

# SUMMARY FOR TEST 5

Phase Transitions: Mixtures ( $G(x)$  curves & tangent & phase diagram)

Boltzmann Statistics:

derivations: const.  $T, V, N \rightarrow P(s) = \frac{e^{-E_s/kT}}{\sum_s e^{-E_s/kT}}$

const.  $T, p, N \rightarrow P(s) = \frac{e^{-(E_s + pV_s)/kT}}{\sum_s e^{-(E_s + pV_s)/kT}}$

$$Z = \sum_s e^{-E(s)/kT}$$

$$\bar{X} = \frac{1}{Z} \sum_s X(s) e^{-E(s)\beta}$$

Applications:

- for specific small set of states
- paramagnet
- fluctuation dissipation thm  $C = \dots$   $\chi = \dots$
- show & use e.g.  $\bar{E} = -\frac{1}{Z} \frac{\partial Z}{\partial \beta}$  & similar relations
- rotations
- equipartition theorem
- composite systems
- Maxwell distribution (derive  $\bar{v}$ ,  $\sqrt{v^2}$ ,  $v_{max}$  etc.)

$$F = -kT \ln Z \rightarrow S, \mu$$

- Harmonic Oscillator

NOT: ideal gas:  $F \rightarrow \dots$