Your answer should be based on a graphical interpretation.