Phase diagrams of binary mixtures

Phase rule: F = C - P + 2

$\longrightarrow$ p,T

for binary mixtures = 2

p = constant:

Phase α

$F' = 2$

$F' = 1$ $F' = 1$

Phase γ

$F = 2$ $F' = 0$

$F' = 2$

$F' = 1$ Phase β

Temperature

Composition (mole fraction)
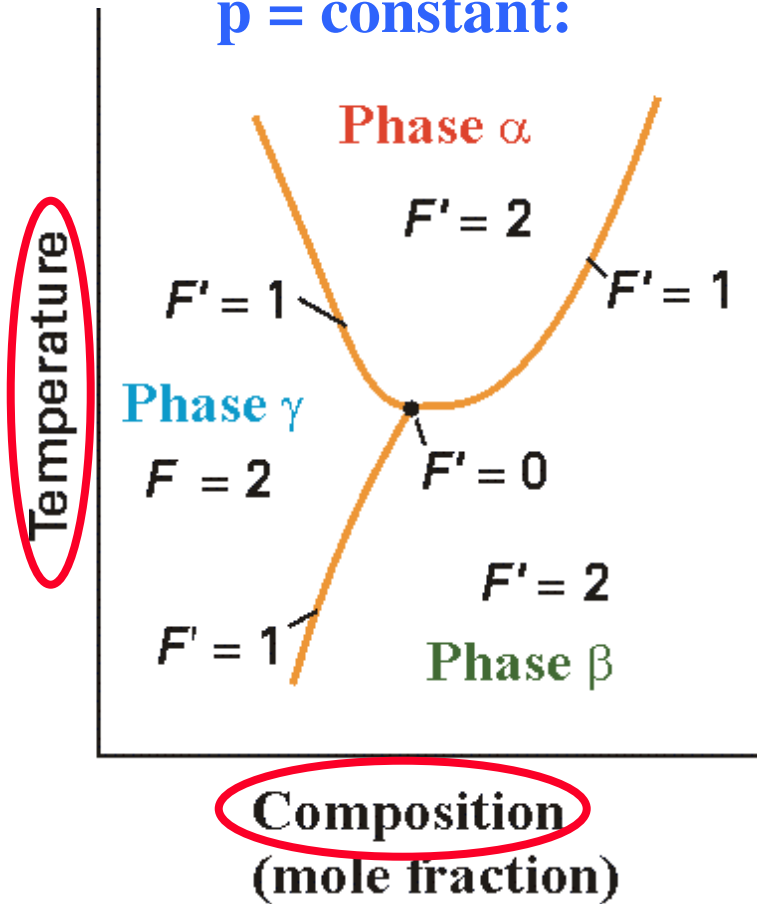
Temperature-composition diagram for binary mixture of volatile liquids

Boiling point of pure B

Composition of vapour

in equilibrium

Temperature

a Tie line a'

Boiling point of mixture

Boiling point of pure A

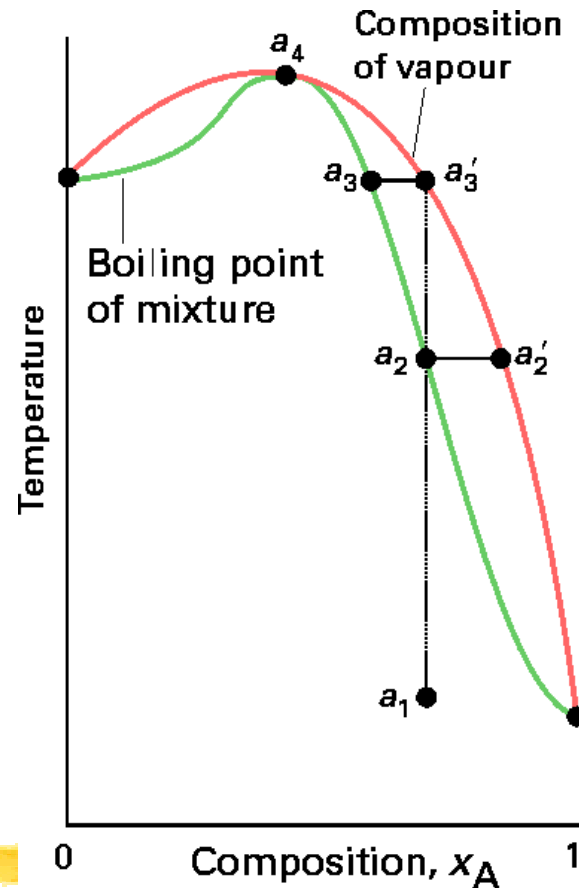0   Composition, x_A 1

n 260
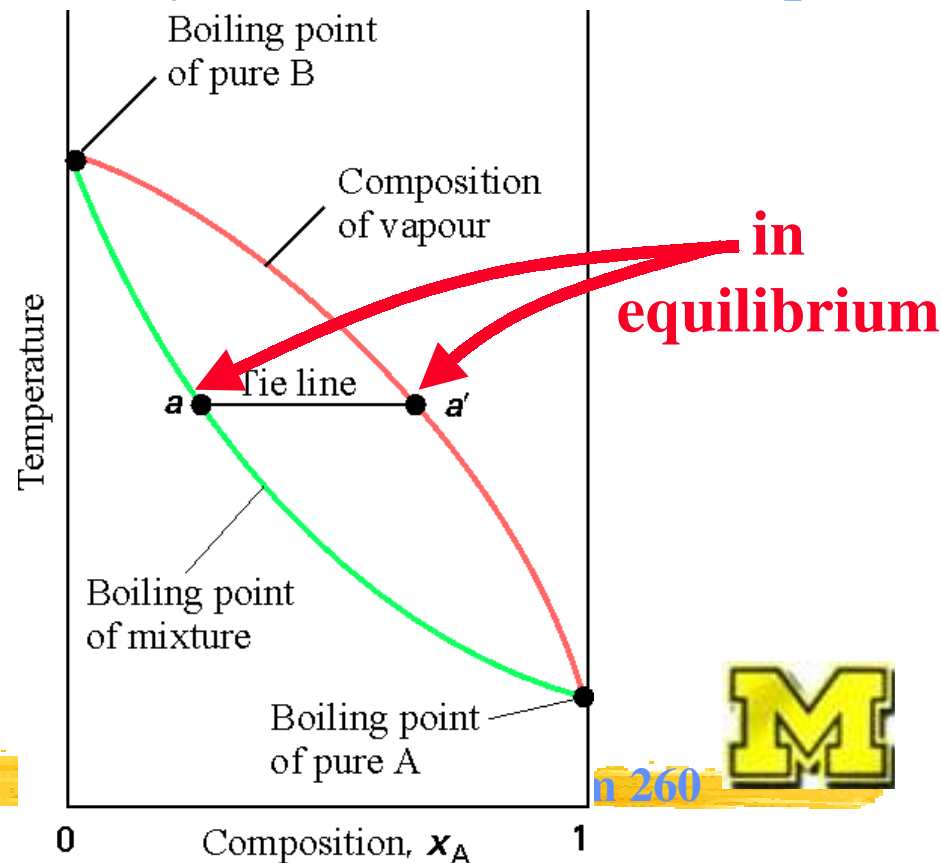
Finally, as promised: Whisky distillery
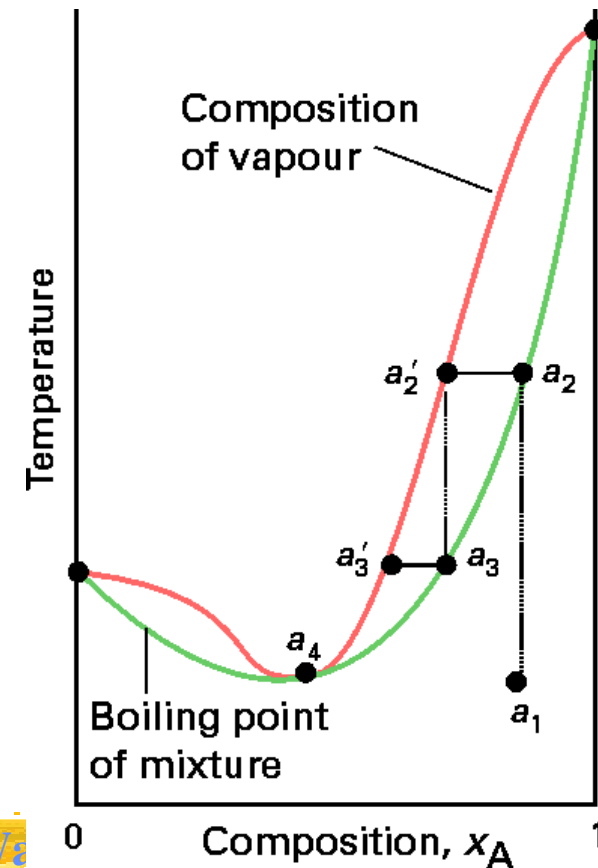
Non-ideal mixtures

Fractional distillation:
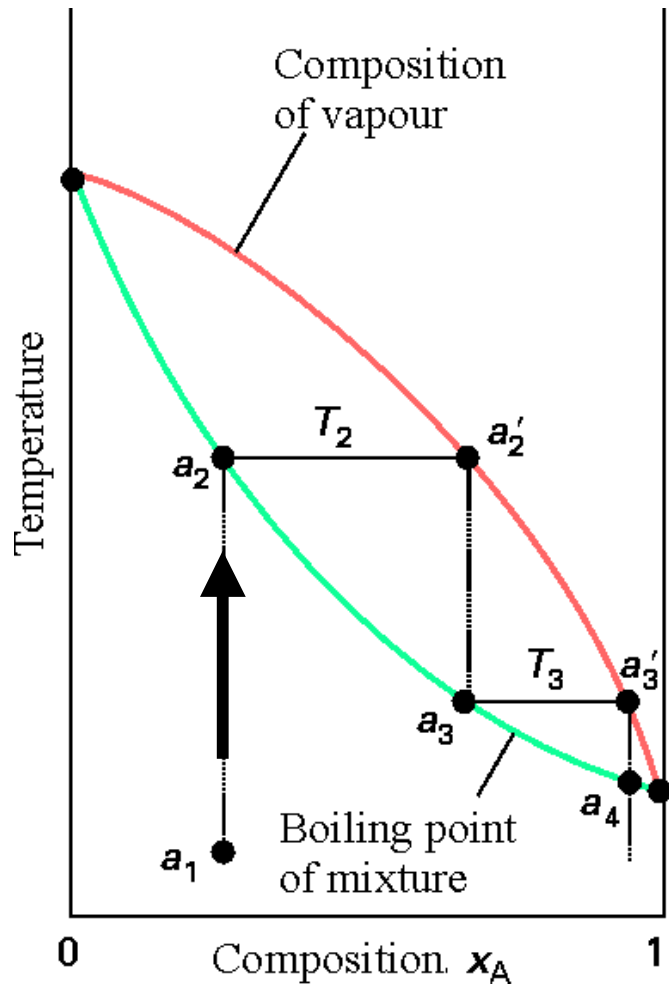
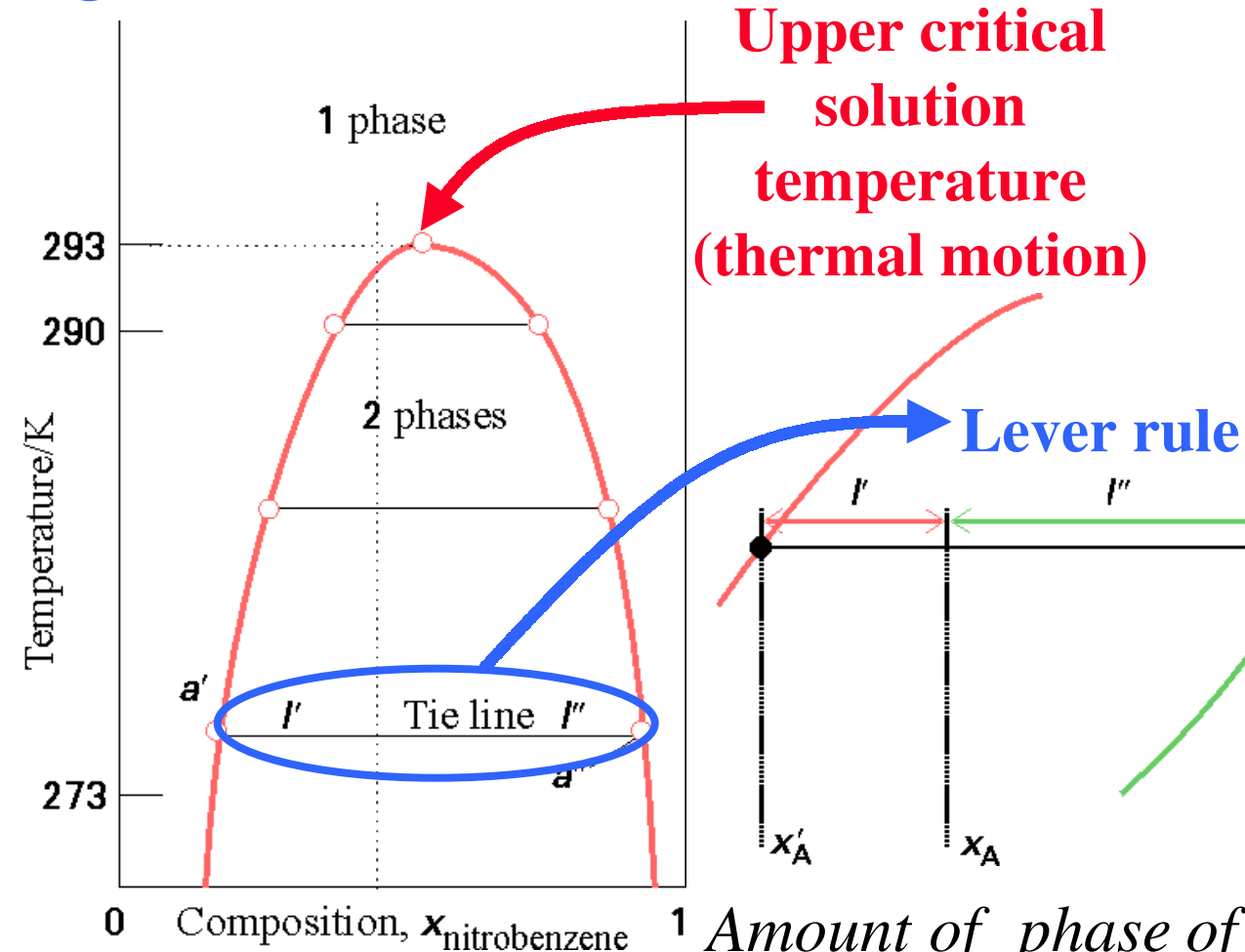### High-boiling azeotrope, e.g., nitric acid/water

Low-boiling azeotrope, e.g., ethanol/water

Liquid-liquid phase diagrams of partially miscible liquids

E.g., hexane/nitrobenzene:

E.g., triethylamine /water:

Upper critical solution temperature (thermal motion)

Lever rule

Lower T_{crit} (complex formed)

$$\frac{Amount\ of\ phase\ of\ composition\ a''}{Amount\ of\ phase\ of\ composition\ a'} = \frac{l'}{l''}$$