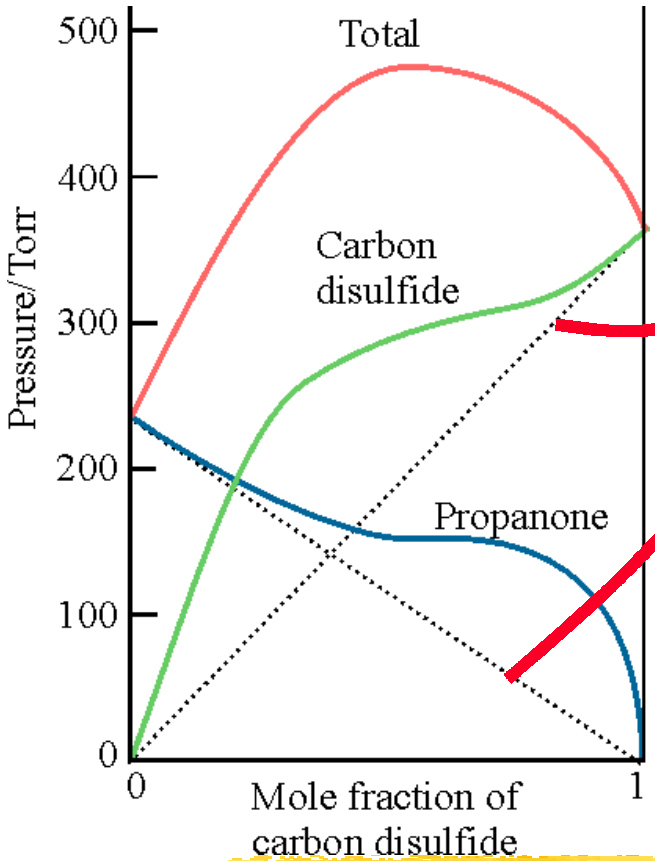
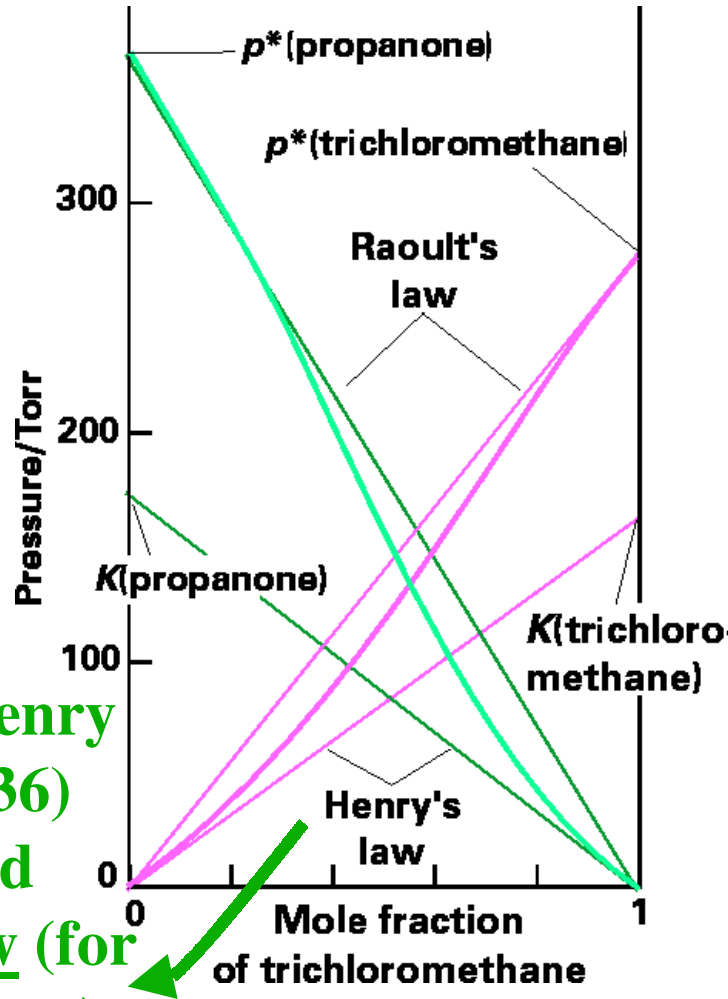
Non-ideal solutions

Strong deviations from ideality are shown by dissimilar substances



Raoult's law obeyed for a close-to-pure solvent



William Henry (1775-1836) observed <u>Henry's law</u> (for a dilute solute):

$$p_B = x_B K_B$$ **(e.g., gas solubility)**

Ideal and real solutions: Activities

From both Raoult's (solvent) and Henry's laws (solute) follows:

$$\mu_{solv}(l) = \mu^{\ominus}_{solv}(l) + RT \ln x_{solv}$$
$$= \mu^{\ominus}_{solv}(l) + RT \ln C[solv]$$

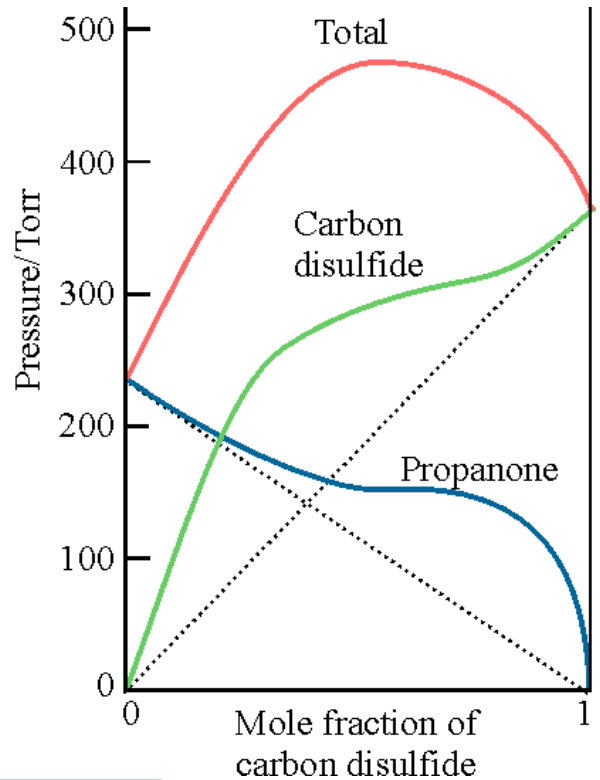
$$\Rightarrow \mu_J = \mu^{\ominus}_J + RT \ln[J]$$

standard chemical potential @ 1 M

BUT:

⇓

to preserve equation for real solutions:



$$\mu_J = \mu^{\ominus}_J + RT \ln a_J$$

Effective concentration = activity $a_J = \gamma_J[J]$

The chemical potential is a measure of the ability of J to bring about physical or chemical change

Consequences of chemical potential changes in mixtures: Colligative properties

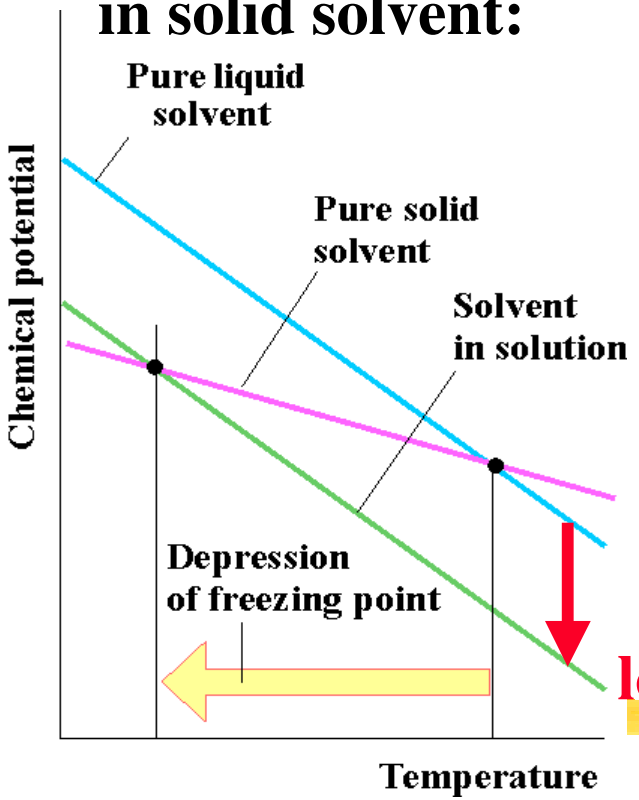
Freezing point depression:

$$\Delta T_f = K_f b_B$$

K_f: cryoscopic constant

b_B: molality

Solute is insoluble in solid solvent:



Chemical Potential lowered by solute

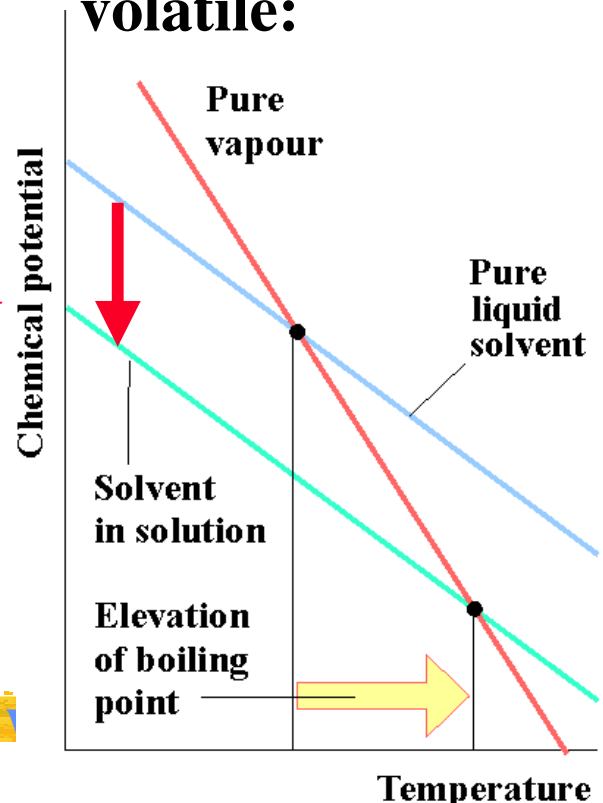
Nils

Boiling point elevation:

$$\Delta T_B = K_B b_B$$

K_B: ebullioscopic constant

Solute is not volatile:



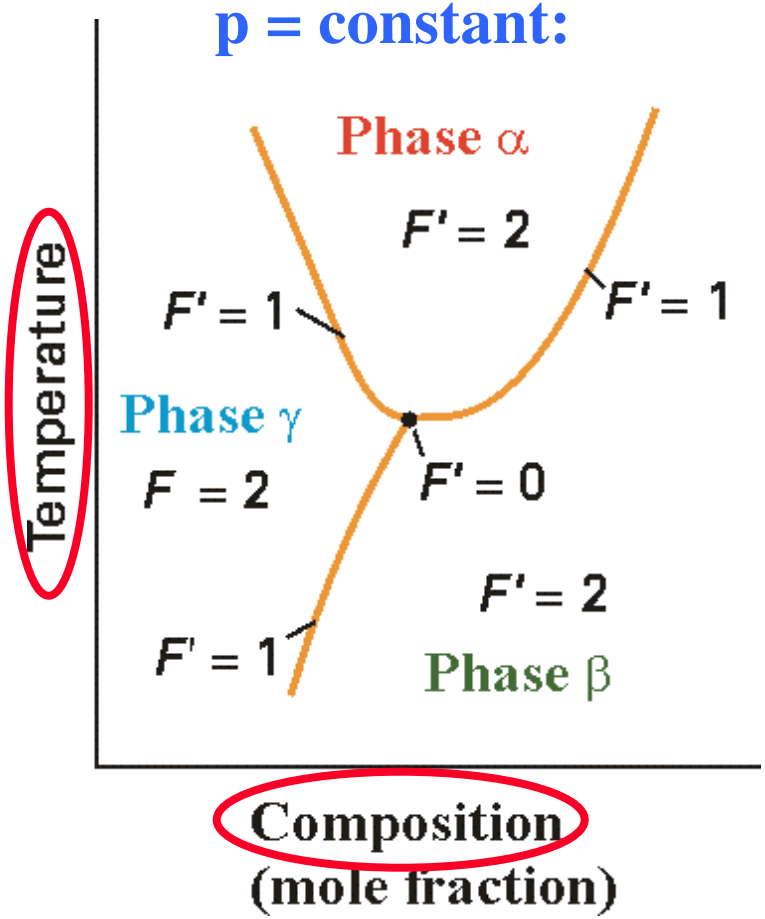
Chemical Potential lowered by solute

Phase diagrams of binary mixtures

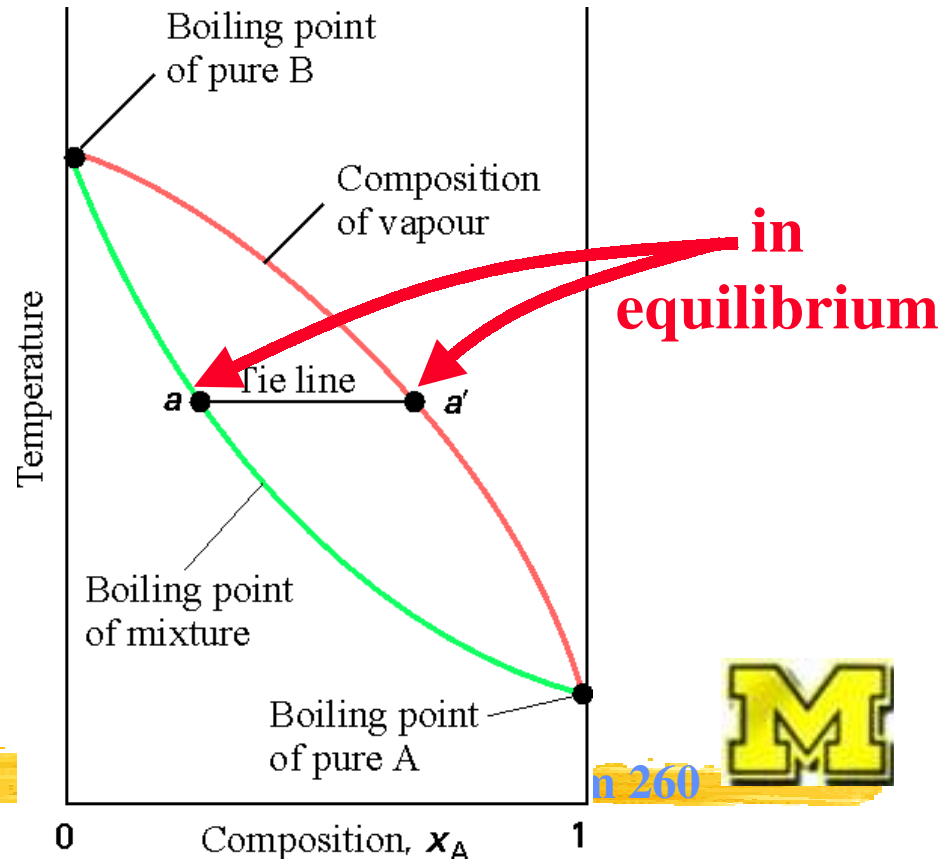
Phase rule: $F = C - P + 2$ (p,T)

for binary mixtures = 2

p = constant:

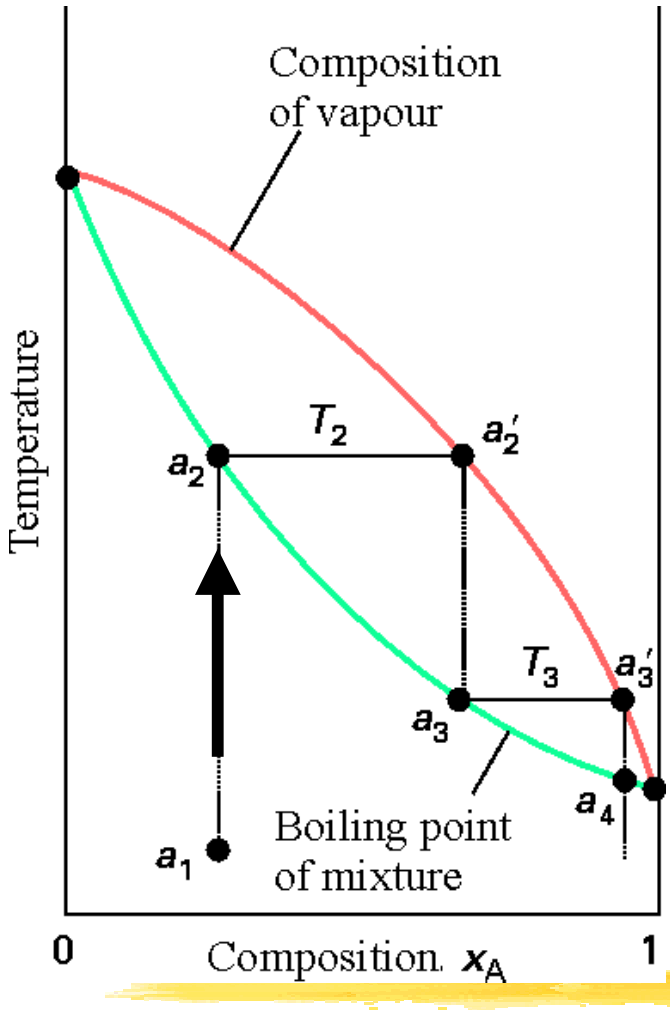


Temperature-composition diagram for binary mixture of volatile liquids



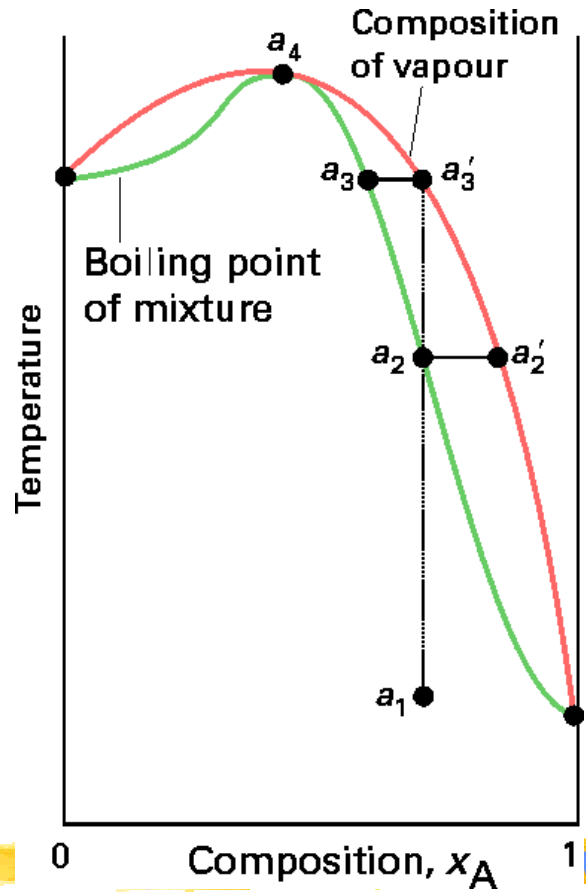
Finally, as promised: Whisky distillery

Fractional distillation:

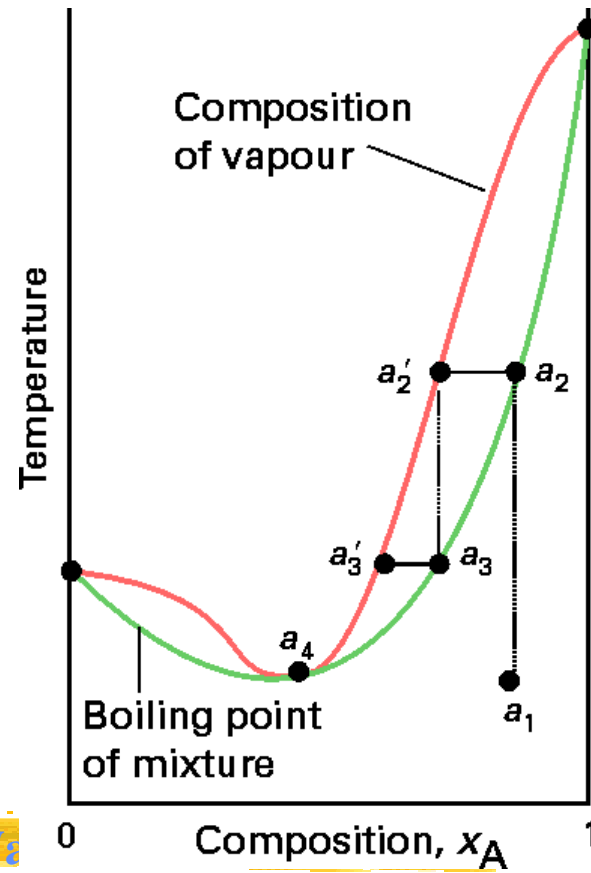


Non-ideal mixtures

High-boiling azeotrope, e.g., nitric acid/water

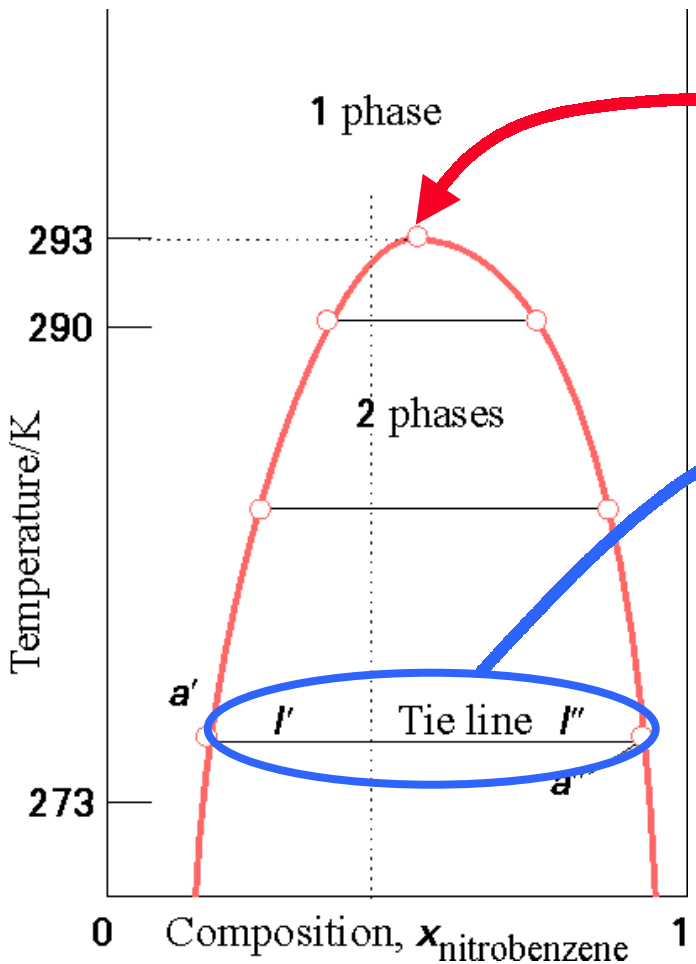


Low-boiling azeotrope, e.g., ethanol/water



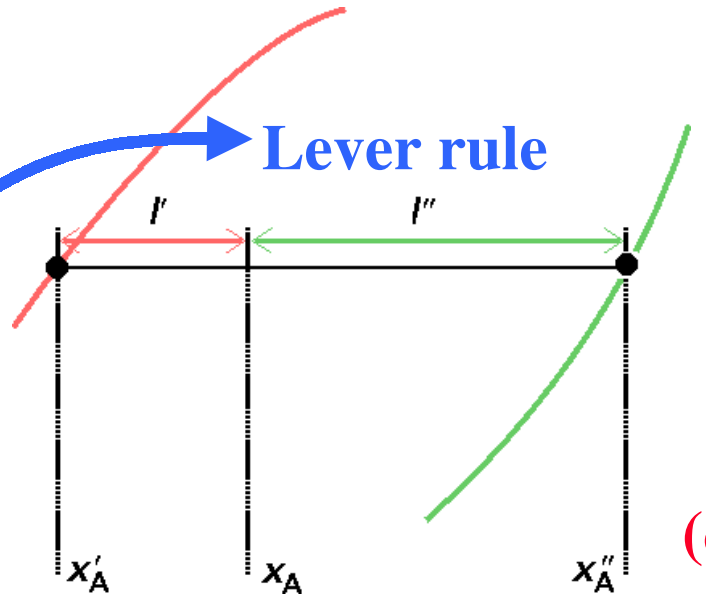
Liquid-liquid phase diagrams of partially miscible liquids

E.g., hexane/nitrobenzene:



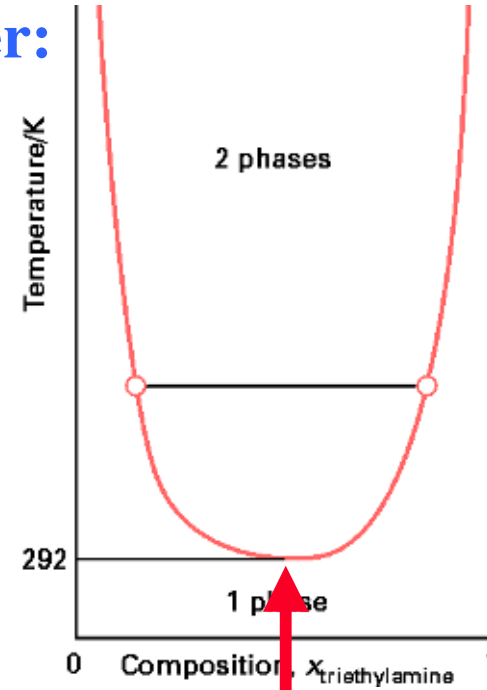
Upper critical solution temperature (thermal motion)

Lever rule



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

E.g., triethylamine /water:



Lower T_{crit} (complex formed)

Test Report

Convert To PDF:

JPG to PDF

Package: Image-to-pdf

Execution Status: Failed

Bug: Indicates that the image is corrupt for all images.

Alternative: Images-to-pdf

Execution Status: **Successful**
Bug: None

Html to PDF:

Package: Gotenberg paid api

Execution Status: -

Bug: -

Alternative: -

Execution Status: -
Bug: -

Word to PDF:

Package: Html-pdf-node

Execution Status: **Successful**

Bug: Worked fine for urls that had less text but crashed (timeout at 30 sec) when I provided it with a URL and that page had lots of text.

Alternative: Word to HTML to PDF

Execution Status: -
Bug: -

Word to HTML:

Package: converithtmldocx2

Execution Status: **Successful**

Bug:

Alternative:

Execution Status: **-**
Bug: **-**

PowerPoint to PDF

Package: ppt2pdf

Execution Status: Failed

Bug: Internal package error (probably not supporting node version)

Alternative: Aspose API

Execution Status: **-**
Bug: **-**

Excel to PDF

Package: xlsx-populate puppeteer

Execution Status: **Successful**

Bug: It tries to fit all the columns of the xls in one page of the pdf file. In case of larger number of columns, some of the columns appears cropped on the page.

Alternative: GroupDocs SDK or xls to csv then to JSON to html with css then to pdf.

Execution Status: **-**
Bug: **-**

Convert From PDF:

PDF to JPG

Package: pdf-to-img

Execution Status: **Successful**

Bug: -

Alternative: -

Execution Status: -
Bug: -

PDF to PPT

Package: pdf-to-img

Execution Status: **Failed**

Bug: Creates the pptx file but it does not contain any of the content that was in pdf. Instead, it only contains the following text in it.
/tmp/pdf_ppt_9SXCHX/output_863635973.pptx

Alternative: `pdf-parse` to extract text from the PDF and `pptxgenjs` to create a PowerPoint presentation.

Execution Status: **Successful**
Bug:

1. It only extracts text, not images or complex formatting.
2. The layout won't match the original PDF.
3. It's a basic conversion that might require manual adjustments after creation.

PDF to WORD

Package: pdf-officegen

Execution Status: **Failed**

Bug: Compatibility issue with Latest node versions

Alternative:

1. pdf-parse for extracting text from PDFs
2. docx for creating Word documents

Execution Status: **Successful**
Bug: Does not maintain the format

PDF to Excel

Package: pdf-to-excel

Execution Status: **Successful**

Bug: Doesn't maintain the format.

Alternative: -

Execution Status: **-**

Bug: -

PDF to PDF/A

Package: -

Execution Status: **-**

Bug: -

Alternative: -

Execution Status: **-**

Bug: -