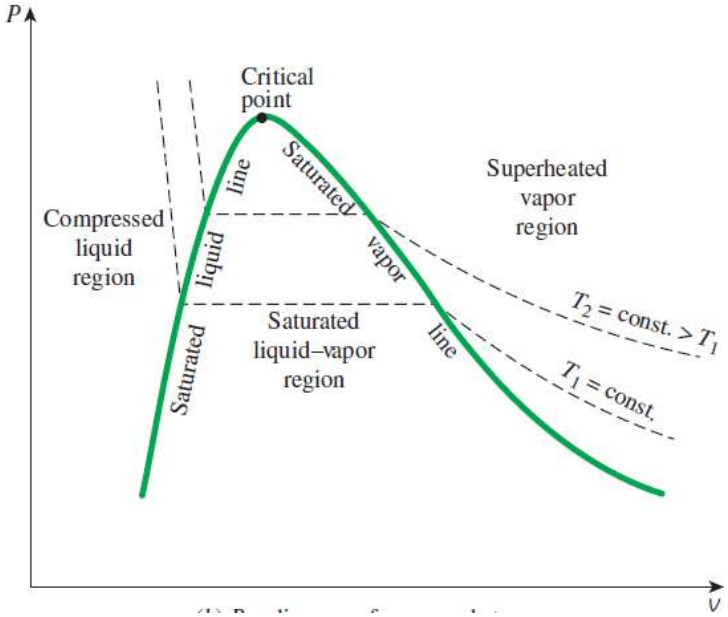
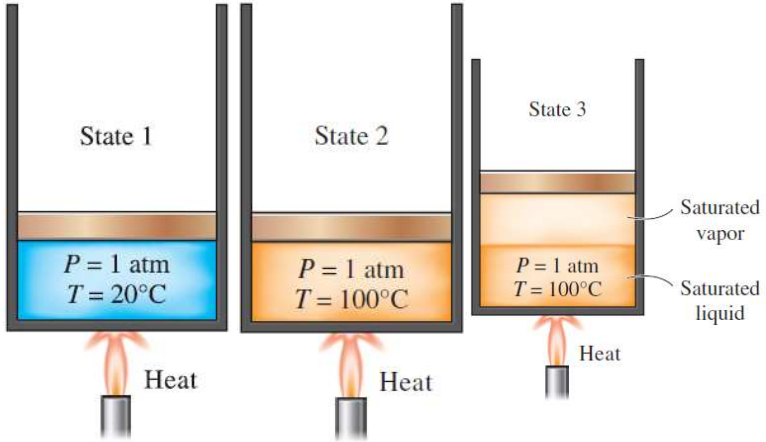
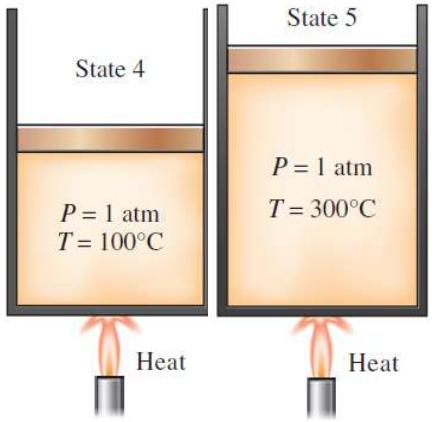
PhaseBook
Solid-Liquid -Vapor Transitions

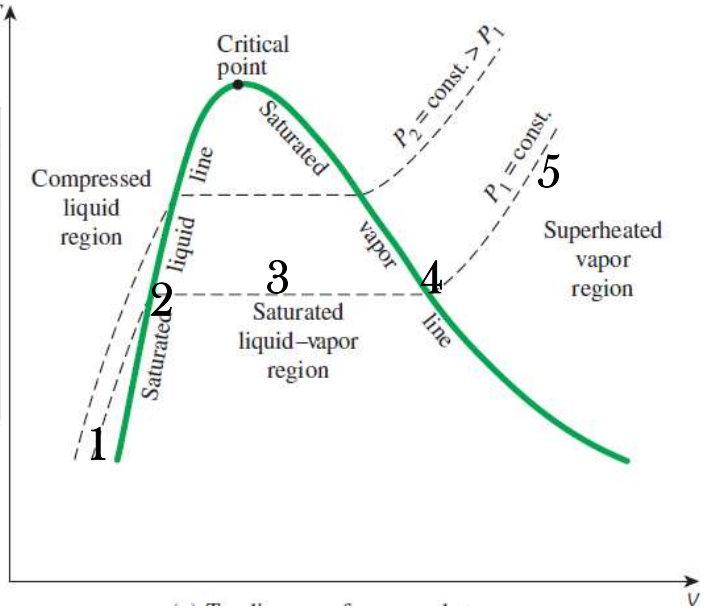
Raj Pala,
rpala@iitk.ac.in
Department of Chemical Engineering,
Associate faculty of the Materials Science Programme,
Indian Institute of Technology, Kanpur.

Different ways of conducting experiments



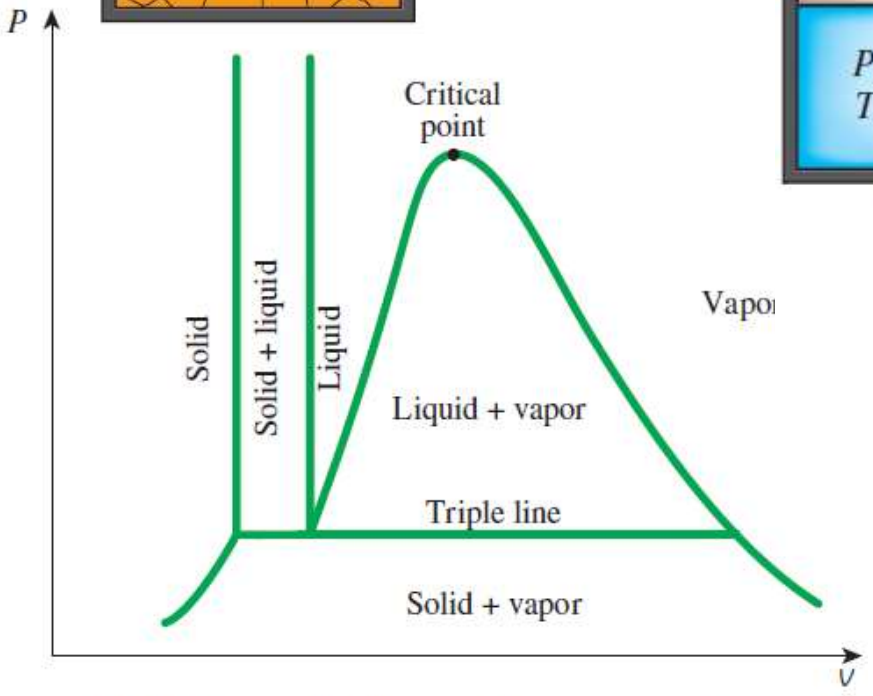




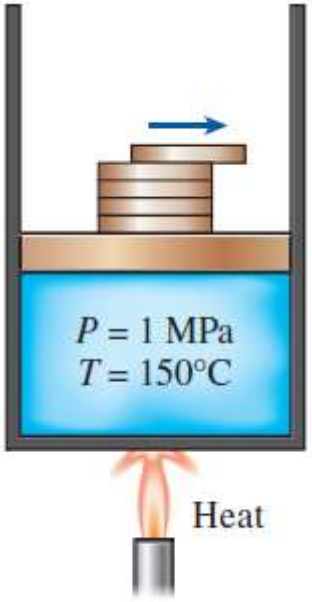


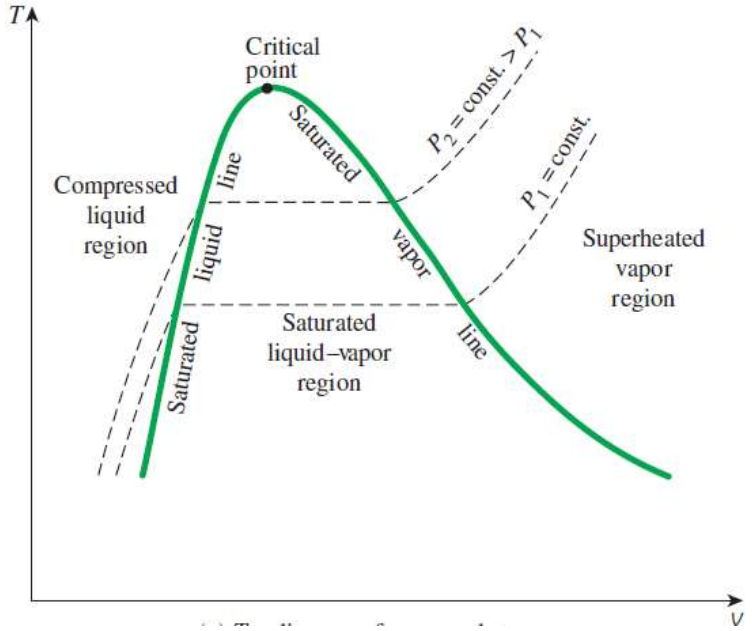
Figs: Cengel & Boles, TD

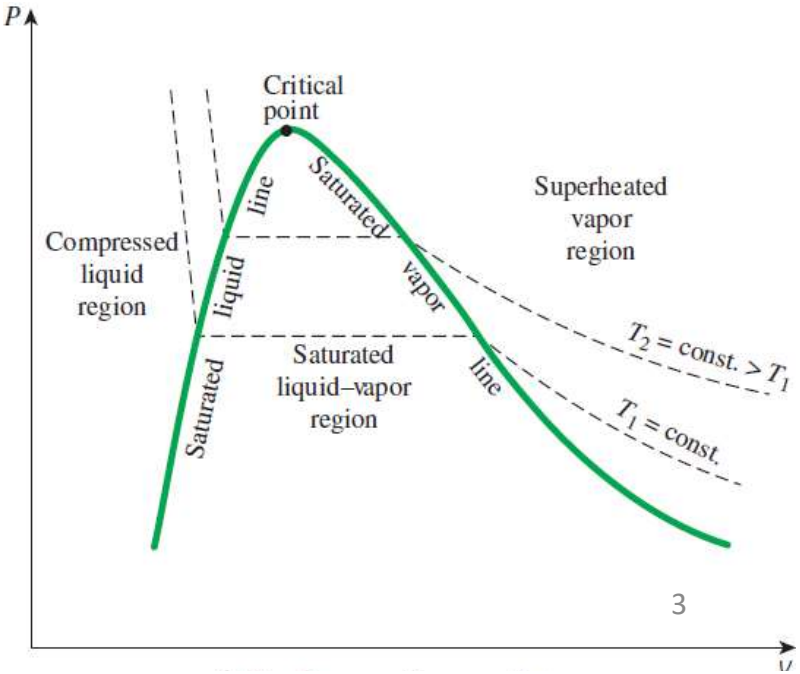
Solid-Liquid-Vapor transitions



(a) P-v diagram of a substance that contracts on freezing



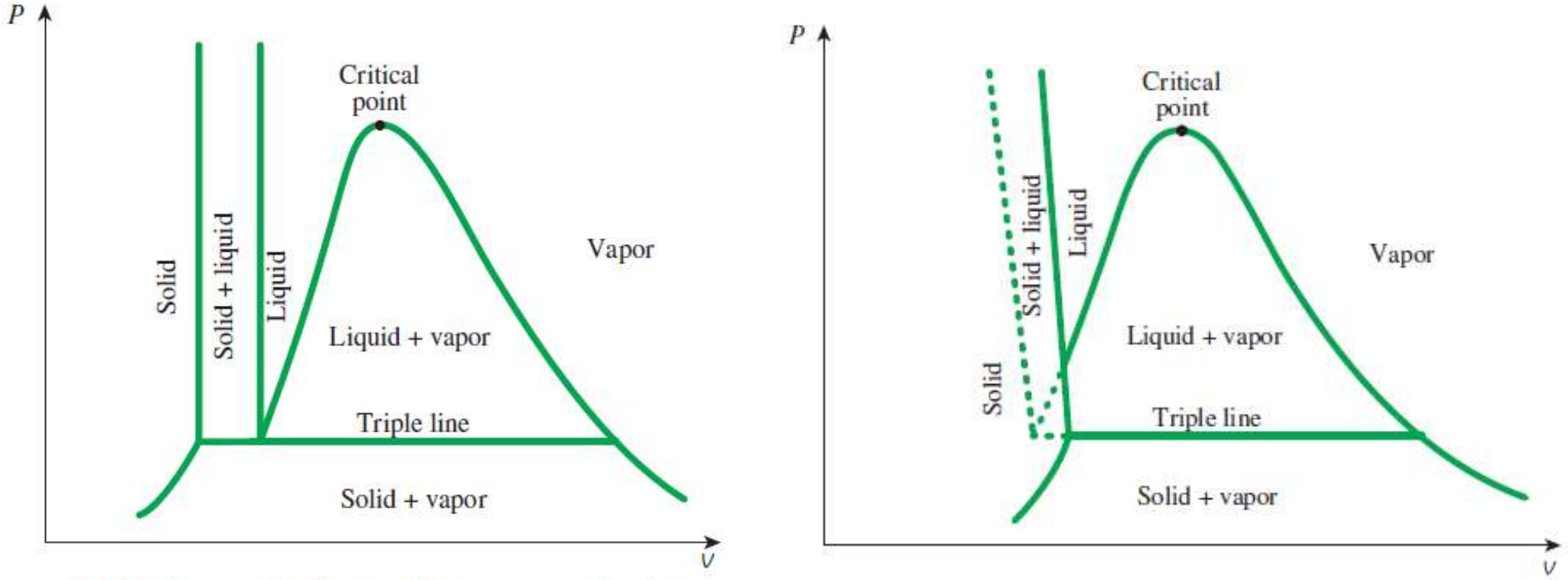




- Liquid is not possible below triple line

Figs: Cengel & Boles

Solid-Liquid-Vapor transition for water



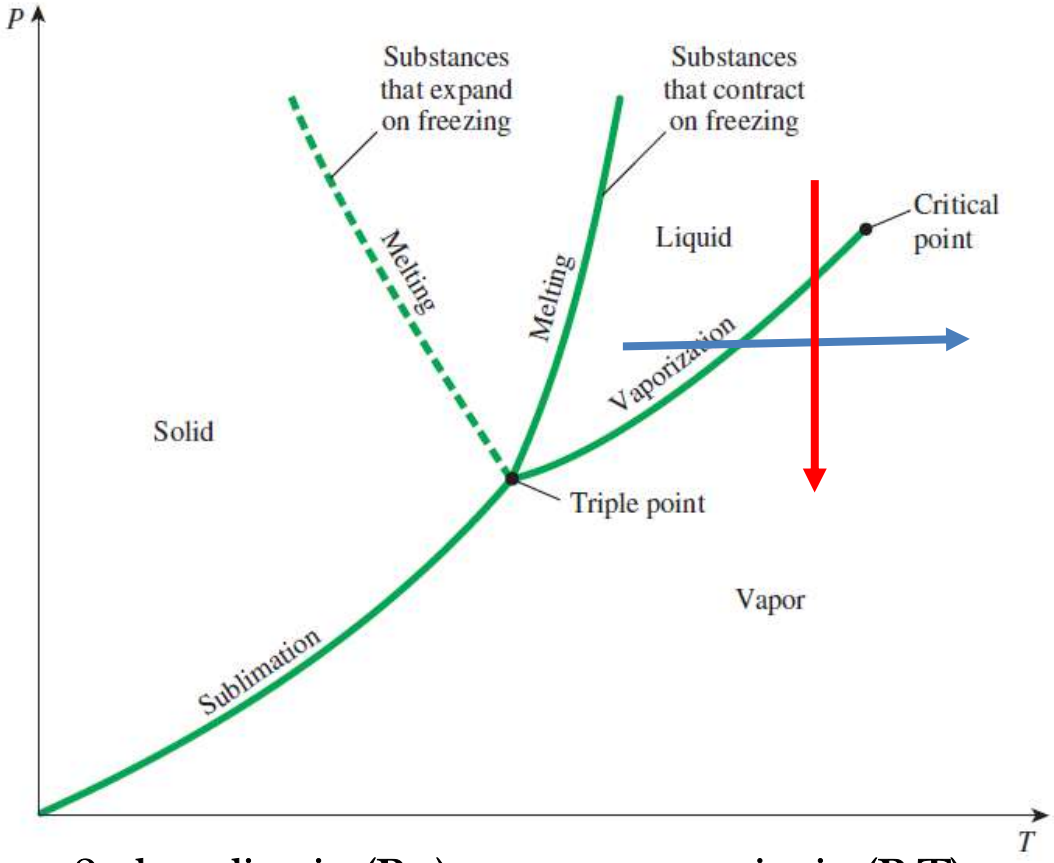
(*a*) *P*-*v* diagram of a substance that contracts on freezing

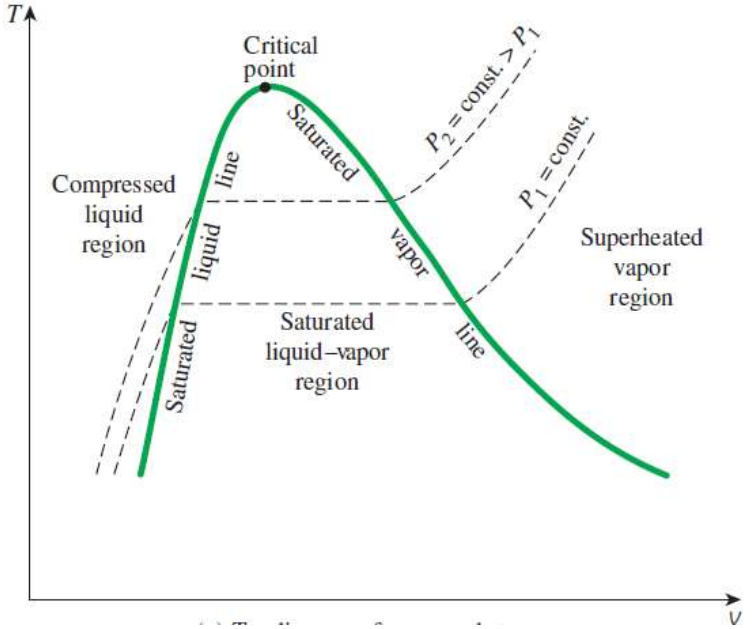
(*b*) *P*-*v* diagram of a substance that expands on freezing (such as water)

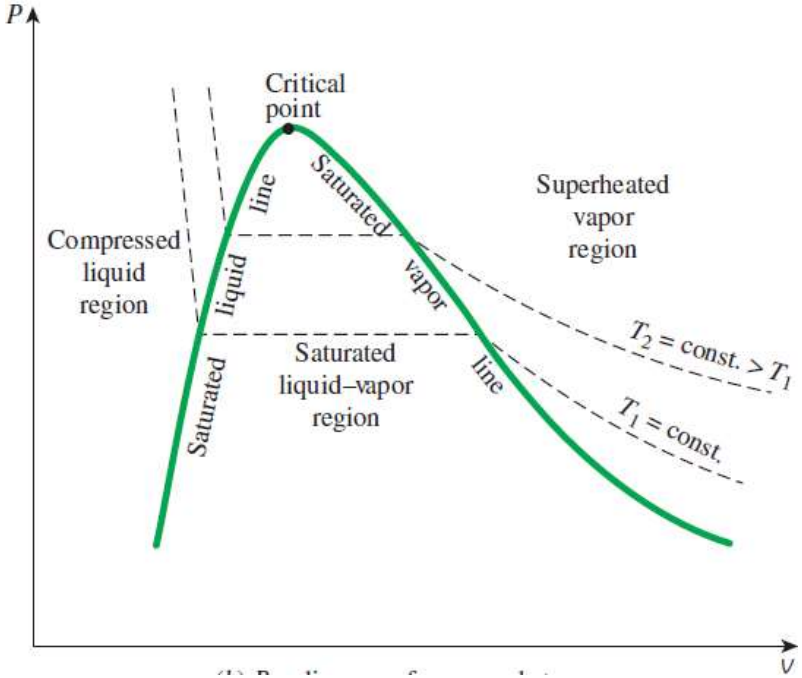
- Ice floats on water!

Fig: Cengel & Boles

P vs. T for Solid-Liquid-Vapor transitions







- 2-phase line in (P-v) appears as a point in (P-T)
- Triple line in (P-v) appears as a Triple point in (P-T)
- "Simple compressible substance"?
- No surface, electrical & magnetic effects
- No phase transition
- We will define it further after some more "work"

Fig: Cengel & Boles

Ice is cool!

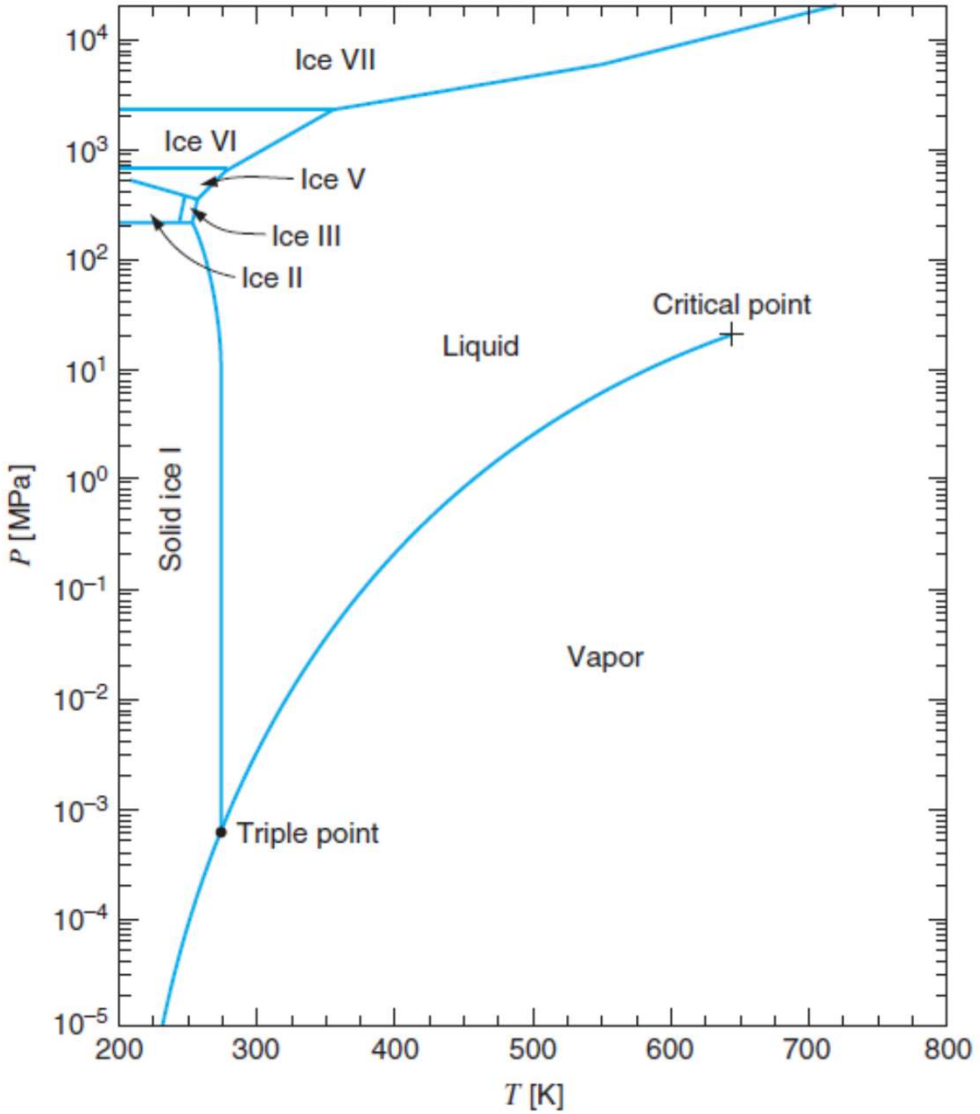
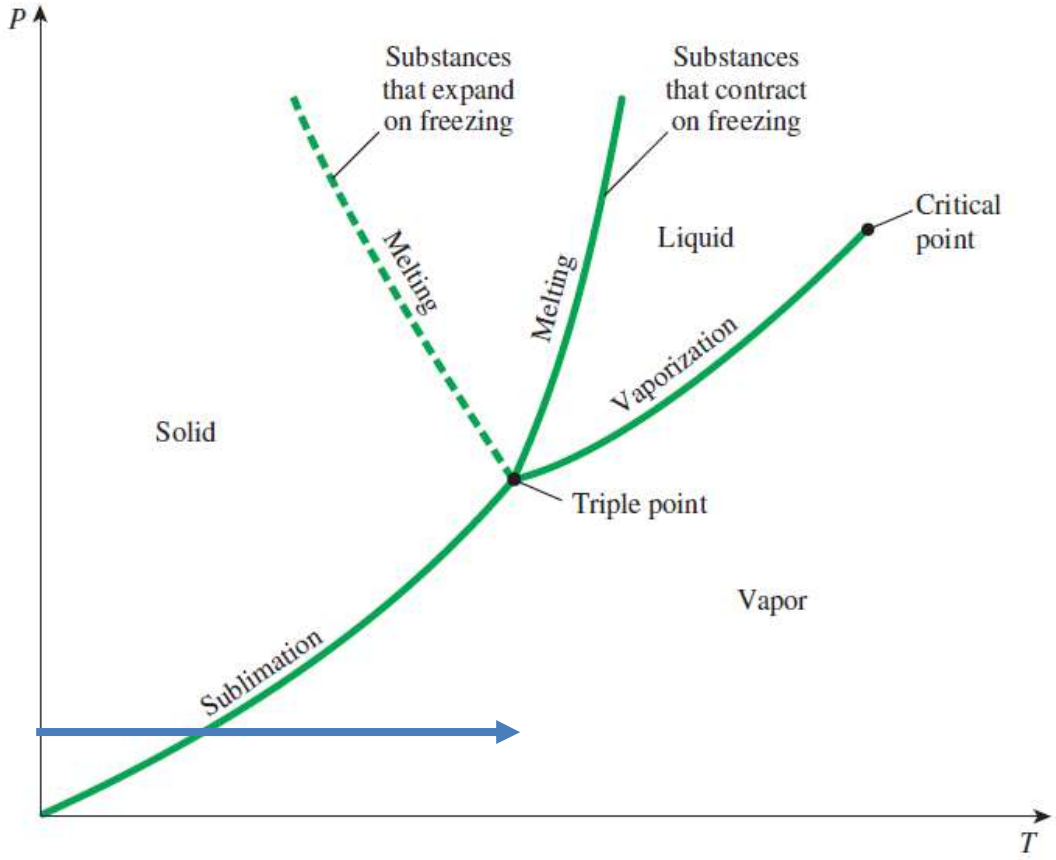
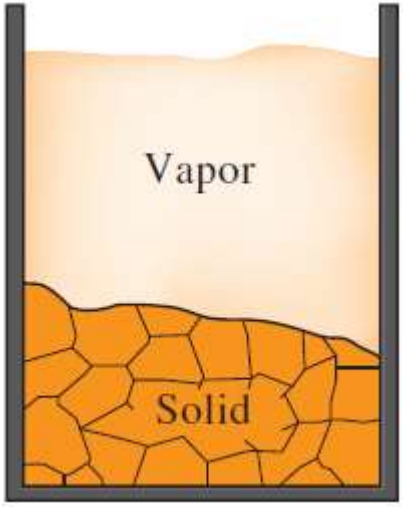


Fig: Borgnakke & Sonntag, TD

Sublimation





- Both liquids and gases have continuous translational symmetry; Solid have discrete translational symmetry
- Sublimation vs. vaporization
- Sublimation: CO_2 (dry ice), Camphor, Napthalene...

Fig: Cengel & Boles

Sublimation in "dry ice"

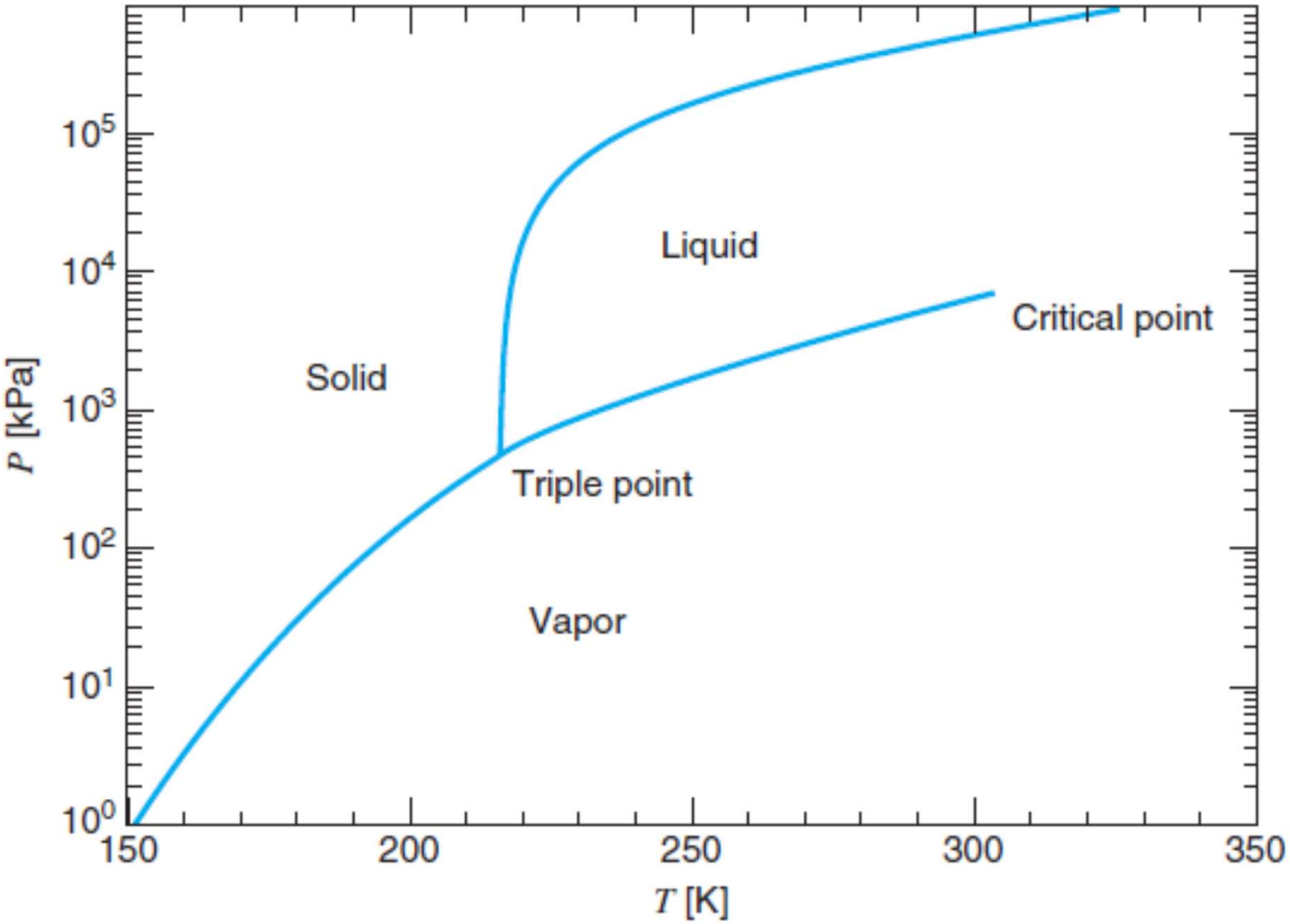


Fig: Borgnakke & Sonntag, TD