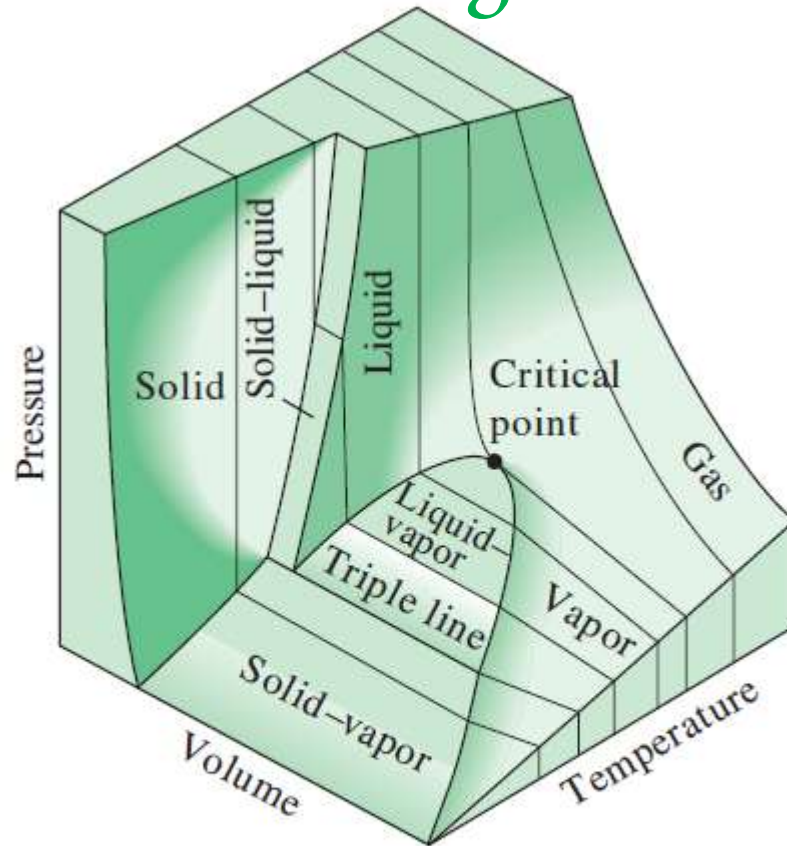


*PhaseBook*  
*Frowning Faces & 3D Phase Diagrams*

Raj Pala,  
[rpala@iitk.ac.in](mailto:rpala@iitk.ac.in)

Department of Chemical Engineering,  
Associate faculty of the Materials Science Programme,  
Indian Institute of Technology, Kanpur.

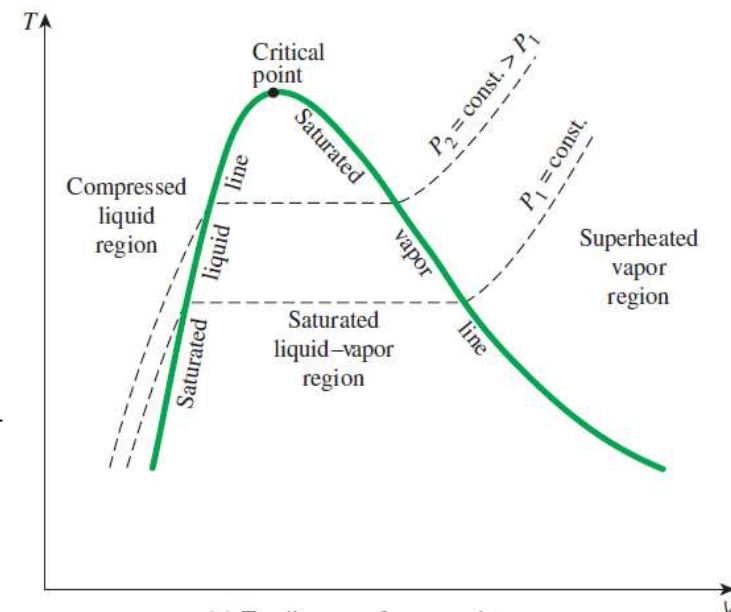
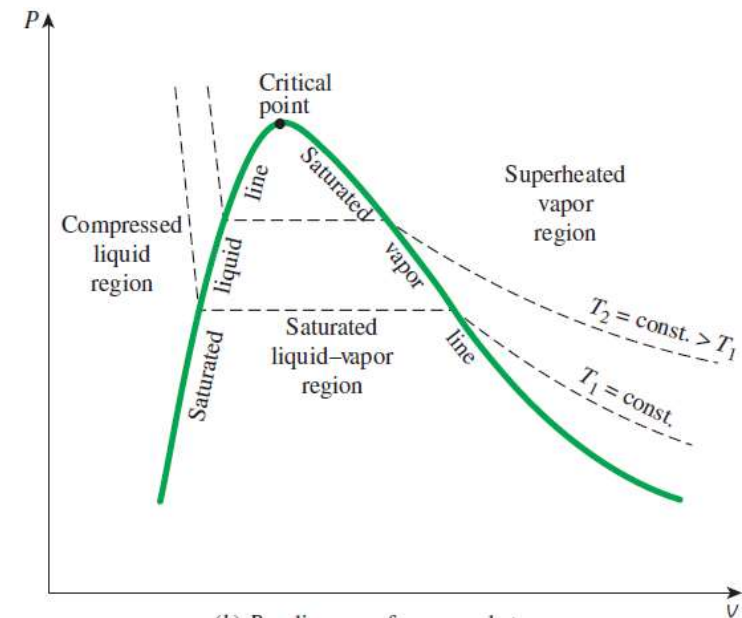
# Correlating 2D diagrams to 3D: $P(v,T)$



**FIGURE 3-23**

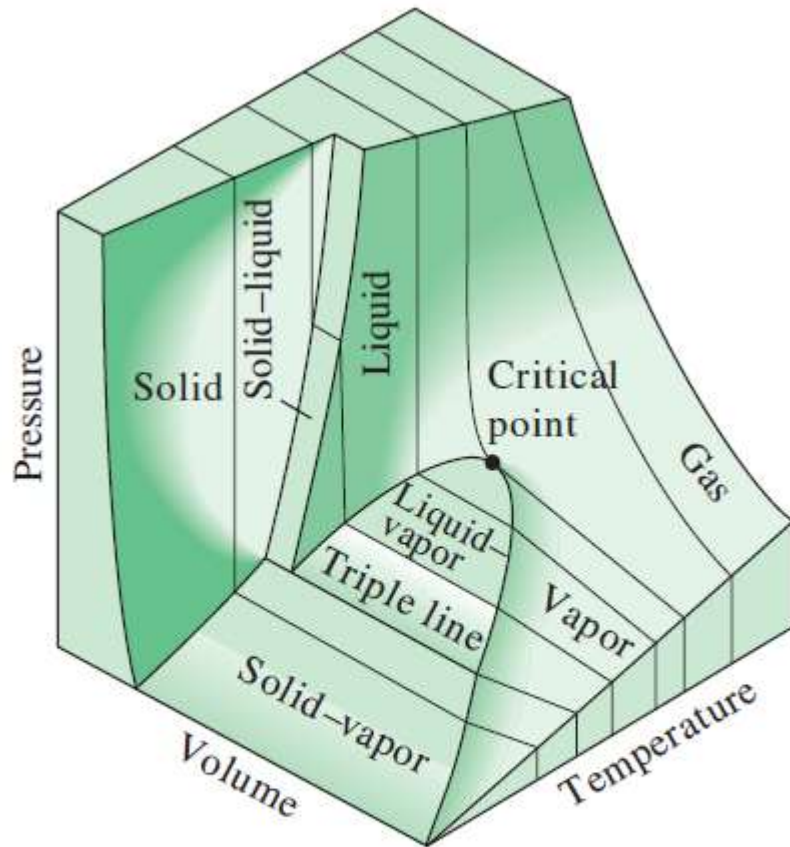
$P$ - $v$ - $T$  surface of a substance that contracts on freezing.

- Different set of lines needs to be indicated to correlate constant pressure processes...



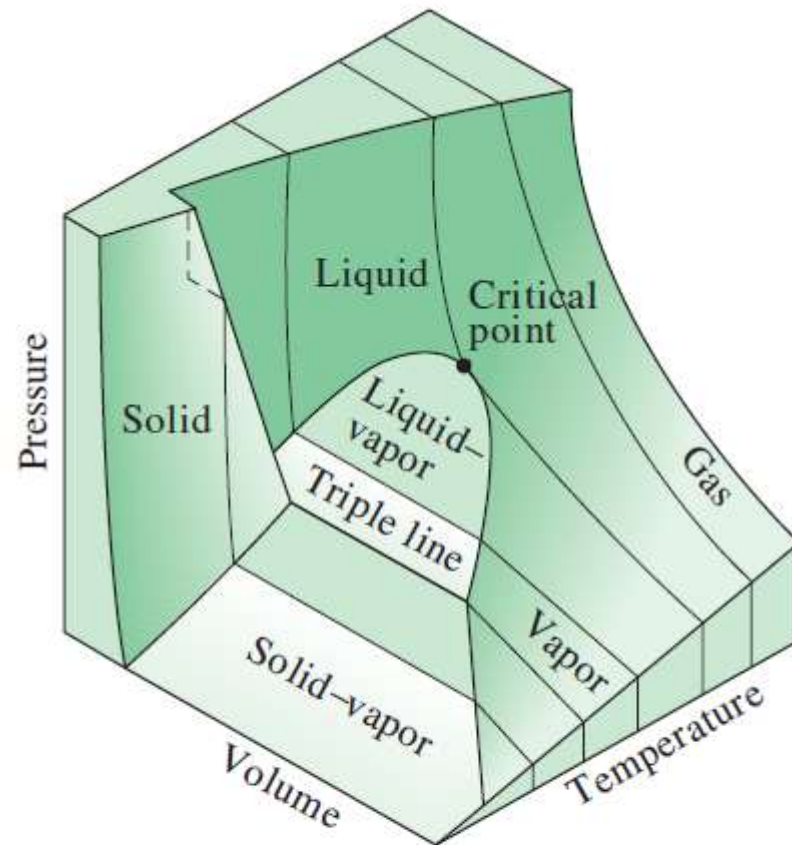
Figs: Cengel & Boles

## *Exercise in visual arts!*



**FIGURE 3-23**

*P-v-T surface of a substance that contracts on freezing.*



**FIGURE 3-24**

*P-v-T surface of a substance that expands on freezing (like water).*