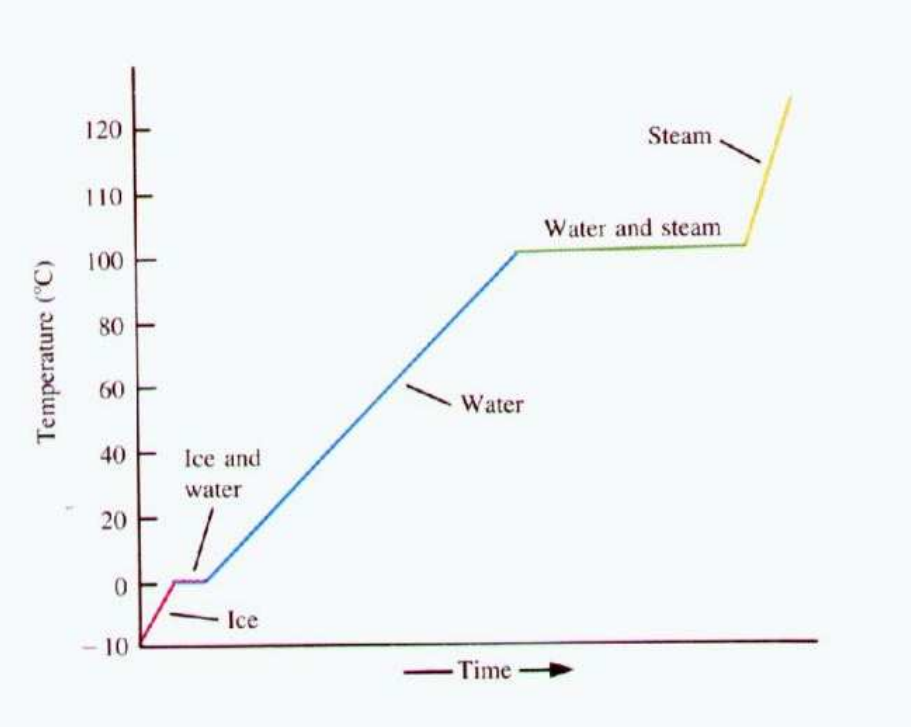
Changes of State and Heating Curves:
Temperature vs. time plot in which heat is added at a constant rate. Intermolecular attractions are overcome, physical changes.



Melting = Freezing Point: No change in temperature, a fixed temperature for pure solids. Kinetic energy increases while potential energy remains the same. Vapor pressure of solid is equal to the vapor pressure of liquid at 1 atm)

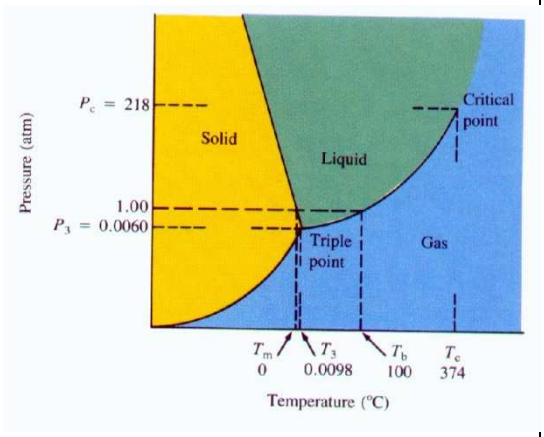
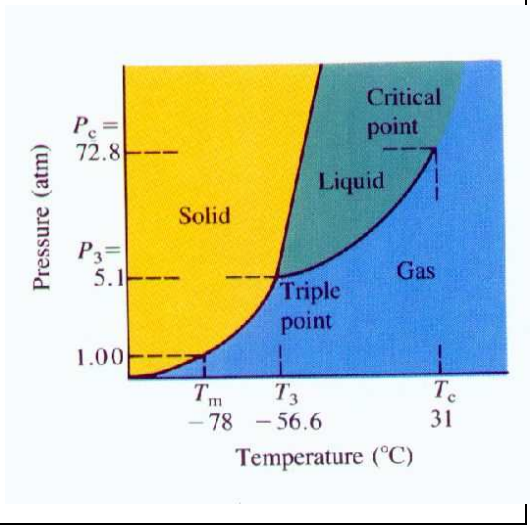
Enthalpy (heat) of fusion: energy required to melt 1 mol of substance at its normal melting point.

Boiling Point: temperature (KE) remains constant, potential energy is used to overcome intermolecular attractions. Heat of vaporization >> Heat of fusion. Occurs when vapor pressure = air pressure overhead (environment), normally at 1 atm. *What is the vapor pressure of Hg at its normal boiling point? Ans: 1 atm.*

Supercooled, liquid exists below normal freezing point.
Superheated; liquid exists above normal boiling point. Usually from rapid heating. "bumping"

10.7 Phase Diagrams

A diagram that represents state of matter as plotted against temperature and pressure in a *closed* system.

Phase Diagram for H_2O	Phase diagram for CO_2
	

Triple Point: All three phases of matter exist.
Ex. H2O; at 0.01ºC and 4.58 torr

Critical Temperature: temperature above which the vapor can not be liquefied no matter what pressure is applied.

Critical Pressure; the pressure required to produce liquefaction at the critical temperature.

Together these points are called the **Critical Point.** For water this is 374ºC and 218 atm. Beyond the critical point is an intermediate "fluid" region. Neither a true liquid nor vapor.

Applications of the Phase Diagram:

For H_2O: The solid/liquid boundary line has a negative slope. The MP of ice decreases with an increase in pressure. Very unusual property: the density of ice, solid phase, is less than the liquid phase. Water reduces its volume by reverting to the more dense liquid phase when pressure is applied. Water has its maximum density at 3.98ºC. Also, lake turn over effect.

Limited in a closed system: Actually water can sublime on at normal pressure when temperature is below 0ºC. Wet clothes will dry at ¯0ºC because the water sublimes.

For CO_2: solid/liquid line has a positive slope. Triple point is at 5.1 atm and ¯56.6ºC and the critical point is at 72.8 atm and 31ºC. CO_2 sublimes at ¯78ºC, "dry ice". As a fire extinguisher, the pressurized CO_2 is a liquid, but reverts to a gas which is more dense than air to "smother" the fire and also cool from the endothermic phase change.

Practice Problems: P. 475 #14, 28, 85, 86, 87, 88, 91, 95, 96, 104, 106