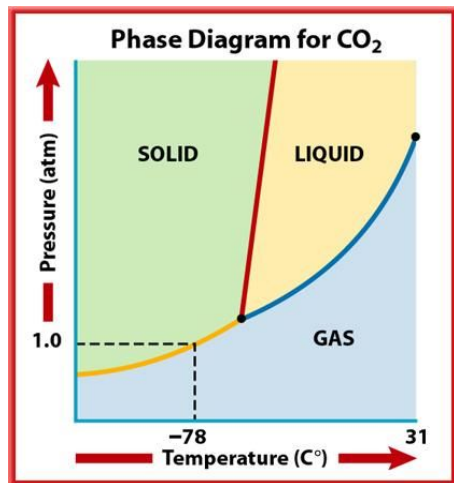


## PHASE DIAGRAMS

Temperature and \_\_\_\_\_ control the phase of a substance. A phase diagram is a graph of pressure versus temperature that shows in which phase a substance exists under different conditions of temperature and pressure. A phase diagram typically has \_\_\_\_\_ regions, each representing a different phase and three curves that \_\_\_\_\_ each phase.



The points on the curves (lines) indicate conditions under which two phases coexist. The critical point indicates the critical pressure and the critical temperature above which a substance cannot exist as a \_\_\_\_\_. The triple point is the point on a phase diagram that represents the temperature and pressure at which three phases of a substance can \_\_\_\_\_.

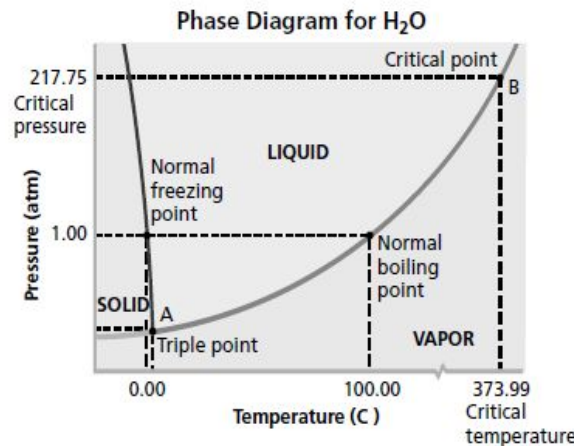
The \_\_\_\_\_ slope of the solid-liquid line in the phase diagram for water indicates that the solid floats on its liquid.

### *Phase Diagram Questions*

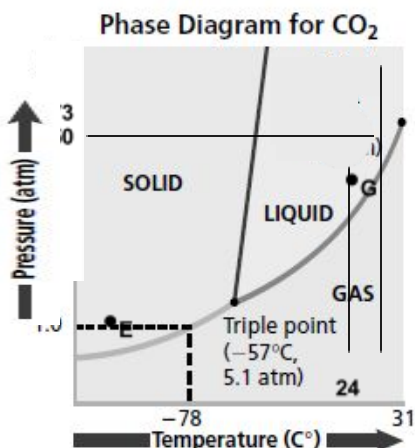
1. What phase change occurs for CO<sub>2</sub> at -100 °C and 1 atm pressure as it is heated to room temperature?
2. What phase change happens to water at 1 atm as the temperature rises from -15°C to 60°C?
3. What state of matter is water at 50°C and 20 atm?
4. At what temperature does the triple point occur for water?
5. At what temperature does the critical point occur for carbon dioxide?
6. At standard pressure and -78°C, what two phase changes can occur for carbon dioxide?
7. What state of matter is carbon dioxide at -80°C and 2 atm?

1. What variables are plotted on a phase diagram?
2. How many phases are represented in a phase diagram? What are they?
3. Use the phase diagram for water to complete the following table.

Temperature (°C)	Pressure (atm)	Phase
200	1	
-2	1	
150	100	
-2	0.001	
30	0.8	
	1	liquid
100.00		vapor



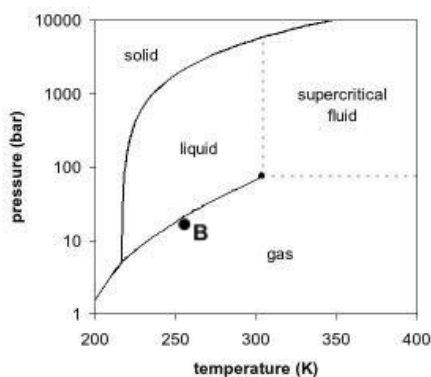
4. What phases of water coexist at point C in water's phase diagram?
5. What two phase changes occur at point D in the phase diagram for water?
6. What is the critical temperature of water?
7. What pressure is at water's normal boiling point?
8. What occurs at the triple point?



Look at the phase diagram for carbon dioxide. Above which pressure and temperature is carbon dioxide unable to exist as a liquid?

- At which pressure and temperature do the solid, liquid, and gaseous phases of carbon dioxide coexist?
- What two phase changes occur at point E in the phase diagram for carbon dioxide?
- What phases of water coexist at point G in CO<sub>2</sub>'s phase diagram?

13. What phase change occurs as carbon dioxide moves from -78°C to 24°C at a pressure of 50 atm?



Use the phase diagram to the left to answer questions 14-18.

14. What is the temperature at which the triple point occurs?
15. What 2 phase changes occur at Point A?
16. What phase change does the substance at 100 bars undergo as the temperature decreases from 250 K to 200 K?
17. What is the pressure at which the critical point occurs?
18. What 2 phase changes occur at Point B?