Changes of State

Water exists on Earth as a liquid, a solid, and a vapor. As water cycles through the atmosphere, the oceans, and Earth's crust, it undergoes repeated changes of state. You will learn what conditions can control the state of a substance.

BELLWORK-name the

following state changes:

- Solid to liquid b) liquid to solıd
- Liquid to gasd) gas to liquid

e) Solid to gas

Melting - solid to liquid

Freezing- liquid to solid

Vaporization- liquid to gas

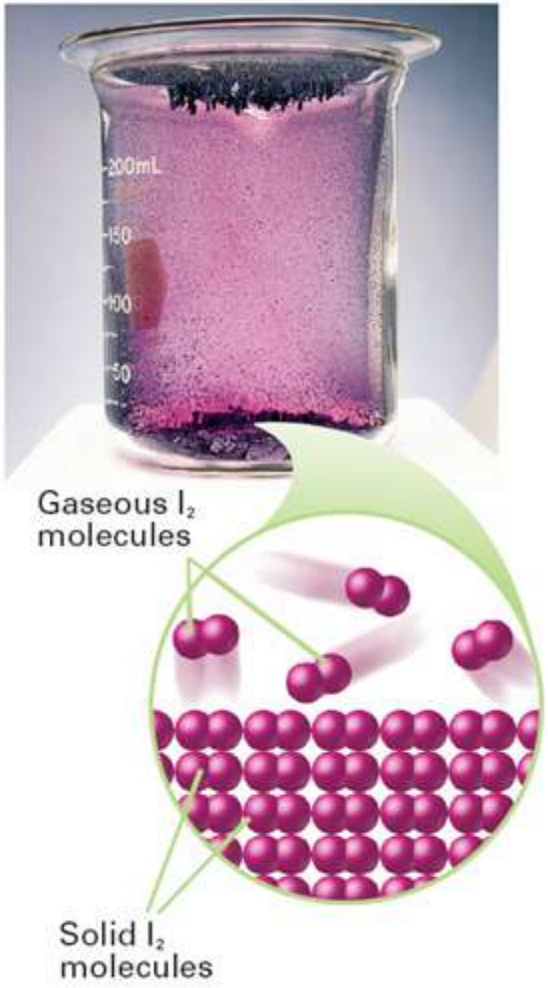
Vapor- a gas that is usually a liquid at room temp

Condensation- changing from a gas to a liquid

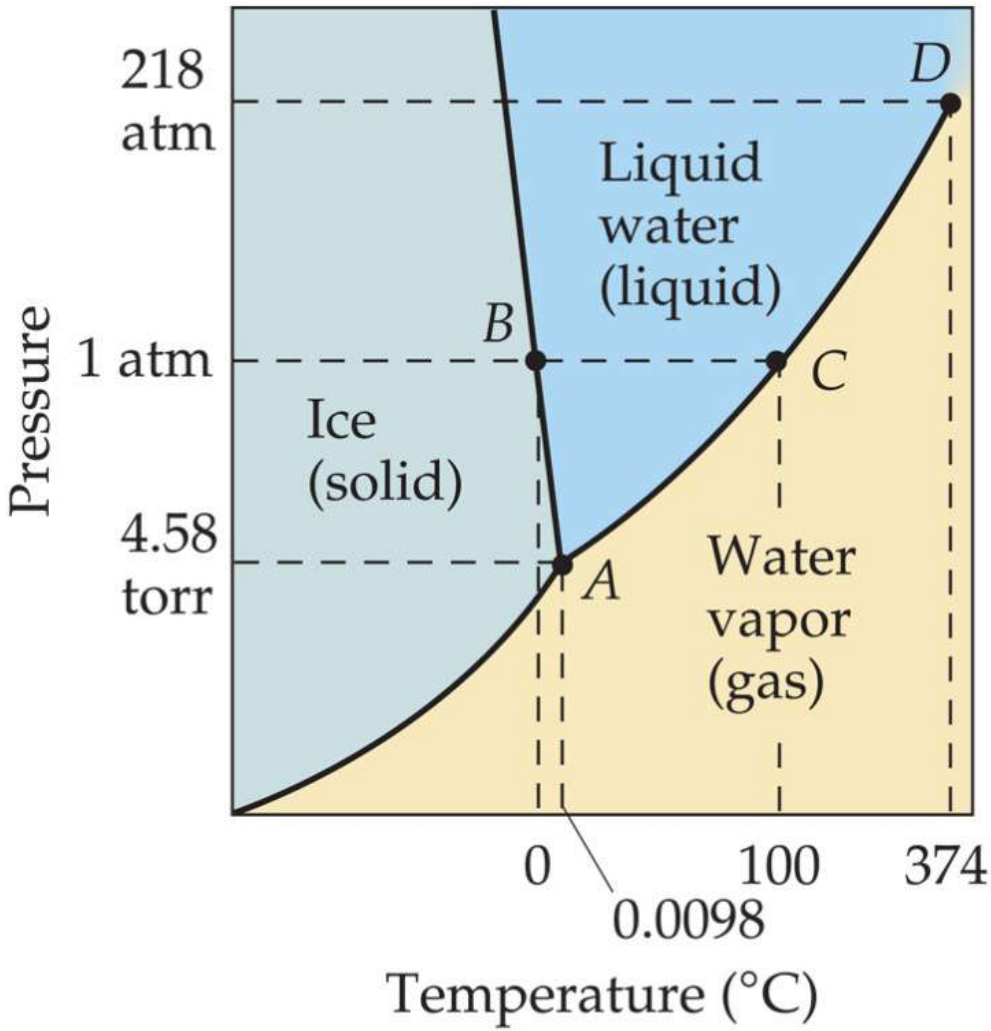
The change of a substance from a solid to a vapor without passing through the liquid state is called sublimation.

Sublimation occurs in solids with vapor pressures that exceed atmospheric pressure at or near room temperature.

When solid iodine is heated, the crystals sublime, going directly from the solid to the gaseous state. When the vapor cools, it goes directly from the gaseous to the solid state.



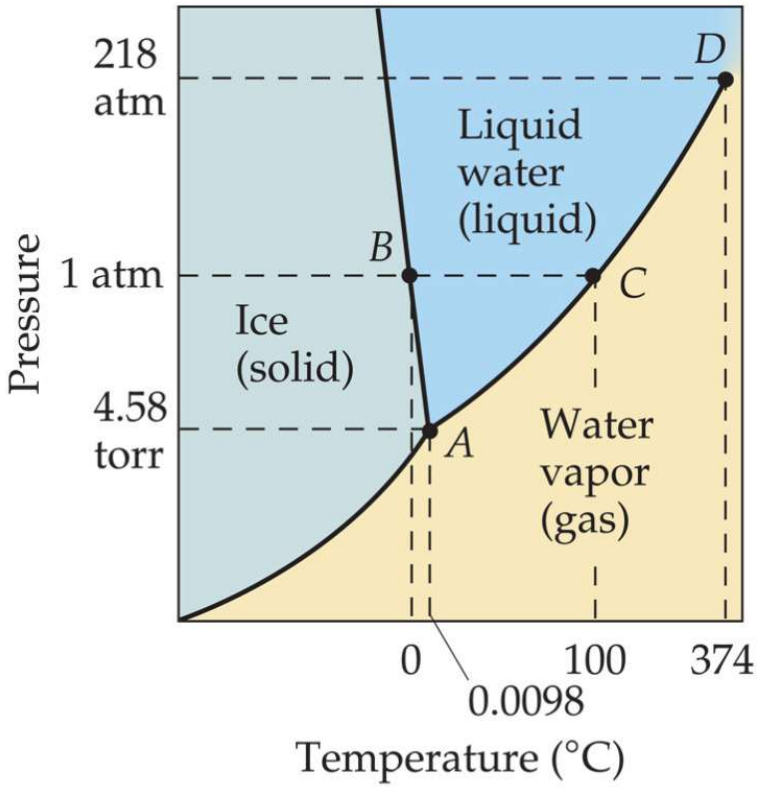
A phase diagram is a graph that gives the conditions of temperature and pressure at which a substance exists as solid, liquid, and gas (vapor).



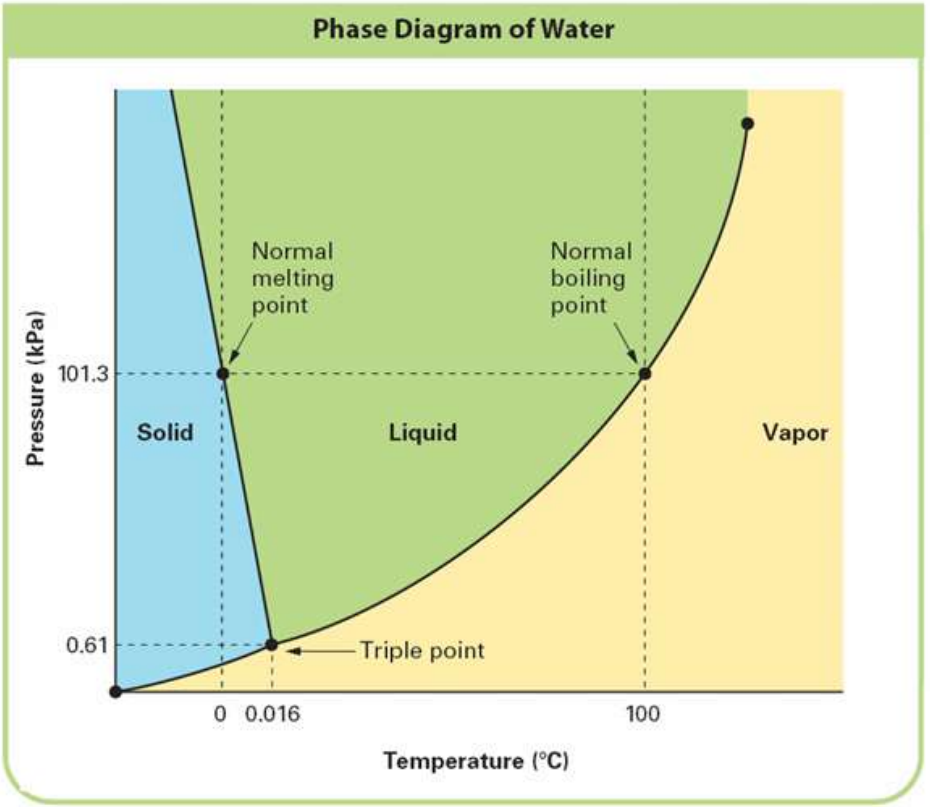
On the line between two phases, both states exist at equilibrium.

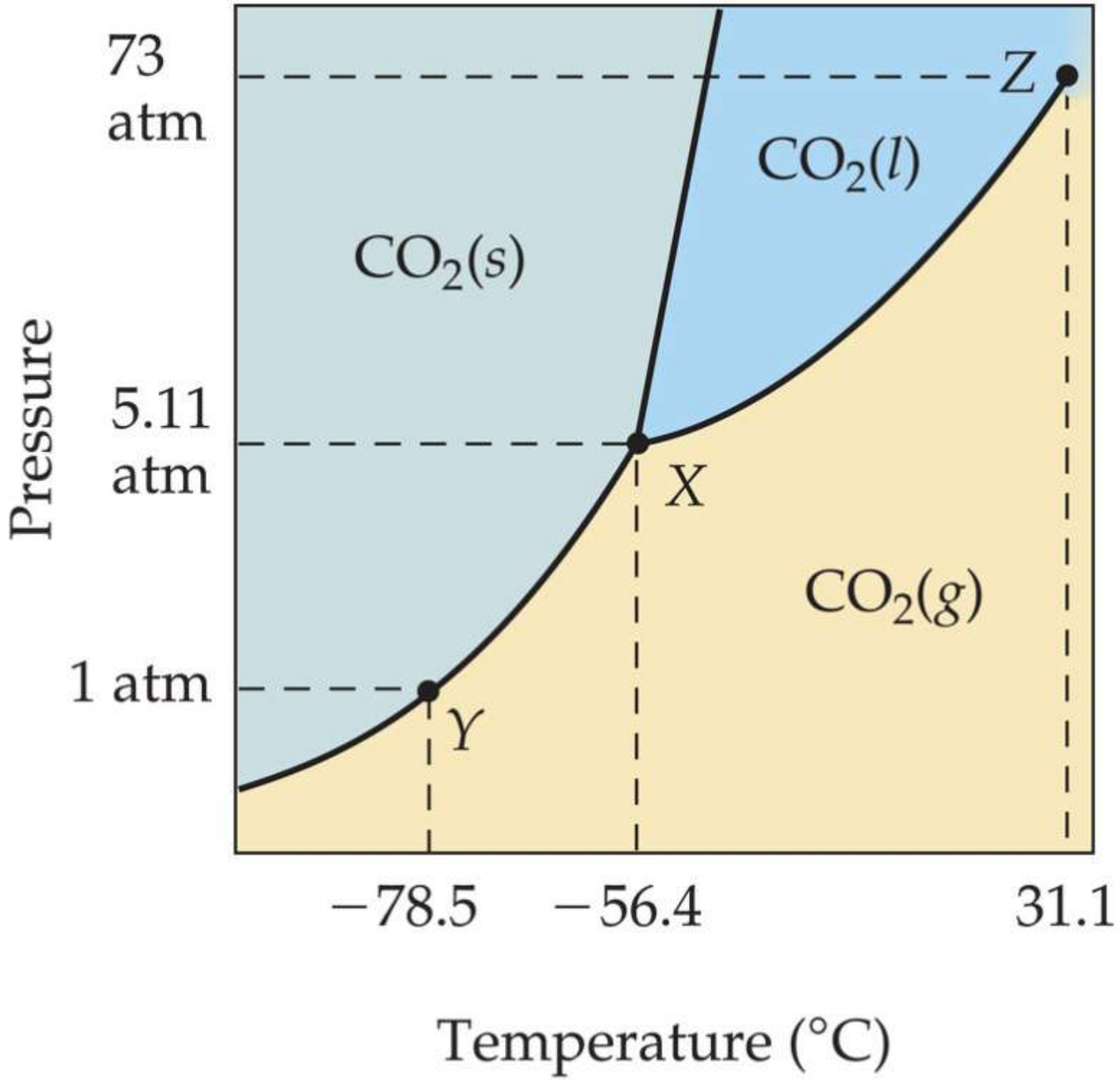
At 1 atm and 0°C ice and water are at equilibrium.

This is the normal melting/freezing point of H_2O.



The triple point describes the only set of conditions at which all three phases can exist in equilibrium with one another.




73
atm
5.11
atm
1 atm
Pressure
Z
X
Y
$CO_2(s)$
$CO_2(l)$
$CO_2(g)$
−78.5
−56.4
31.1
Temperature (°C)

1. Identify the change of state that occurs when solid CO_2 changes to CO_2 gas as it is heated.
   - condensation
   - freezing
   - vaporization
   - sublimation

2. Sublimation occurs in solids if the vapor pressure at or near room temperature
   - exceeds atmospheric pressure.
   - equals atmospheric pressure.
   - is less than atmospheric pressure.
   - is less than half the atmospheric pressure.

3.What is the significance of a line in a phase diagram?

- Only one phase is present.
- Two phases are in equilibrium.
- Three phases are in equilibrium.
- The distinction between two phases disappears.

4.What is the significance of the triple point in a phase diagram?

- **Temperature and pressure are equal.**
- **Two phases are in equilibrium.**
- **Three phases are in equilibrium.**
- **The distinction among three phases disappears.**