PhaseBook-Liquid Vapor Transition

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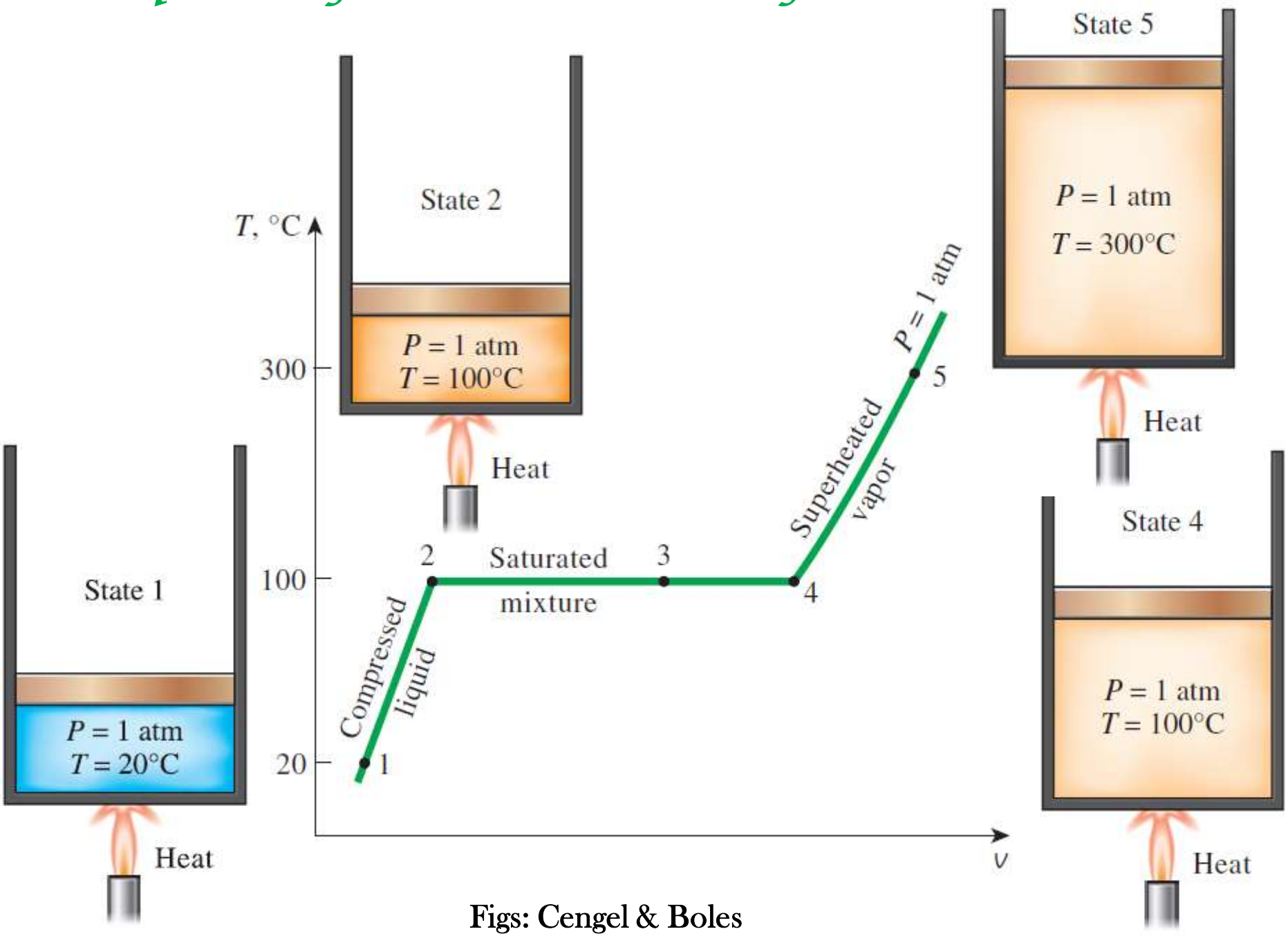
Liquid-Vapor Transition

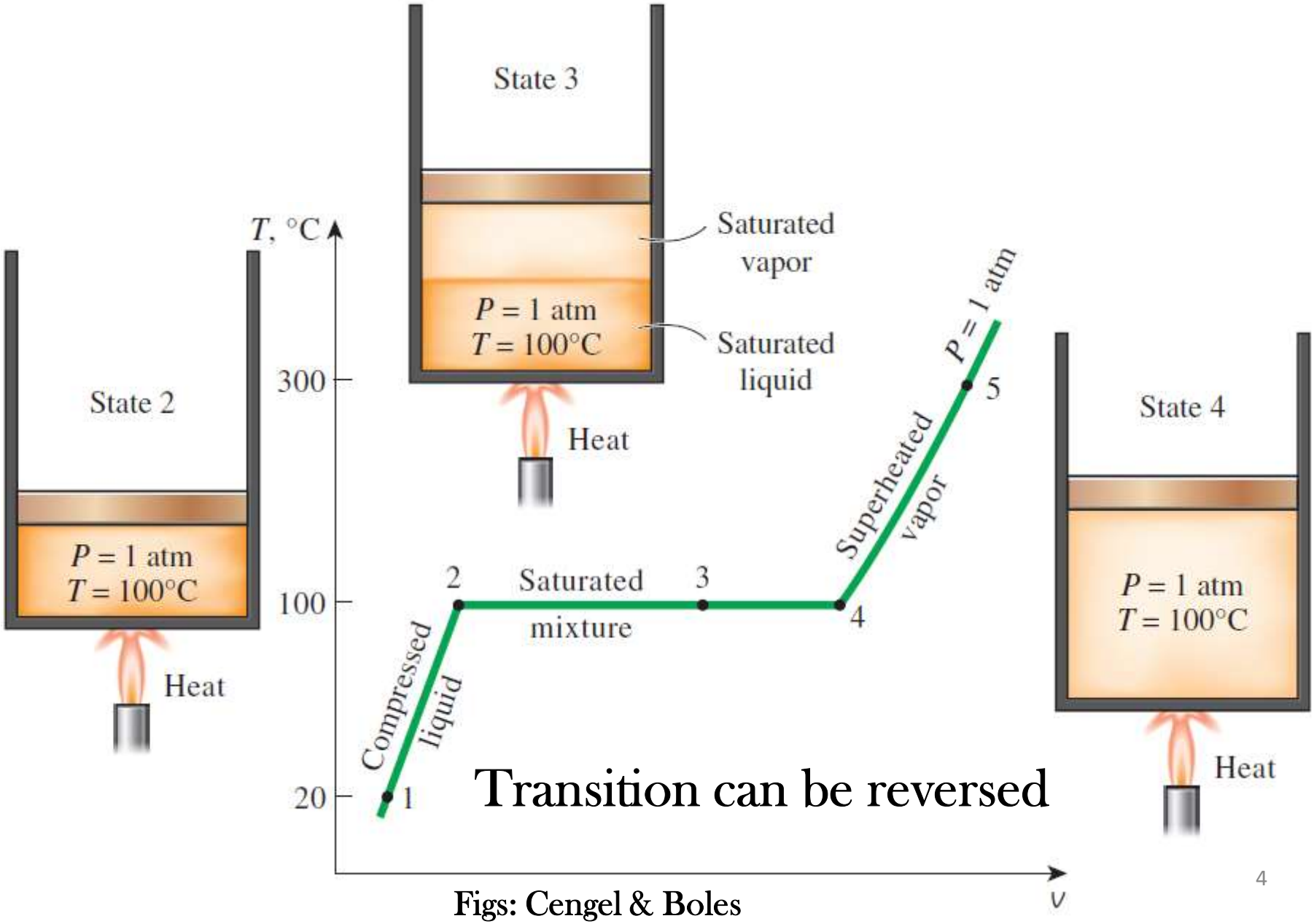
- Vapor Vs Gas?; Evaporation Vs. Boiling?
- Boiling: Vapor pressure=superincumbent pressure
- Evaporation can occur below boiling point too; Evaporation increases with temperature
- Many processes (like refrigeration, evaporative cooling, reactor control...) involve phase change-Latent heat especially of water is large

Liquid-Vapor Transition-Physical Realization



Figs: Cengel & Boles

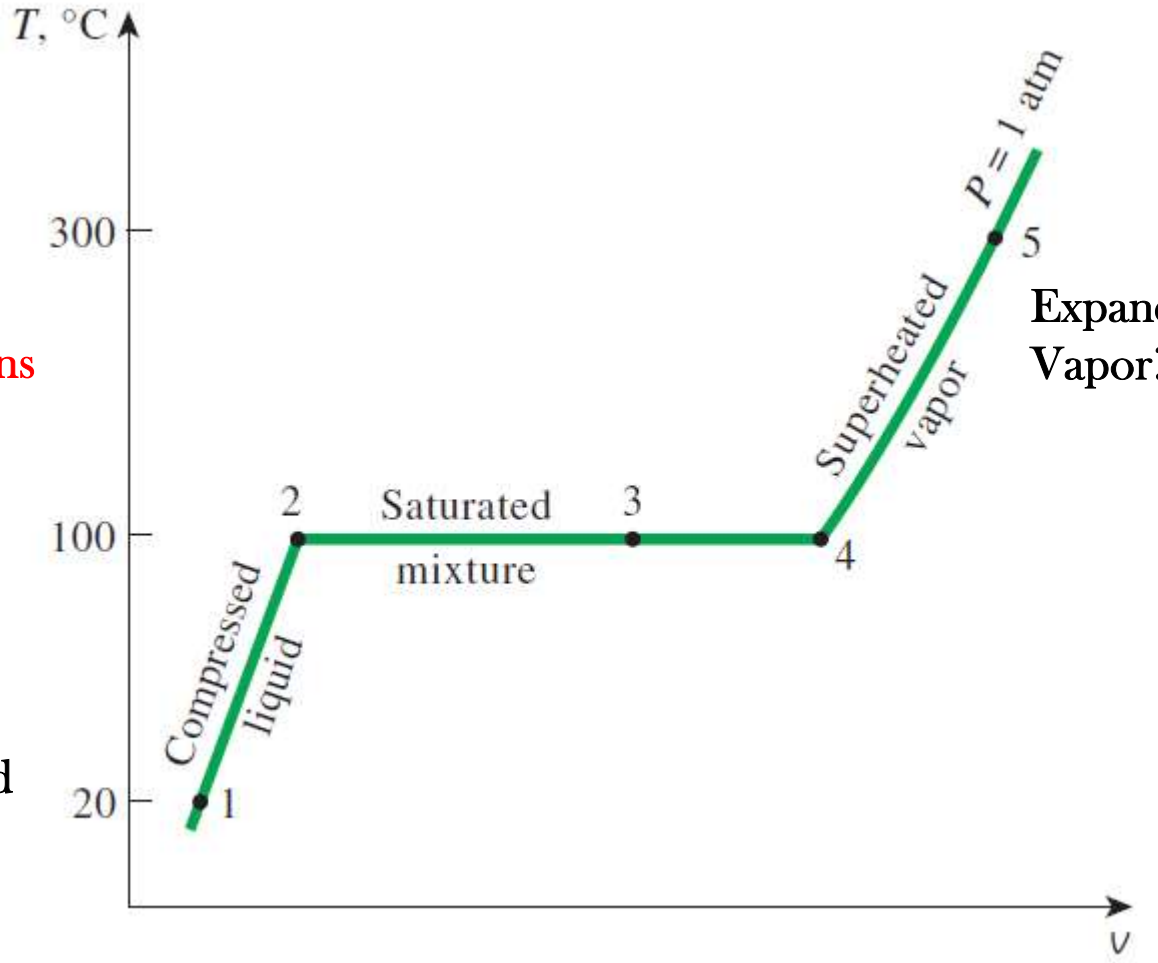
Liquid-Vapor Transition-Two phase region



Figs: Cengel & Boles

Liquid-Vapor Transition-Quirky terminologies

Supercooled Liquid: Liquid Below Freezing Point-Has nothing to do L-V transitions



Subcooled Liquid

Expanded Vapor?

Figs: Cengel & Boles

Boiling temperature Vs. Pressure

- Boiling: Vapor pressure=superincumbent pressure

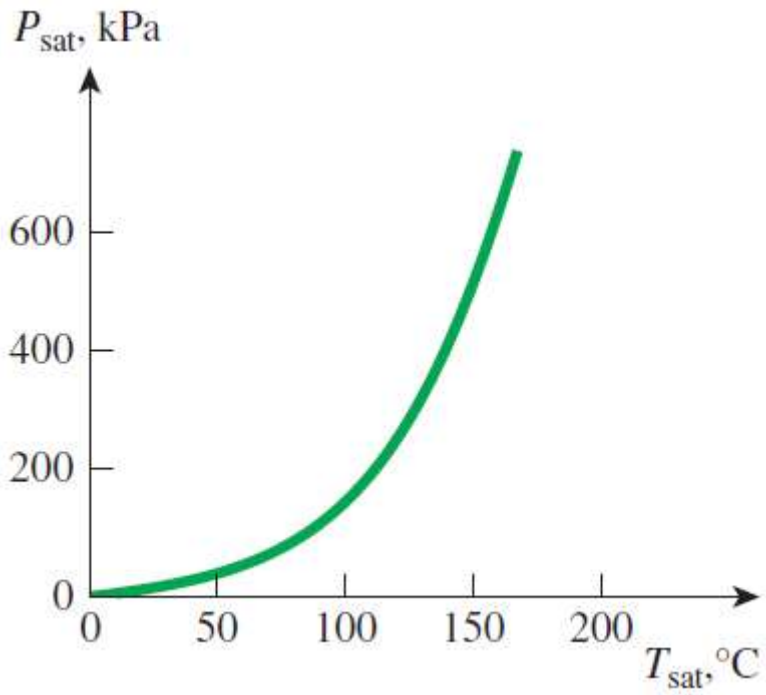


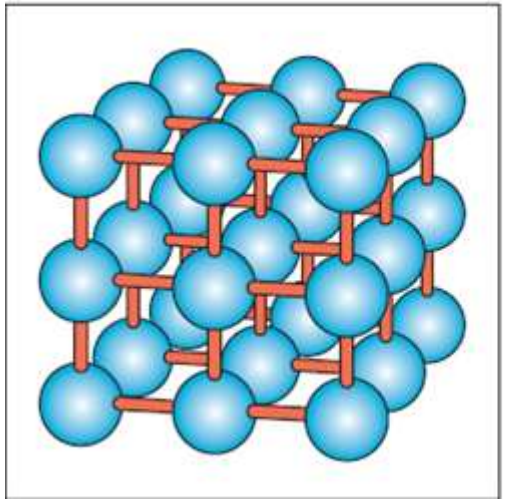
TABLE 3–1

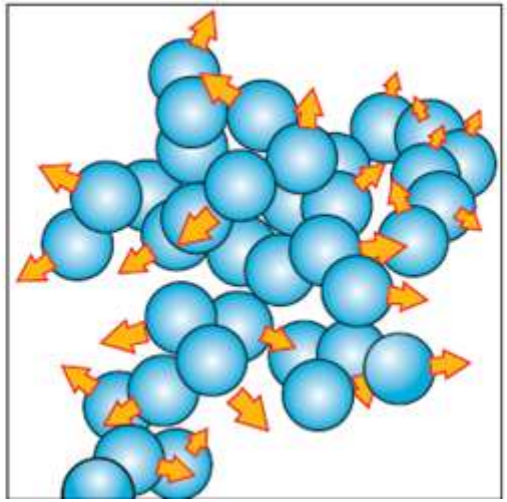
Saturation (or vapor) pressure of water at various temperatures

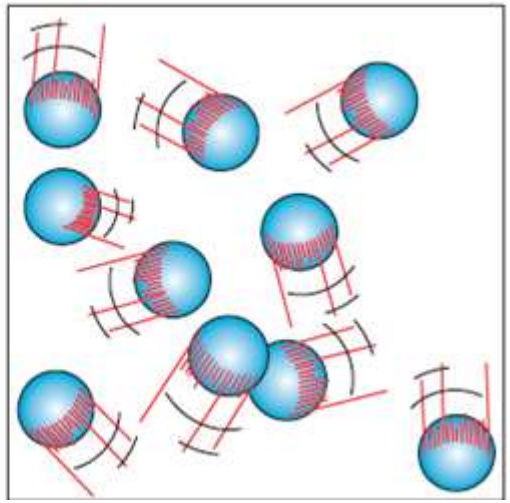
Temperature T, °C	Saturation Pressure P_{sat}, kPa
−10	0.260
−5	0.403
0	0.611
5	0.872
10	1.23
15	1.71
20	2.34
25	3.17
30	4.25
40	7.38
50	12.35
100	101.3 (1 atm)
150	475.8
200	1554
250	3973
300	8581

Fig & table: Cengel & Boles

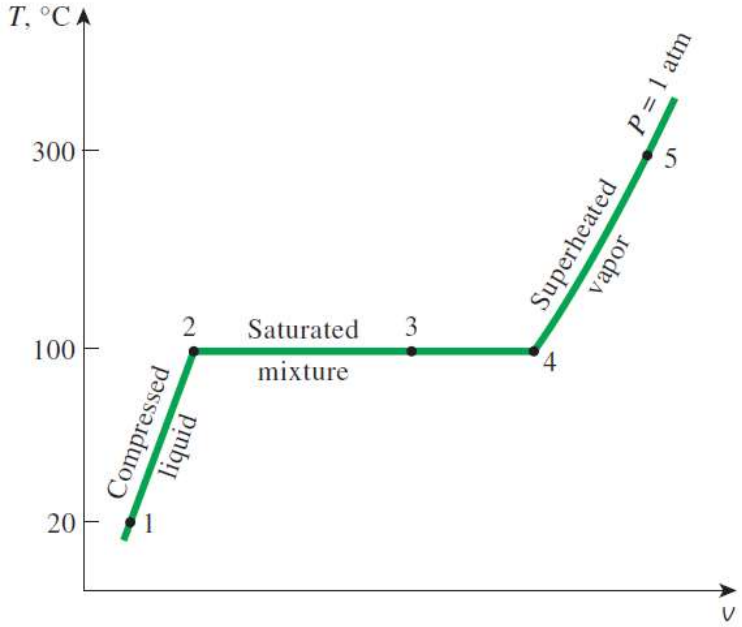
Revisiting structure-property correlations





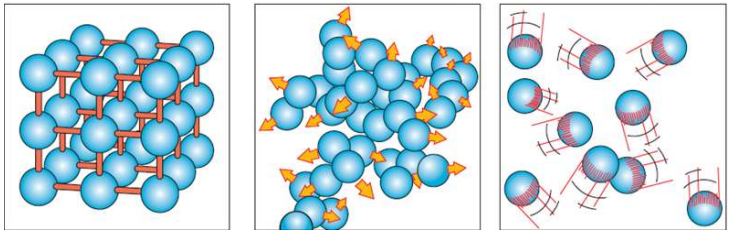


- Latent heat
- Latent heat of vaporization
- Latent heat of "fusion" (Fusion=Freezing)



Figs: Cengel & Boles

Intuitive structure-property correlations



Substance	LHF (KJ/Kg)	M. Pt (°C)	LHV (KJ/KG)	B. Pt (°C)
Ethyl alcohol	108	-114	855	78.3
Ammonia	332.17	-77.74	1369	-33.34
Carbon dioxide	184	-78	574	-57
Helium			21	-268.93
Hydrogen	58	-259	455	-253
Lead	23	327.5	871	1750
Nitrogen	25.7	-210	200	-196
Oxygen	13.9	-219	213	-183
Refrigerant R134a		-101	215.9	-26.6
Refrigerant R152a		-116	326.5	-25
Silicon	1790	1414	12800	3265
Toluene	72.1	-93	351	110.6
Water	334	0	2264.705	100

https://en.wikipedia.org/wiki/Latent_heat