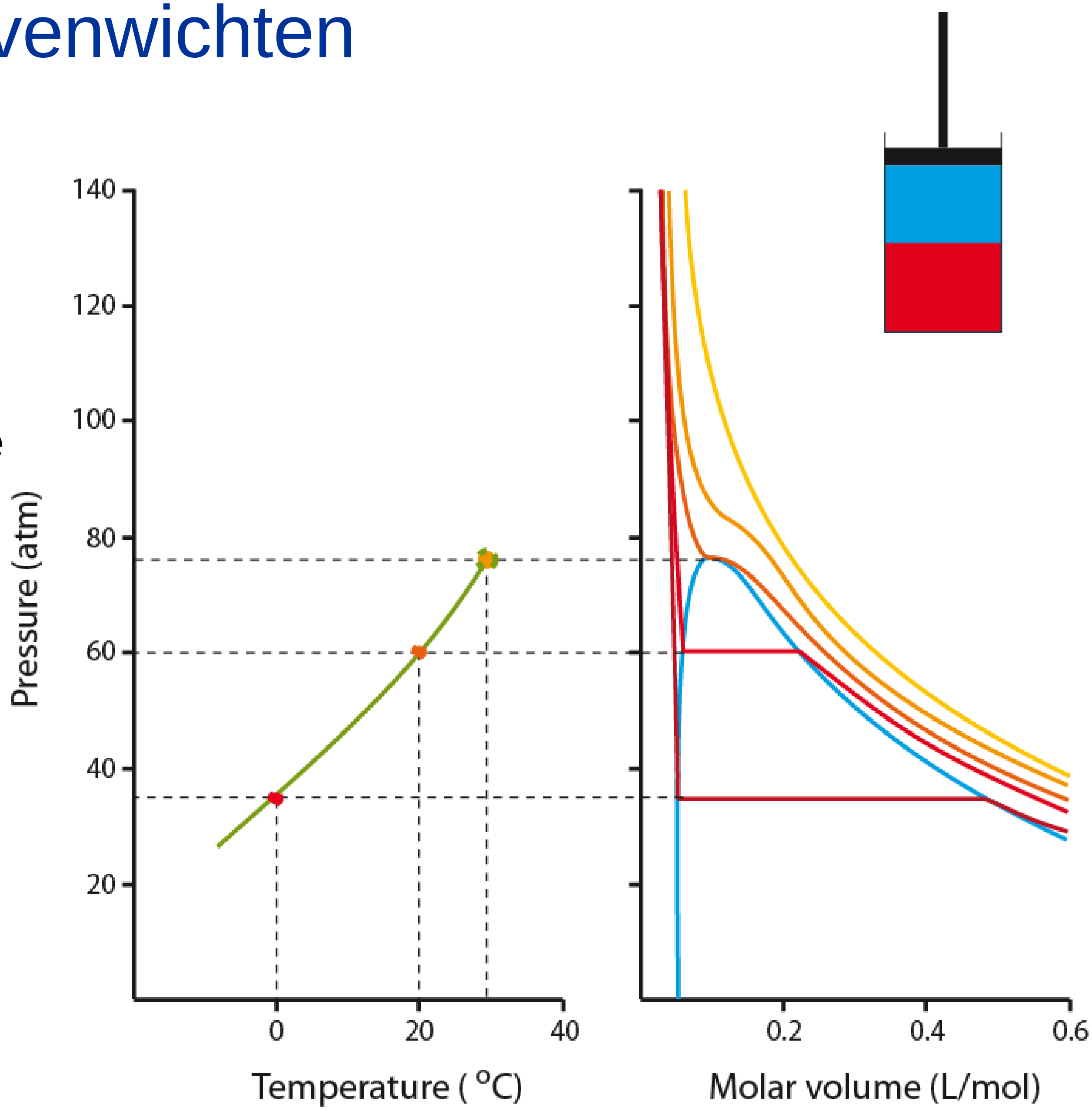
Fasenevenwichten van mengsels

Vloeistof-dampevenwichten

Zuivere stoffen

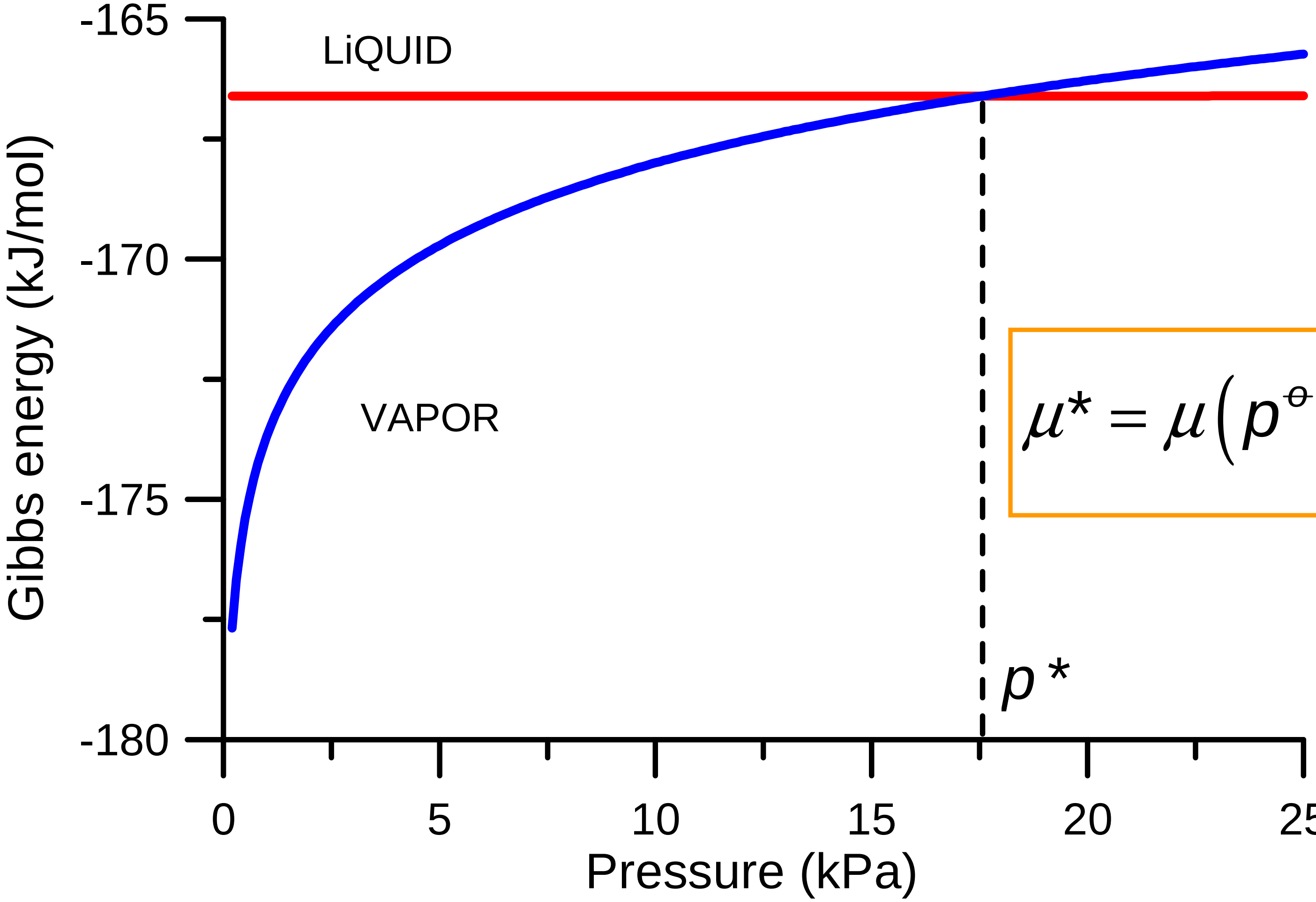
- dampspanning
- extensieve variabele
  - 2-fasengebied
- “hefboom”-regel



Vloeistof-dampevenwichten

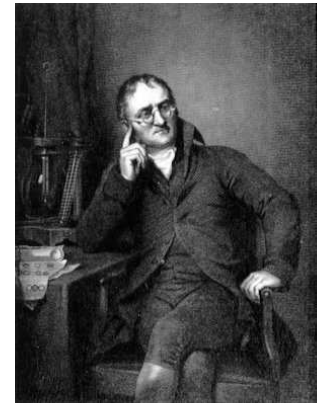
Dampspanning (voorbeeld methanol)

Form	$\Delta_f G^\ominus$ (kJ/mol)	$S^\ominus$ (J/(K mol))	V_m (cm^3/mol)
liquid	-166.6	126.8	40.5
vapor	-162.3	239.9	—



$$\mu^* = \mu\left(p^\ominus, T\right) + RT \ln \frac{p^*}{p^\ominus}$$

Vloeistof-dampevenwichten



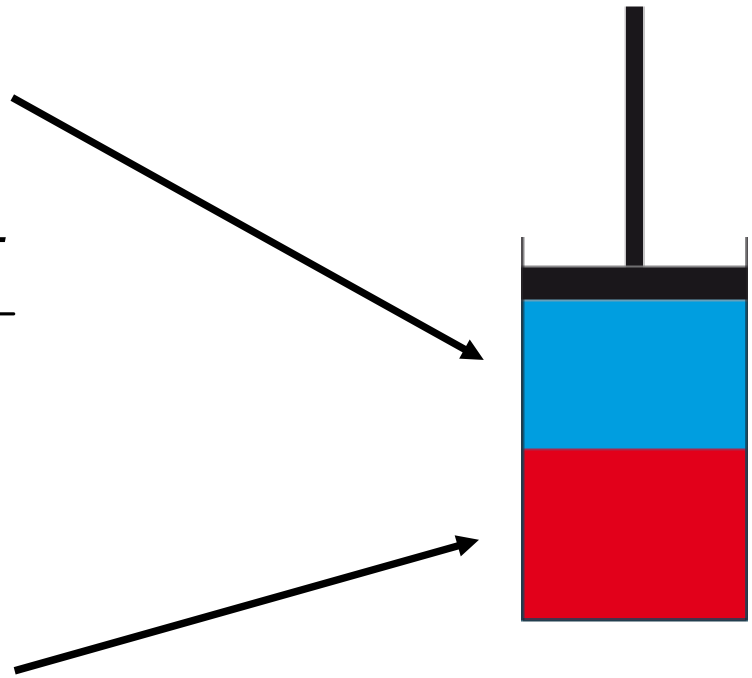
John Dalton (1766 – 1844)

Dampmengsels

Wet van Dalton $p_j = y_j p$

Molfractie $y_j = \frac{n_j}{n}$

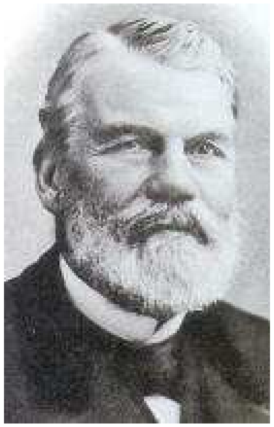
Partiële druk $p_j = \frac{n_j RT}{V}$



Vloeistofmengsels

Molfractie $x_j = \frac{n_j}{n}$

Vloeistof-dampevenwichten



François Raoult (1830 – 1901)

Kooklijn: wet van Raoult $$p_j = x_j p_j^*$$

Chemische potentiaal is hetzelfde $\mu_{j,v} = \mu_{j,l}$

Voor de vloeistof: $$\mu_{j,l} = \mu^{\ominus}_{j,l} + RT \ln x_j$$

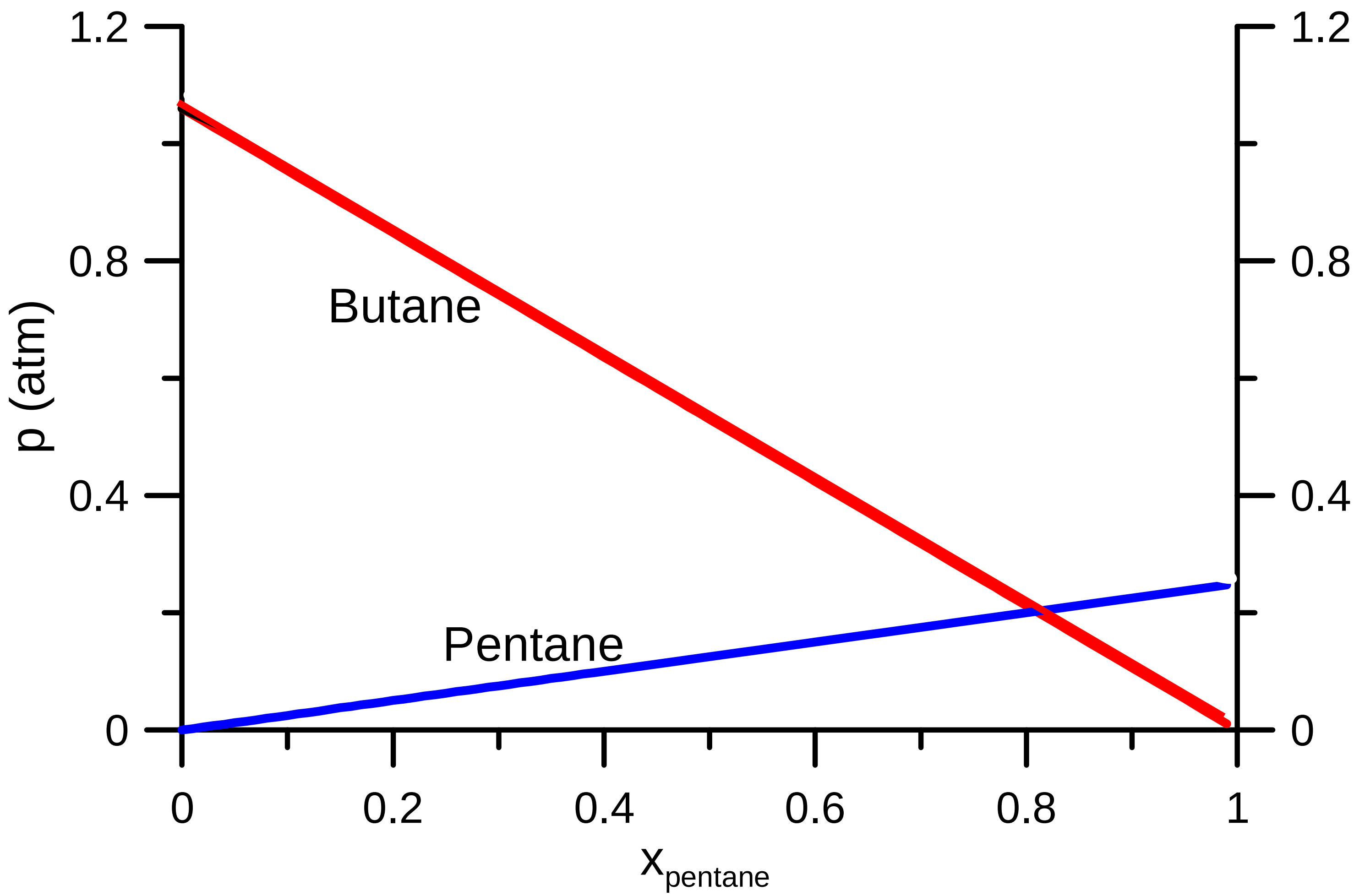
Voor de damp: $$\mu_{j,v} = \mu^{\ominus}_{j,v} + RT \ln \frac{p_j}{p^{\ominus}}$$

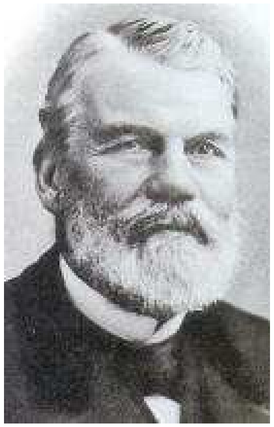
$$\mu^{\ominus}_{j,l} + RT \ln x_j = \mu^{\ominus}_{j,v} + RT \ln \frac{p_j}{p^{\ominus}}$$

Voor de zuivere vloeistof: $$\mu^{\ominus}_{j,l} = \mu^{\ominus}_{j,v} + RT \ln \frac{p^*}{p^{\ominus}}$$

Vloeistof-dampevenwichten

Kooklijn: wet van Raoult $p_j = x_j p_j\,*$

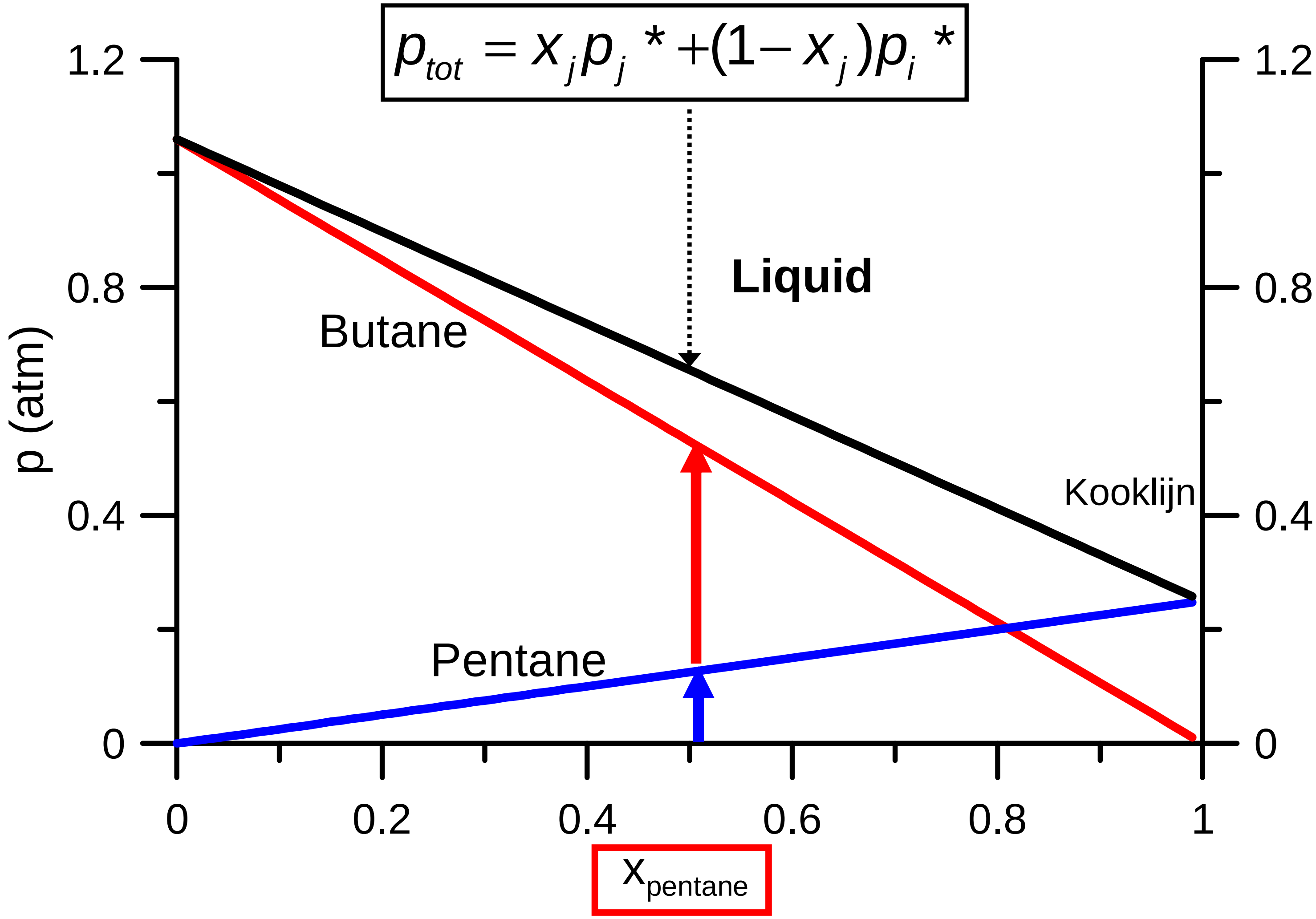


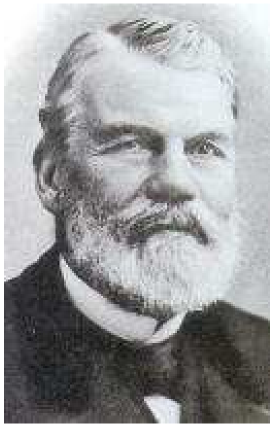


François Raoult (1830 – 1901)

Vloeistof-dampevenwichten

Kooklijn: wet van Raoult $p_j = x_j p_j^*$





François Raoult (1830 – 1901)

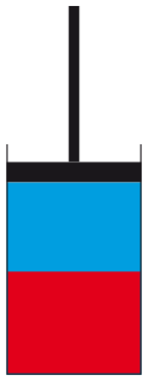
Vloeistof-dampevenwichten

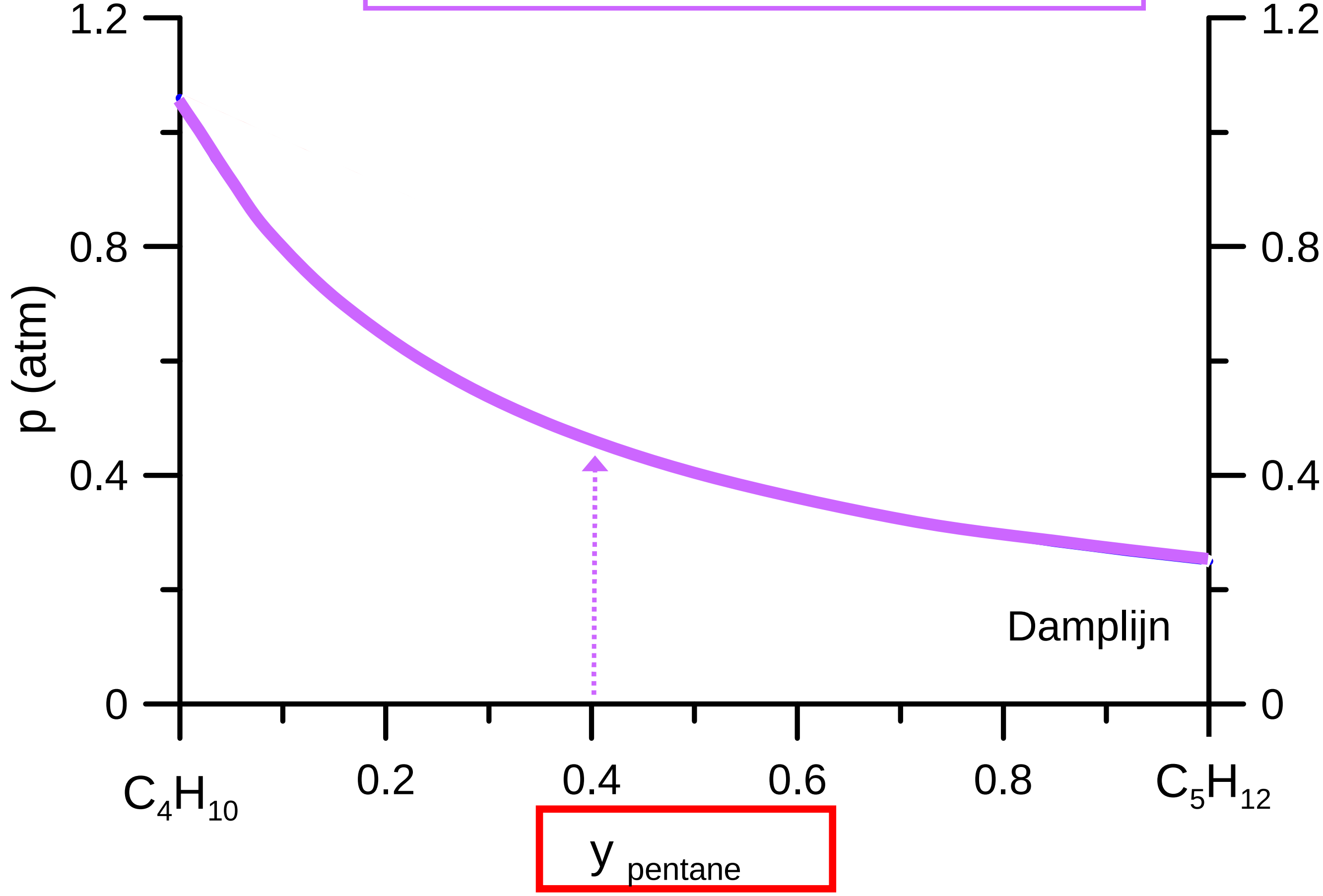
$$p_j = x_j p_j^*$$

$$p = p_A + p_B = x_A p^*_A + x_B p^*_B$$

Damplijn:

$$y_j = \frac{x_j p_j^*}{p} = \frac{x_j p_j^*}{x_A p_A^* + x_B p_B^*}$$

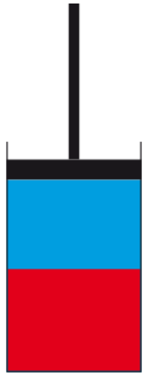


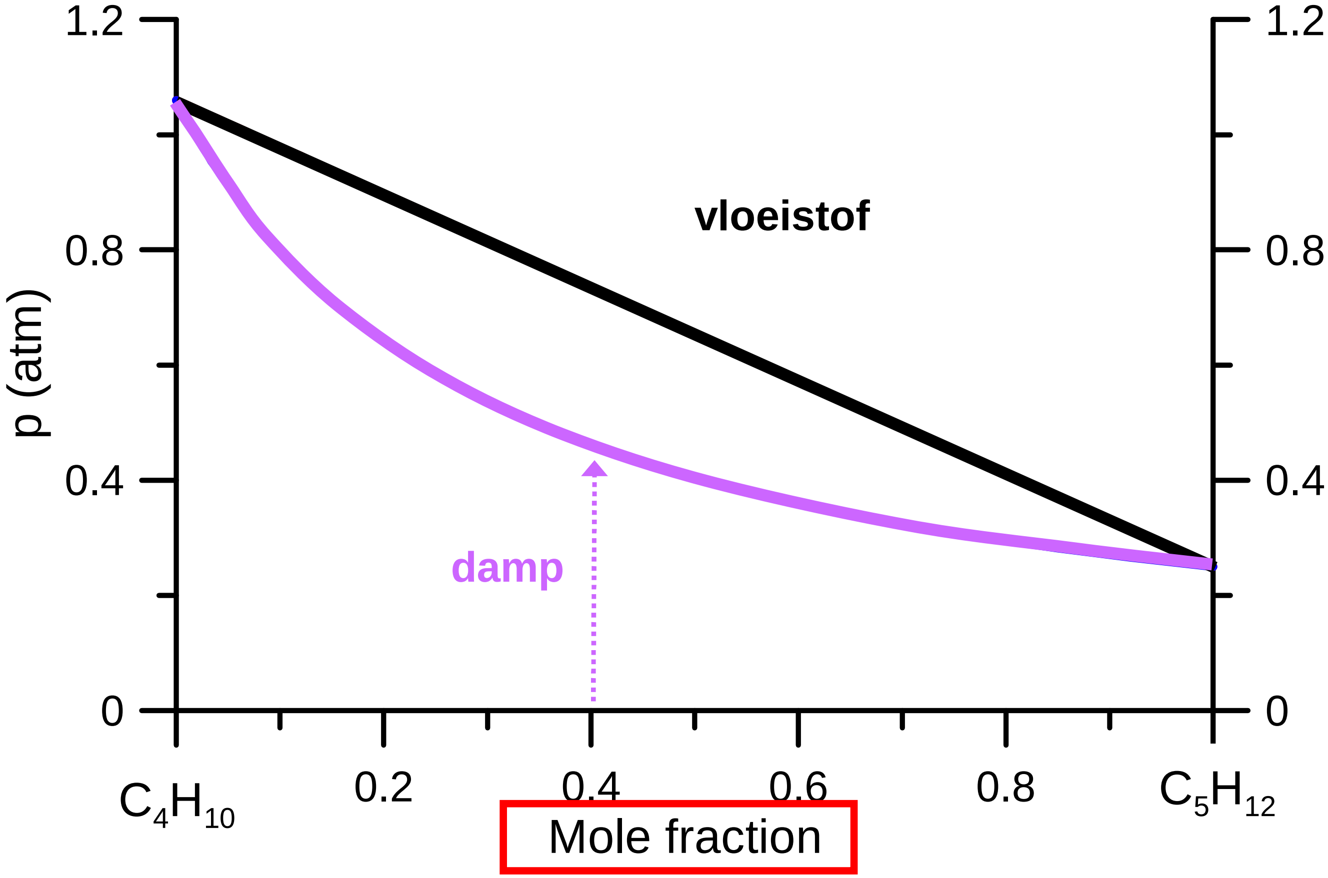


Vloeistof-dampevenwichten

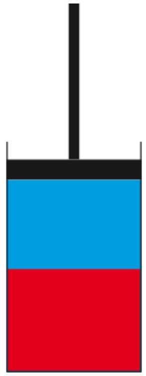
$$p_j = x_j p_j{}^*$$

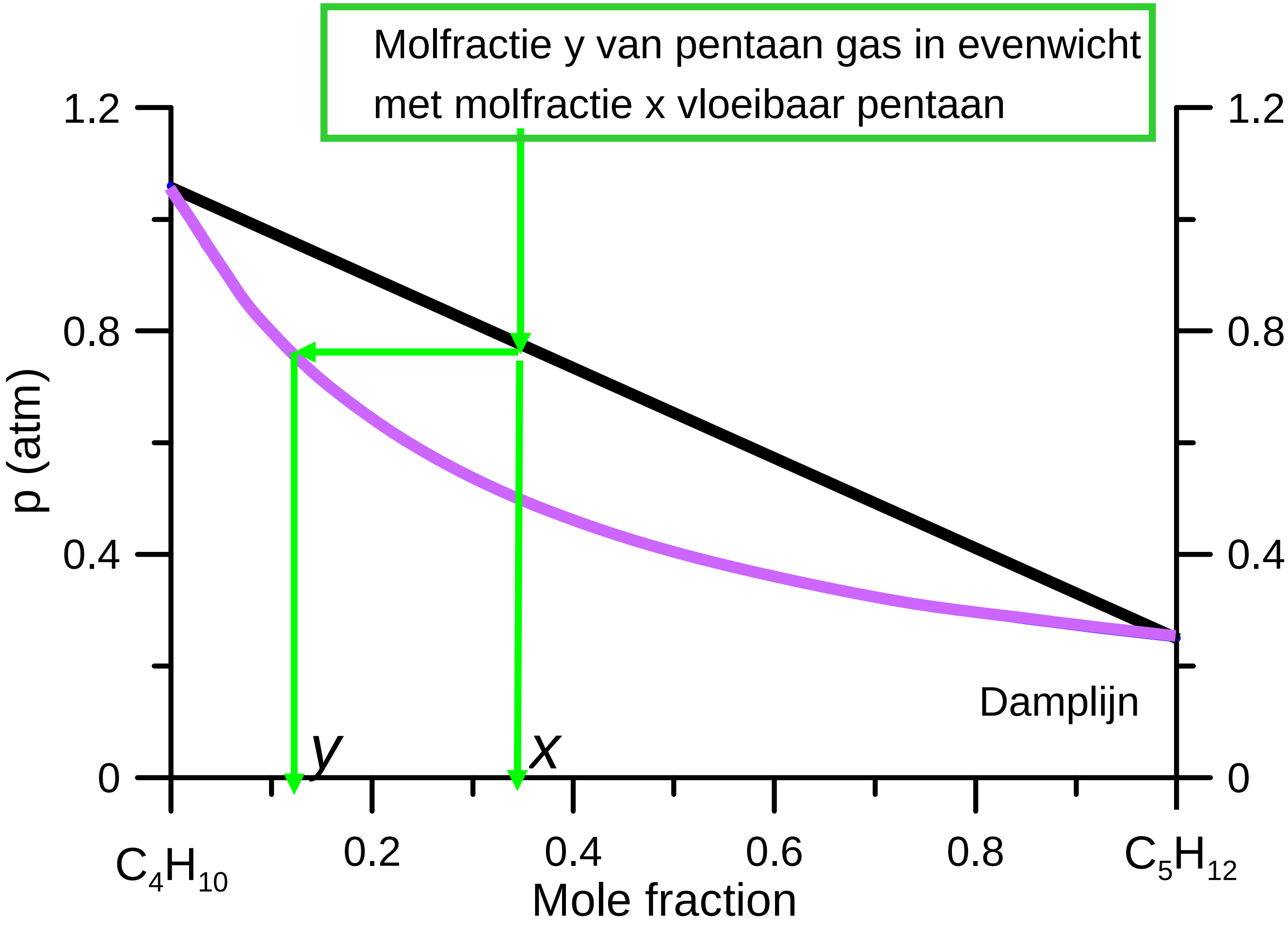
$$p = p_A + p_B = x_A p^*{}_A + x_B p^*{}_B$$





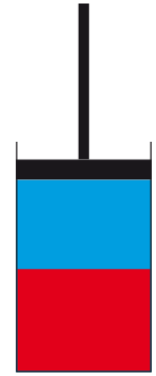
Vloeistof-dampevenwichten

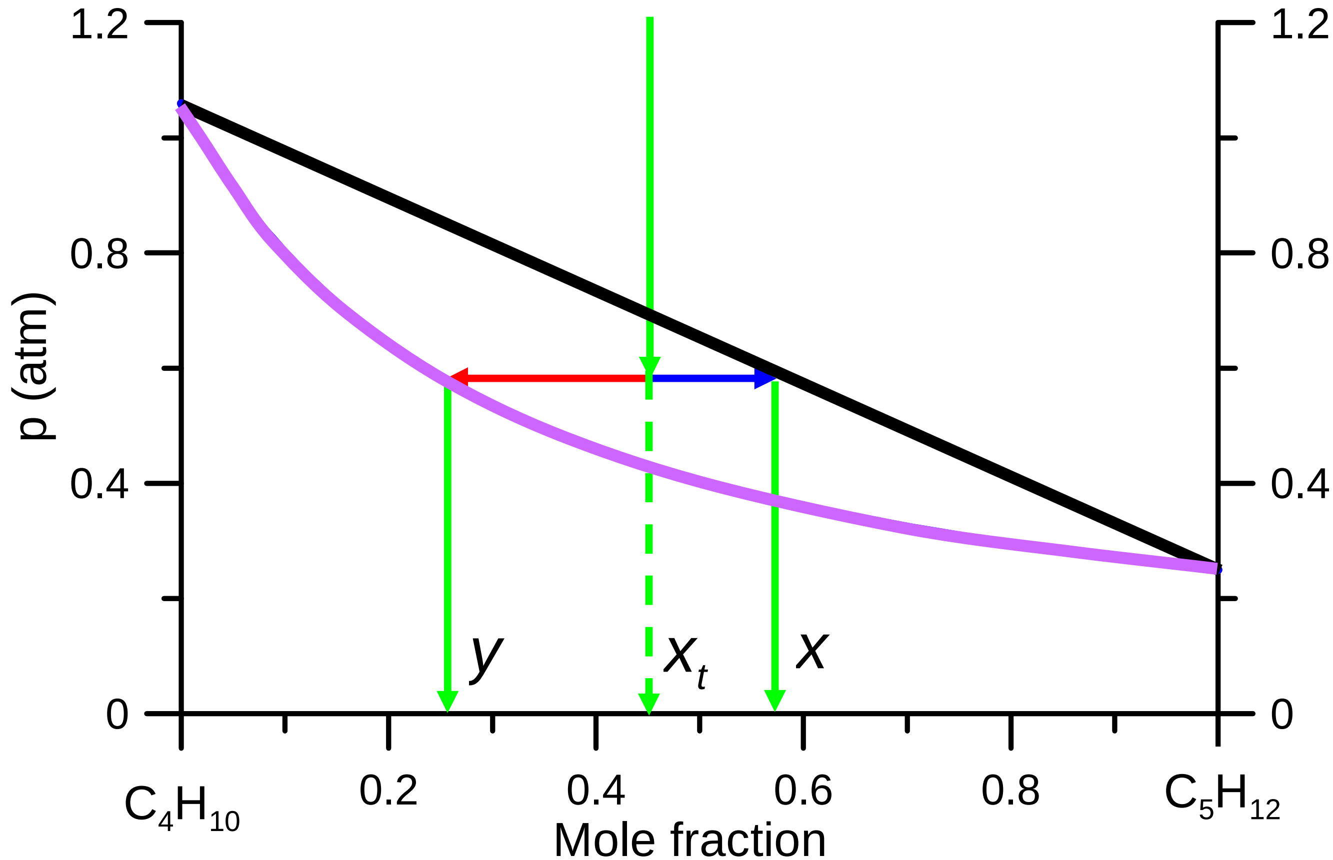




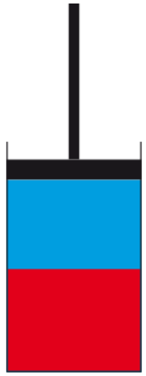
Vloeistof-dampevenwichten

Hefboomregel (lever rule) $$\frac{n_v}{n_l} = \frac{x_t - x}{y - x_t}$$

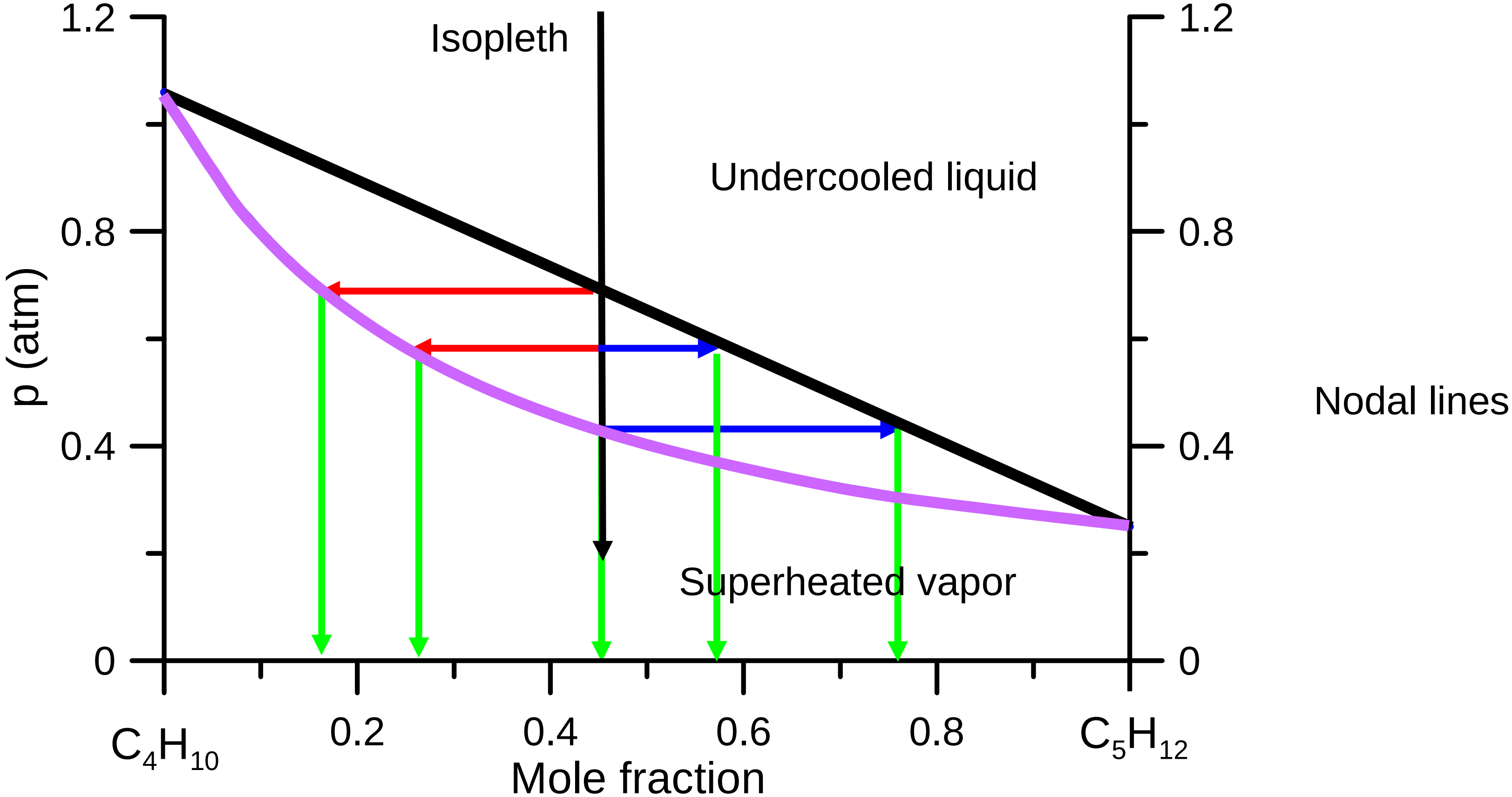




Vloeistof-dampevenwichten

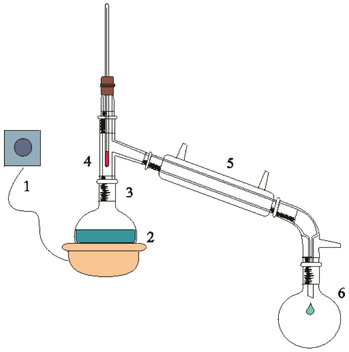


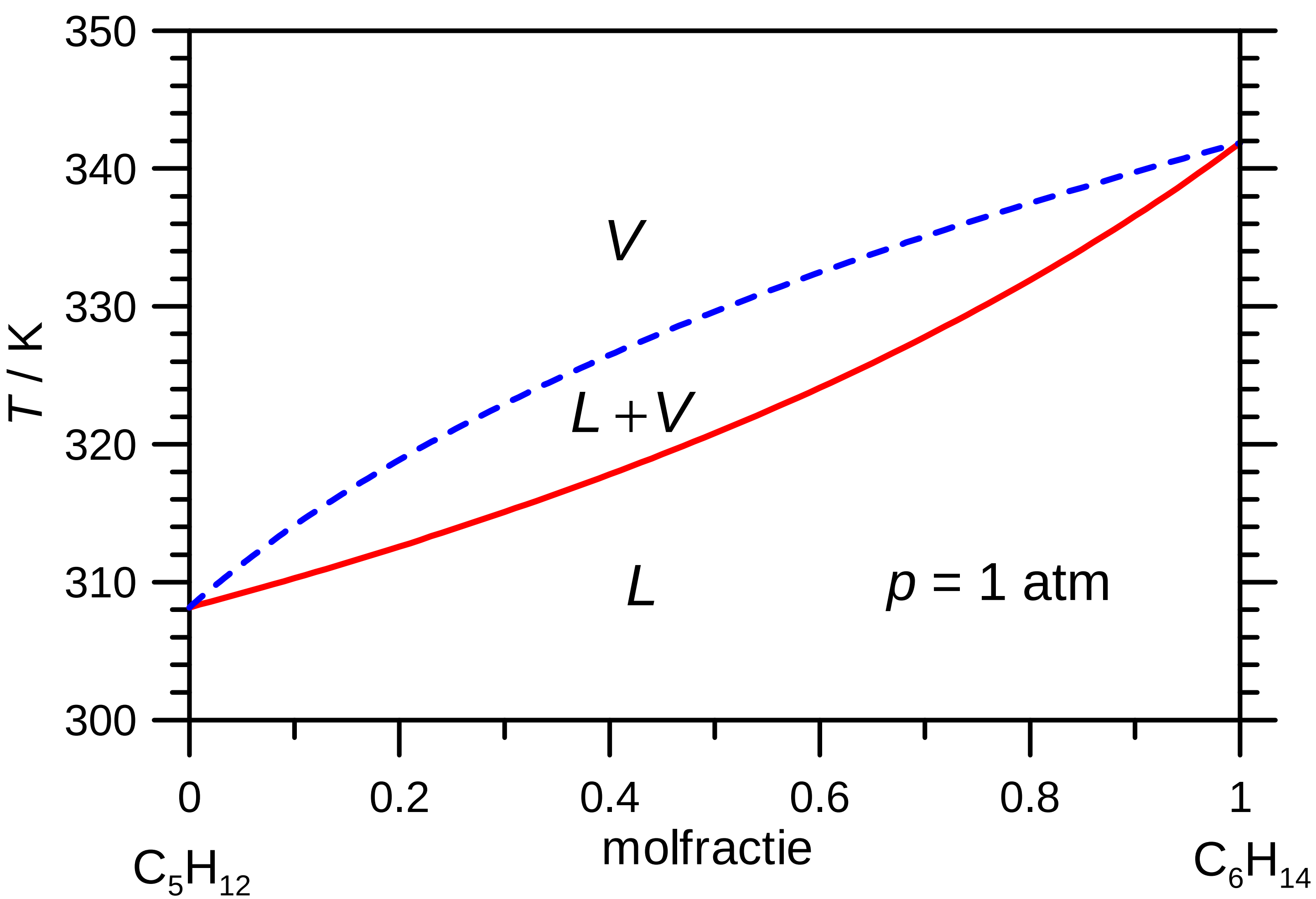
Verdamping door decompressie: interpretatie P-x-diagram



Vloeistof-dampevenwichten

Interpretatie **T-x-diagram**: fasengebieden

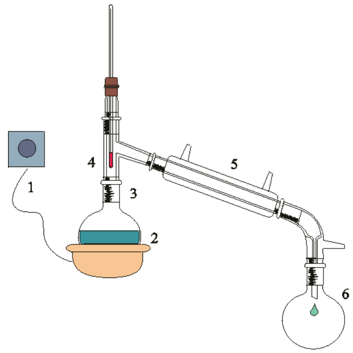


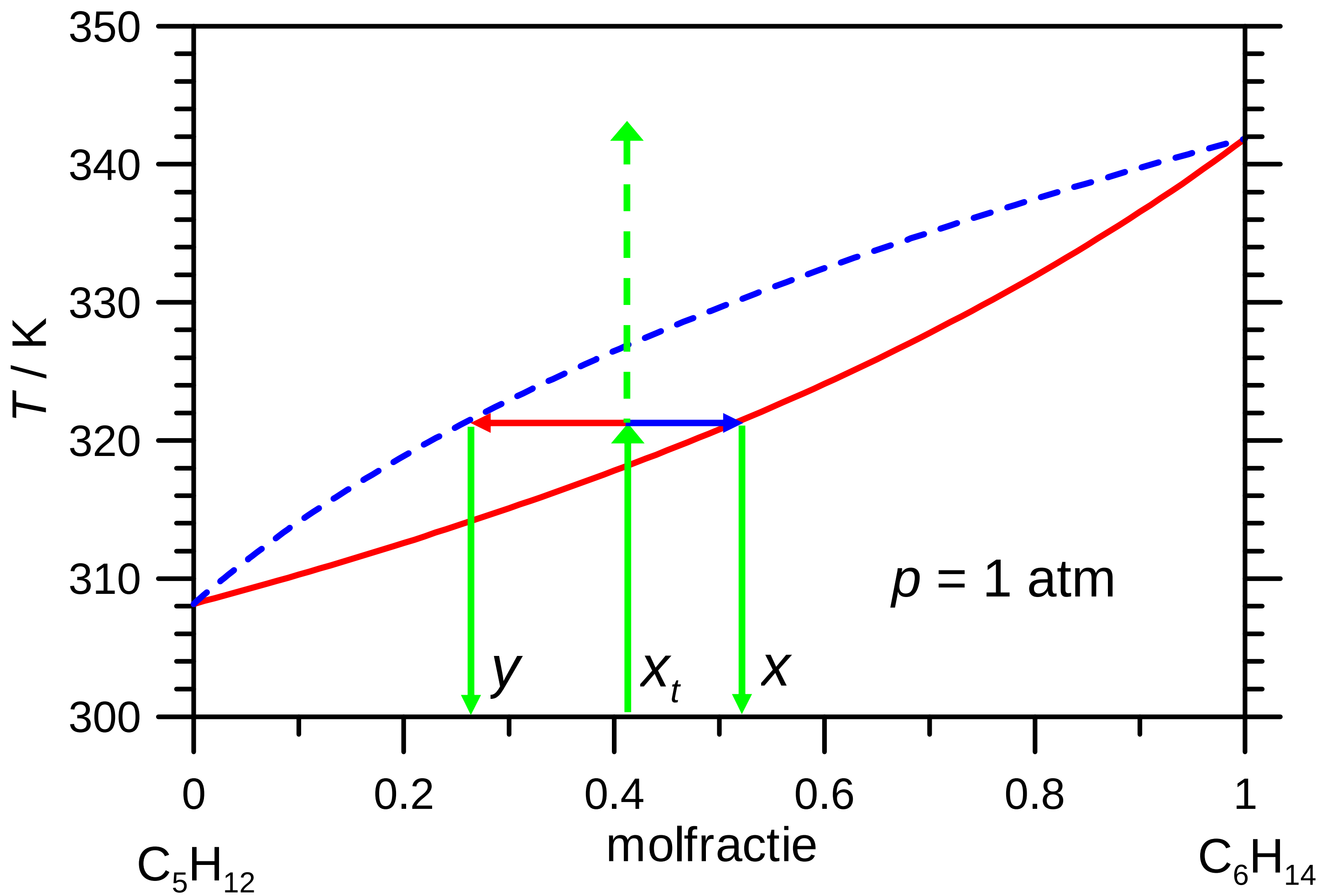


Vloeistof-dampevenwichten

Interpretatie T-x-diagram: hefboomregel

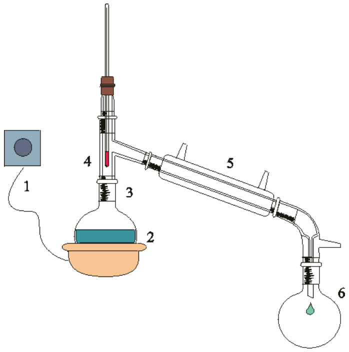
$$\frac{n_v}{n_l} = \frac{x_t - x}{y - x_t}$$

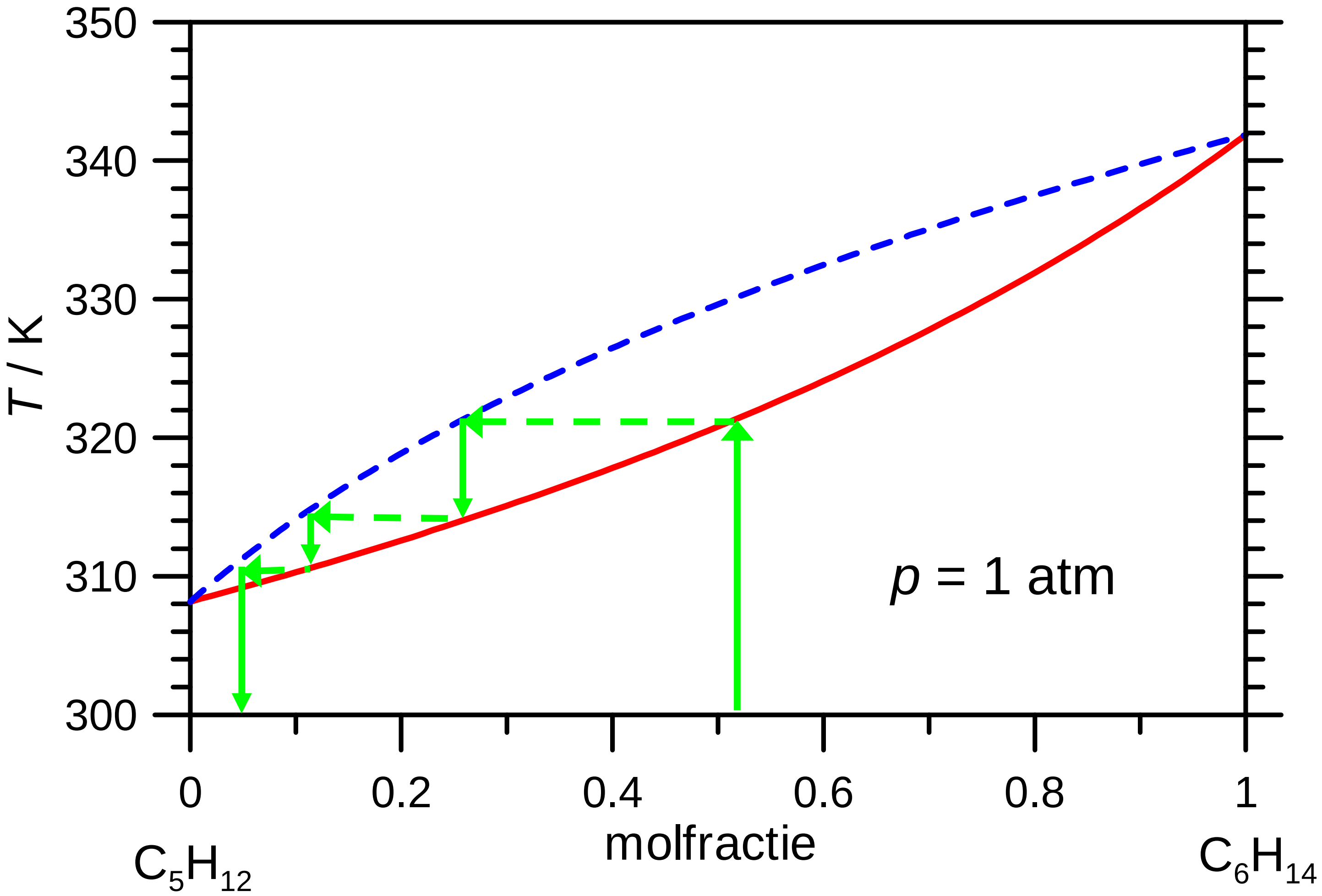




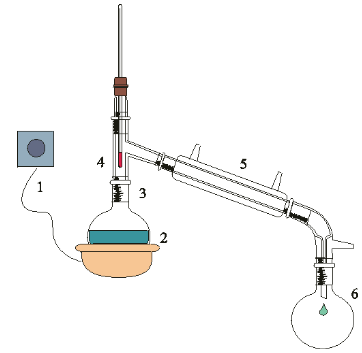
Vloeistof-dampevenwichten

Interpretatie T-x-diagram: destillatie

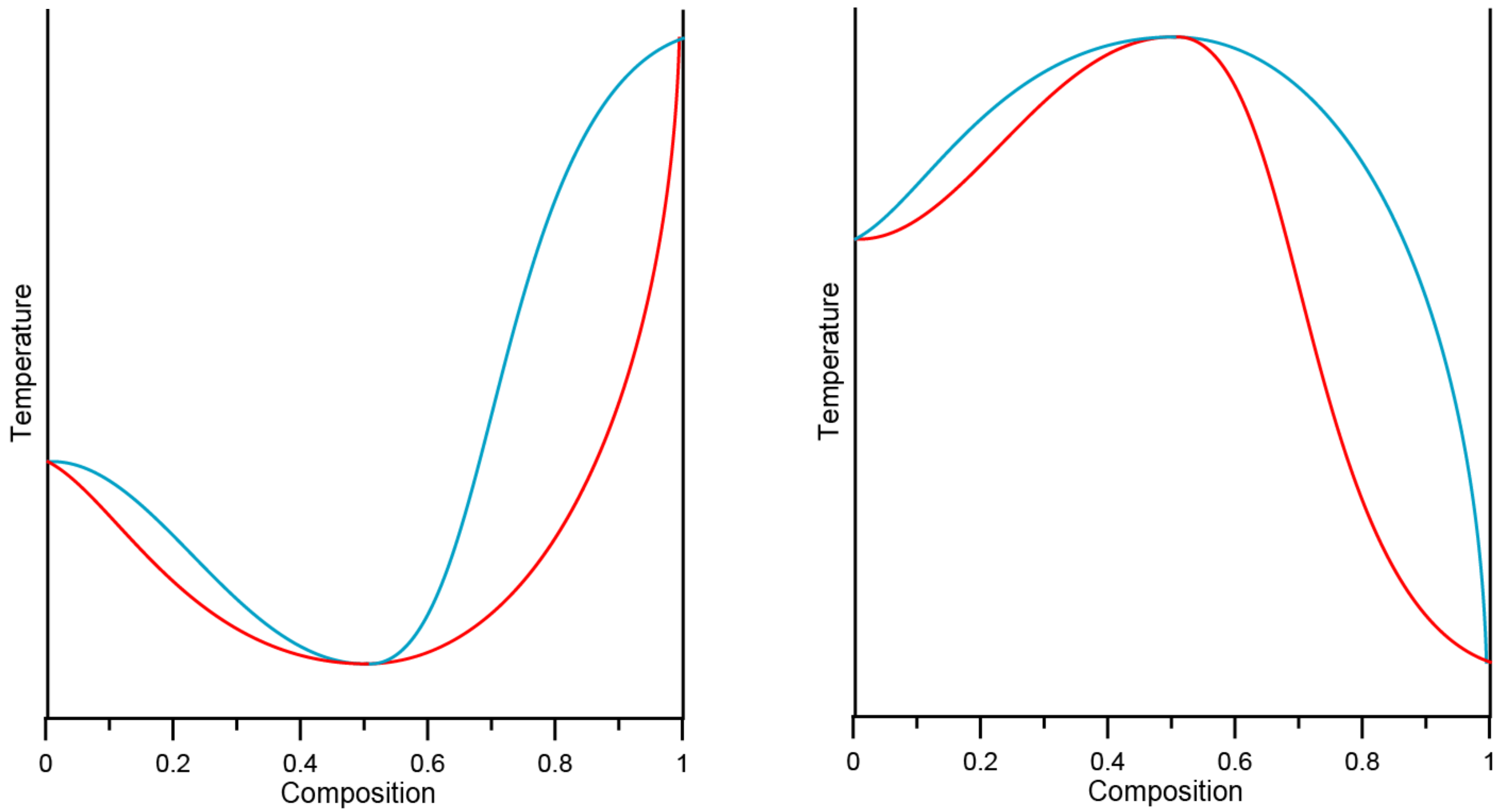




Vloeistof-dampevenwichten

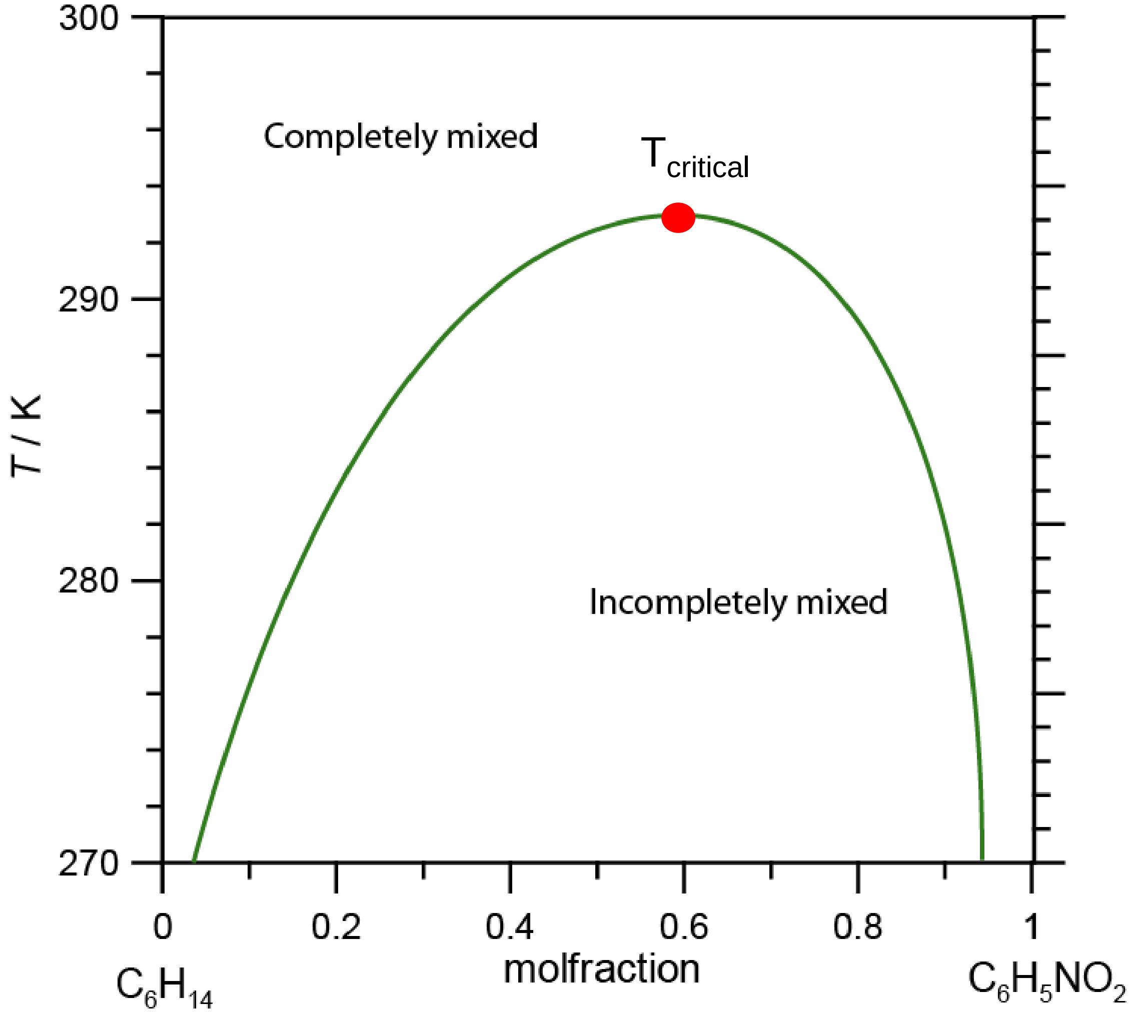


Niet-lineariteiten: azeotropie



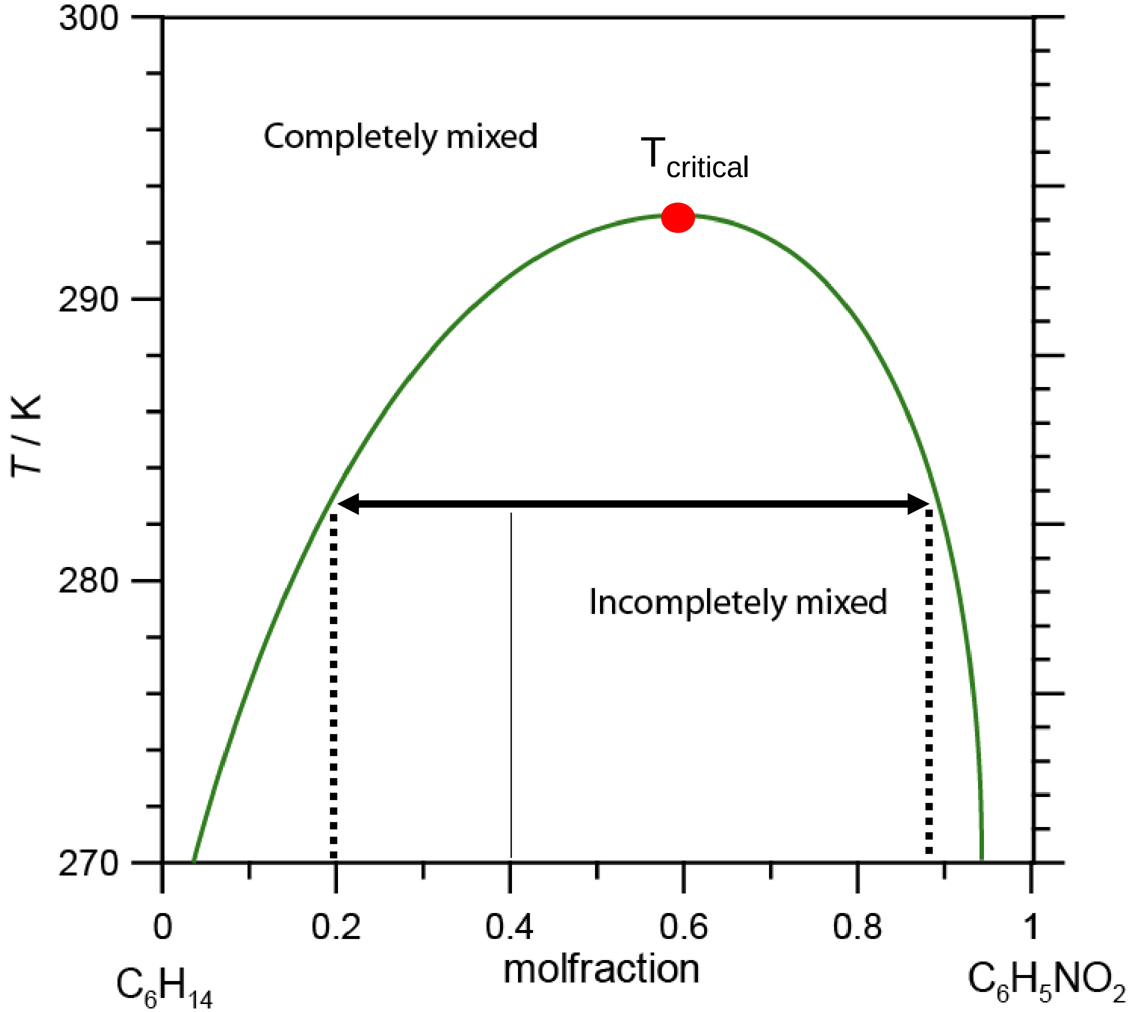
Vloeistof-vloeistof-evenwichten

Gedeeltelijke mengbaarheid (nitrobenzeen in hexaan)



Vloeistof-vloeistof-evenwichten

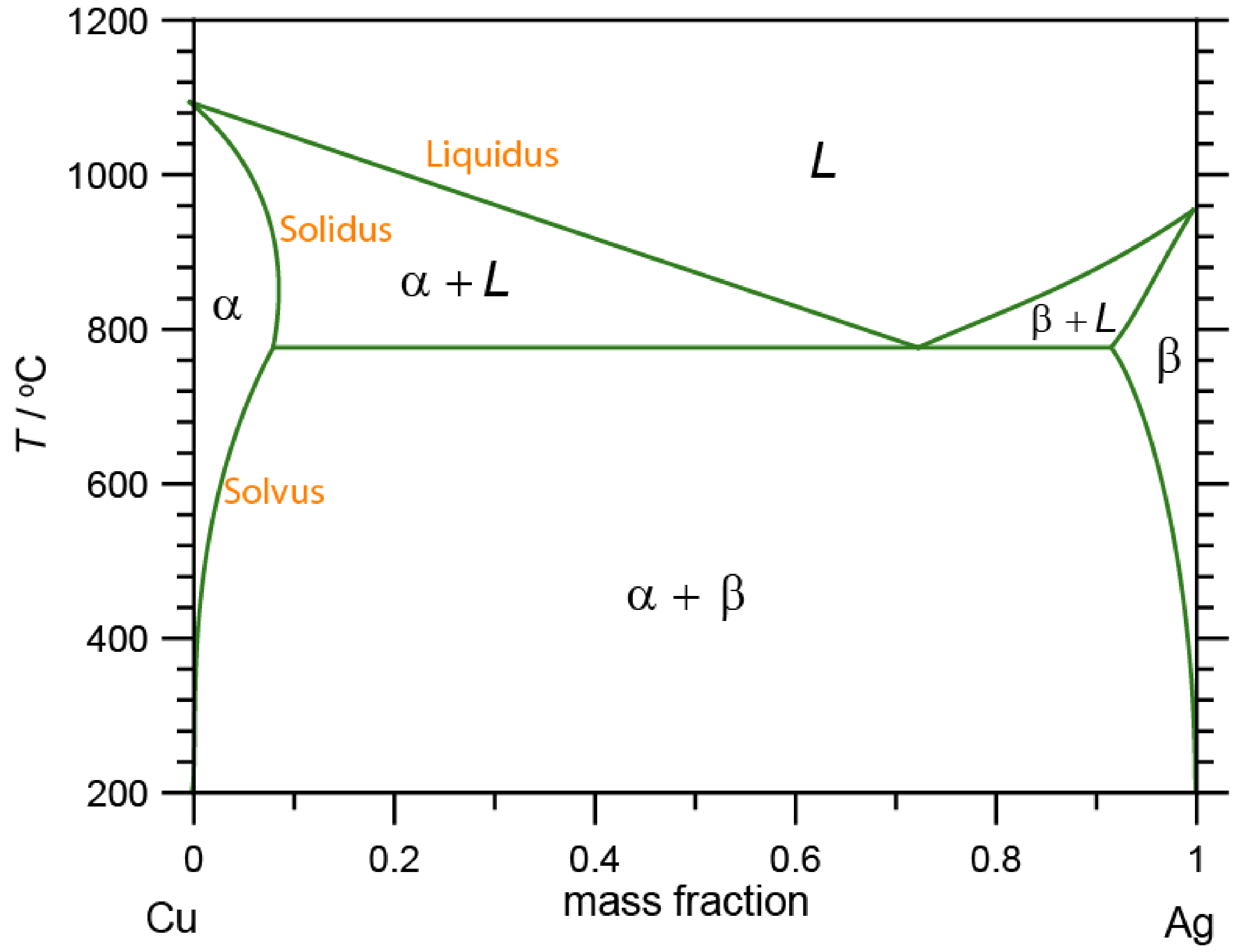
Gedeeltelijke mengbaarheid (nitrobenzeen in hexaan)



Vloeistof-vast-evenwichten

Kenmerken

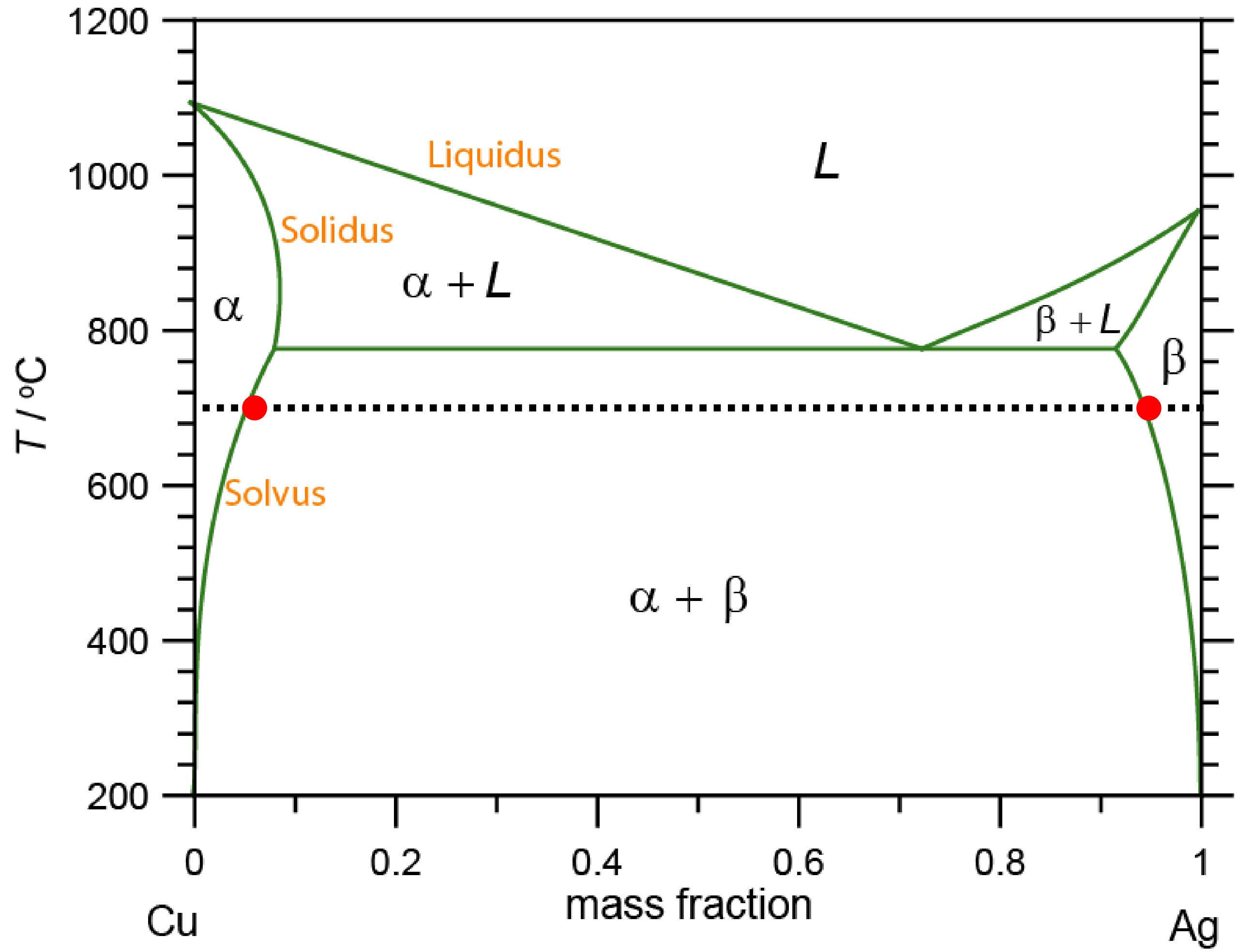
- Eutectisch punt
- oplosbaarheid



Vloeistof-vast-evenwichten

Kenmerken

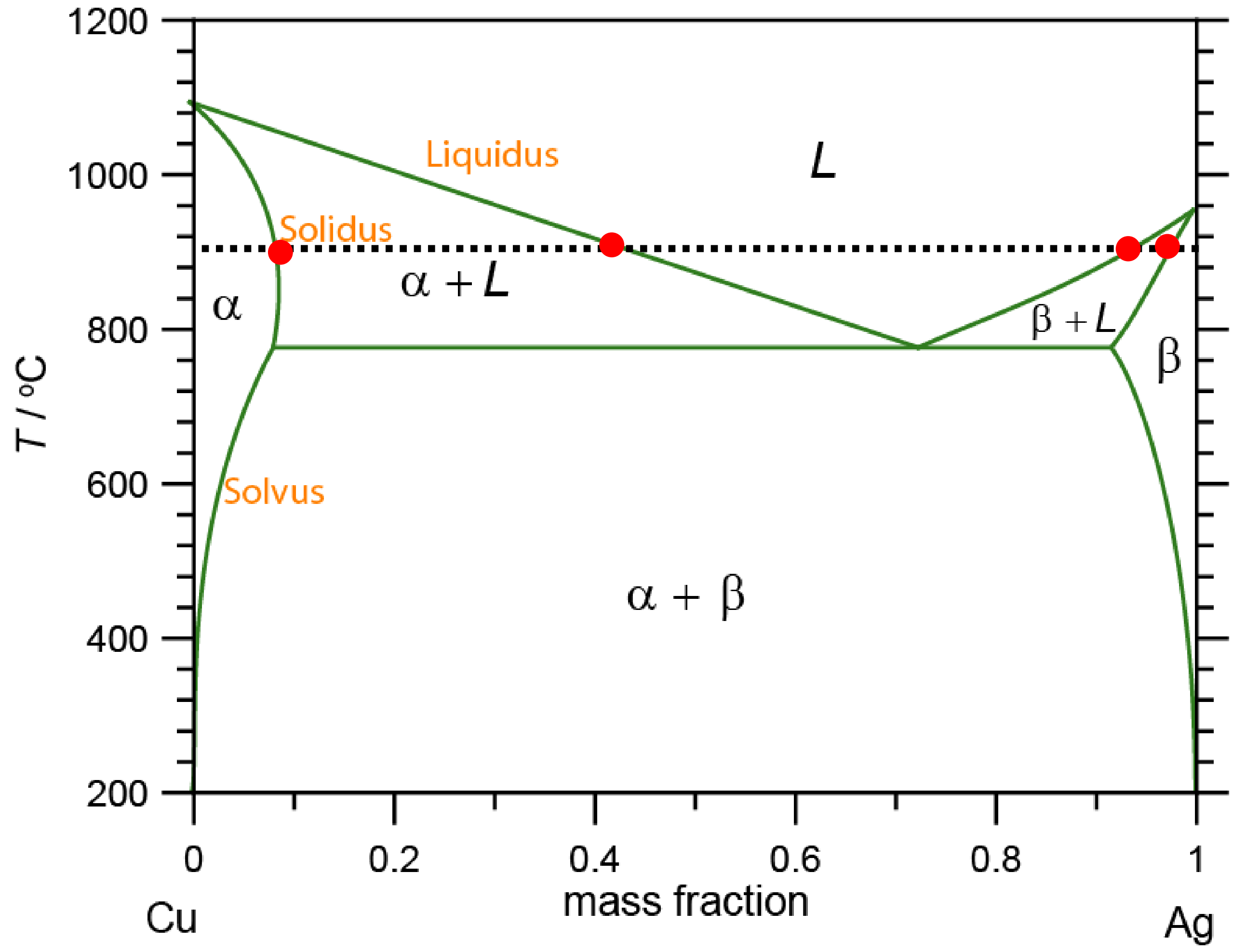
- Eutectisch punt
- oplosbaarheid



Vloeistof-vast-evenwichten

Kenmerken

- Eutectisch punt
- oplosbaarheid



Vloeistof-vast-evenwichten

Kenmerken

- Verbinding
- Eutecticum
- Incongruent smeltpunt