Unit 4 - Week 2: Estimation of Thermodynamic Properties

Assessment 2

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

1. Estimated water at 72°C has vapor pressure of 6.5 kPa and fugacity of 2.7 kPa. At such conditions, liquid has a molar volume of 25 cm³/mol and vapor has a molar volume of 50 cm³/mol. Then what is fugacity of liquid at 72°C?

a) 10 kPa
b) 2.7 kPa
c) 30 kPa

d) No, the value is incorrect.

Assessment 2

2. The van der Waals constants for n-butane (1) and n-octane (2) are given as:

\[ a_1 = 5.85 \times 10^{-5} \text{ Pa m}^6 \text{ mol}^{-2} \quad b_1 = 0.067 \text{ m}^3 \text{ mol}^{-1} \]

\[ a_2 = 2.85 \times 10^{-5} \text{ Pa m}^6 \text{ mol}^{-2} \quad b_2 = 0.137 \text{ m}^3 \text{ mol}^{-1} \]

What are the van der Waals constants \( a \) and \( b \) for equilibrium molar volume of 1 mole at 1 atm and 30°C for:

a) liquid and vapor
b) vapor

Assessment 2

3. For a gas mixture, the appropriate equation of state is found to be

\[ P = \frac{RT}{V} \]  

where \( P \) is the pressure, \( R \) is the gas constant, \( T \) is the temperature, and \( V \) is the molar volume. The molar volume of this mixture at 10 bar and 75°C is:

a) 0.08 m³/mol
b) 0.12 m³/mol
c) 0.15 m³/mol

d) No, the value is incorrect.

Assessment 2

4. The constants for van der Waals equation

\[ P = \frac{RT}{V-b} - \frac{n^2 a}{V(V-b)(V-2b)} \]

for n-butane (1) and its molar volume are given as:

\[ a_1 = 5.85 \times 10^{-5} \text{ Pa m}^6 \text{ mol}^{-2} \quad b_1 = 0.067 \text{ m}^3 \text{ mol}^{-1} \]

\[ a_2 = 2.85 \times 10^{-5} \text{ Pa m}^6 \text{ mol}^{-2} \quad b_2 = 0.137 \text{ m}^3 \text{ mol}^{-1} \]

For the mixture, the equilibrium molar volume is 0.032 m³/mol.

a) 1 atm
b) 3 atm

Assessment 2

5. A gas mixture consisting of 20% A, 50% B, and 30% C on molar basis, the fugacity coefficient of these is 0.5, 0.3, and 0.8 respectively. What is the fugacity of the mixture at 5 atm and 50°C?

a) 2 atm
b) 4 atm

Assessment 2

6. Calculate fugacity of water vapor at 30°C and 10 bar using Redlich-Kwong equation of state with constants \( a = 14.07 \text{ J m}^3 \text{ mol}^{-2} \) and \( b = 0.014 \text{ m}^3 \text{ mol}^{-1} \)

a) 2 atm
b) 4 atm

d) No, the value is incorrect.

Assessment 2

7. The fugacity of component A is larger at 220°C and 110°C, while the fugacity of component B is larger at 220°C and 110°C using Redlich-Kwong equation of state with constants \( a = 14.07 \text{ J m}^3 \text{ mol}^{-2} \) and \( b = 0.014 \text{ m}^3 \text{ mol}^{-1} \)

a) 2 atm
b) 4 atm

d) No, the value is incorrect.