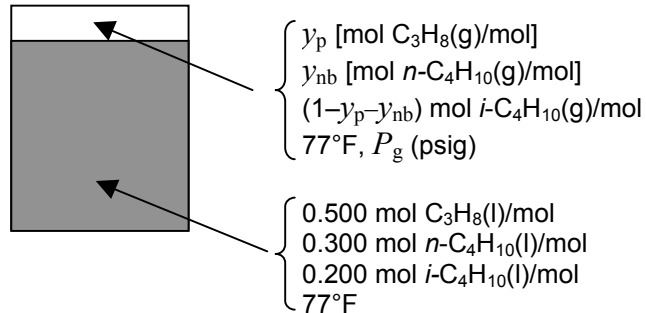


Name: _____

Date: _____

PROBLEM 6.54

A liquid mixture containing 50.0 mole% propane, 30.0% *n*-butane, and 20.0% isobutane is stored in a rigid container at 77°F. The container has a maximum allowable working pressure of 200 psig. The head space above the liquid contains only vapors of the three hydrocarbons.



- (a) Show that the container is currently safe.
- (b) Estimate the temperature above which the maximum allowable pressure would be exceeded. Comment on the suitability of the container to store the given mixture.

Strategy

(6.54-1)

Q: Which of the multicomponent vapor-liquid equilibrium correlations presented in the text—Raoult’s law or Henry’s law—is appropriate to use for this system? Explain your reasoning.

A: _____

Raoult’s law: (Eq. (6.4-1) on p. 257 in the text)

$$p_P = x_p p_p^*(T) = 0.500 p_p^*(77^\circ\text{F})$$

$$p_{nB} = \underline{\hspace{2cm}}$$

$$p_{iB} = \underline{\hspace{2cm}}$$

$$\Rightarrow P = p_P + p_{nB} + p_{iB} = \underline{\hspace{3cm}}$$

(6.54-2)

(6.54-3)

Q: To determine the pressure in the tank, we need only determine and insert the three specified vapor pressures in Eqs. (6.54-2). What are the two sources of hydrocarbon vapor pressure data in the text, and which one can be used for this problem?

A: The Antoine equation (Table B.4) and the Cox chart (Fig. 6.1-4 on p. 247 of the text). The only one we can use for this problem is _____ because _____
