

19. ZADATAK

Procjeniti kritičnu gustoću propana prema Cailletet-Mathiasovom pravilu.

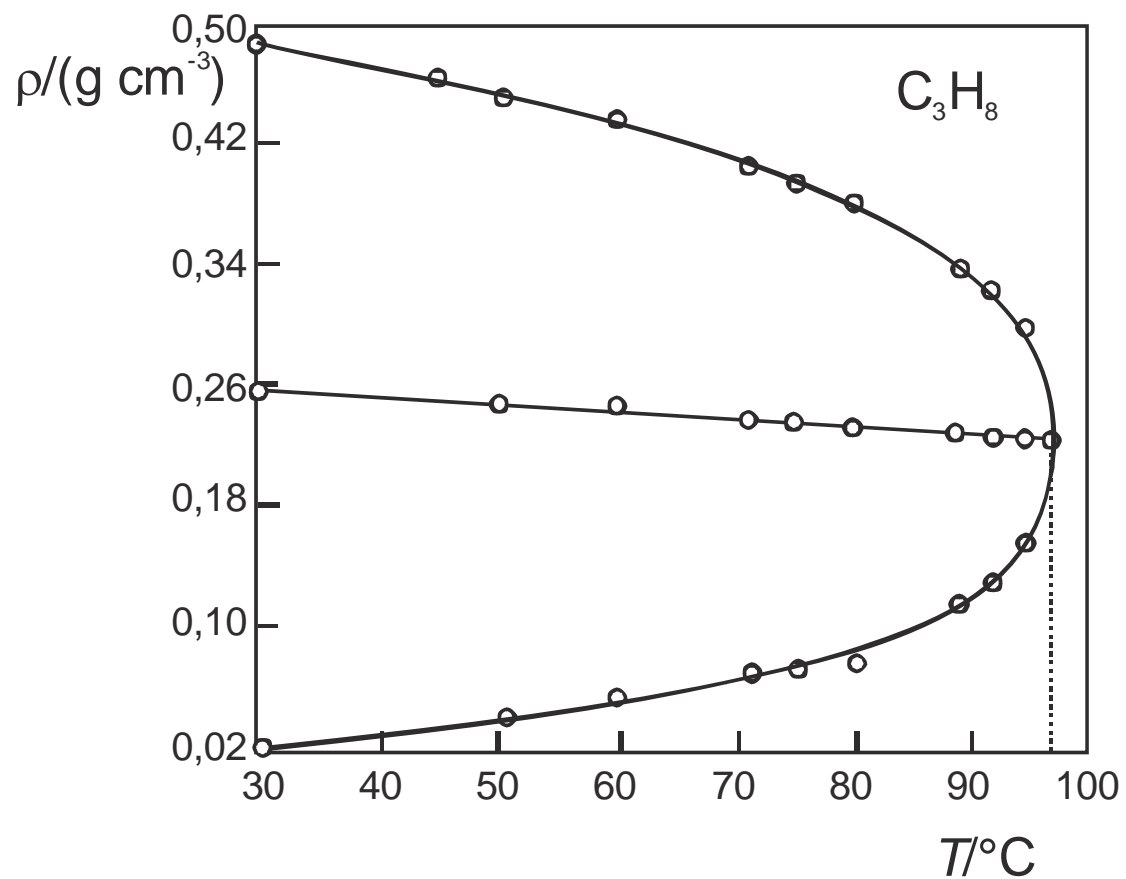
Podaci: $T_K=96,8\text{ °C}$

$T/\text{°C}$	$\rho^L/(\text{gcm}^{-3})$	$\rho^V/(\text{gcm}^{-3})$
30	0,4858	0,0200
80	0,3760	0,0832

CAILLETET-MATHIASOVO PRAVILO

Pravilo linearnog dijametra:

Polovica zbroja gustoća bilo koje tvari u kapljevitom stanju i stanju zasićene pare na istoj temperaturi je linearna funkcija temperature



$$\frac{\rho^{\text{L}} + \rho^{\text{V}}}{2} = \rho(T) = \rho_0 + cT$$

$$\frac{\rho^L + \rho^V}{2} = \rho(T) = \rho_0 + cT$$

30 °C:

$$\rho_{30} = \frac{\rho^L + \rho^V}{2} = \frac{0,4858 + 0,0200}{2} = 0,2529 \text{ g cm}^{-3}$$

80 °C:

$$\rho_{80} = \frac{\rho^L + \rho^V}{2} = \frac{0,3760 + 0,0832}{2} = 0,2296 \text{ g cm}^{-3}$$

$$\rho(T) = \rho_0 + cT$$

$$0,2529 = \rho_0 + c \cdot 30$$

$$0,2296 = \rho_0 + c \cdot 80$$

Dvije jednačbe s dvije nepoznanice!

$$0,2529 - 30c = \rho_0$$

$$0,2296 - 80c = \rho_0$$

$$0,2529 - 30c = 0,2296 - 80c$$

$$50c = -0,0233$$

$$c = -4,66 \cdot 10^{-4} \text{ g cm}^{-3} \text{ } ^\circ\text{C}^{-1}$$

$$\rho_0 = 0,2529 - 30(-4,66 \cdot 10^{-4})$$

$$\rho_0 = 0,2669 \text{ g cm}^{-3}$$

Za kritičnu točku:

$$\rho(T_K) = \rho_0 + cT_K$$

$$\rho(T_K) = 0,2669 - 4,66 \cdot 10^{-4} \cdot 96,8$$

$$\rho(T_K) = 0,2218 \text{ g cm}^{-3}$$

Specifični kritični volumen:

$$v_{\text{sp,K}} = 1/\rho(T_K) = 4,51 \text{ cm}^3 \text{ g}^{-1}$$

Eksperiment:

$$v_{\text{sp,K}} = 4,43 \text{ cm}^3 \text{ g}^{-1}$$