Unit 3 - Week 1: Introduction of Phase Equilibria

Assessment 1

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

Due on 2020-02-12, 23:59 IST.

1) For the equation of state: $Z = 1 + \frac{B}{v}$, what is coefficient of volume expansion, α_P =? *5 points*

- $\alpha_P = \frac{B+v+T(dB/dT)}{T(2v-B)}$
- $\alpha_P = \frac{B+v+T(dB/dT)}{T(v+2B)}$
- $\alpha_P = \frac{B+v+T(dB/dT)}{2T(v+B)}$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\alpha_P = \frac{B+v+T(dB/dT)}{T(v+2B)}$

2) For the equation of state: $Z = 1 + \frac{B}{v}$, what is the coefficient of compressibility, k_T=? *5 points*

- $k_T = \frac{v^2}{Pv^2+BRT}$
- $k_T = \frac{v^2}{Pv^2-BRT}$
- $k_T = \frac{2v^2}{Pv^2+BRT}$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$k_T = \frac{v^2}{Pv^2+BRT}$

3) If coefficient of volume expansion and the coefficient of compressibility are designated as α_P and k_T respectively for a fluid, then what is $(\partial P/\partial T)_v$=? *5 points*

- $\left(\frac{\partial P}{\partial T}\right)_v = \frac{\alpha_P}{2k_T} - 1$
- $\left(\frac{\partial P}{\partial T}\right)_v = \frac{\alpha_P}{k_T}$
- $\left(\frac{\partial P}{\partial T}\right)_v = \frac{2\alpha_P}{k_T}$
- $\left(\frac{\partial P}{\partial T}\right)_v = \frac{\alpha_P}{2k_T} + 1$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\left(\frac{\partial P}{\partial T}\right)_v = \frac{\alpha_P}{k_T}$

4) For van der Waals equation of state $P = \frac{RT}{v-b} - \frac{a}{v^2}$, what is coefficient of volume expansion α_p ? *5 points*

- $\alpha_P = \frac{Rv^2}{Pv^3-2av+ab}$
- $\alpha_P = \frac{Rv^2}{Pv^3+av-2ab}$
- $\alpha_P = \frac{2Rv^2}{Pv^3-av+ab}$
- $\alpha_P = \frac{Rv^2}{Pv^3-av+2ab}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\alpha_P = \frac{Rv^2}{Pv^3-av+2ab}$

5) For van der Waals equation of state: $P = \frac{RT}{v-b} - \frac{a}{v^2}$, what is coefficient of compressibility, k_T=? *5 points*

- $k_T = \frac{v^2(v-b)}{Pv^3-av+2ab}$
- $k_T = \frac{v^2(v-b)}{Pv^3-2av+ab}$
- $k_T = \frac{2v^2(v-b)}{Pv^3+av+2ab}$
- $k_T = \frac{v^2(v-b)}{Pv^3-av+ab}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$k_T = \frac{v^2(v-b)}{Pv^3-av+2ab}$

6) A liquid is compressed from its vapor pressure of 0.381 MPa to 1.2 MPa at T=270 K. *5 points*
For saturated liquid at 270 K, $v^2=1.55\times10^{-3}$ m^3/kg and $\alpha_P=2.095\times10^{-3}$ K^{-1} (coefficient of volume expansion). What is the corresponding change in enthalpy? Use Maxwells relation to solve this problem.

- ΔH = 0.9716 kJ/kg
- ΔH = 0.4553 kJ/kg
- ΔH = 0.5514 kJ/kg
- ΔH = 0.7241 kJ/kg

No, the answer is incorrect.
Score: 0
Accepted Answers:
ΔH = 0.5514 kJ/kg

7) A liquid is compressed from its vapor pressure of 0.381 MPa to 1.2 MPa at T=270 K. *5 points*
For saturated liquid at 270 K, $v^2=1.55\times10^{-3}$ m^3/kg and $\alpha_P=2.095\times10^{-3}$ K^{-1} (coefficient of volume expansion). What is the corresponding change in entropy? Use Maxwells relation to solve this problem.

- $\Delta S = -1.59\times10^{-5}$ kJ/kg-K
- $\Delta S = -2.66\times10^{-3}$ kJ/kg-K
- $\Delta S = -3.09\times10^{-4}$ kJ/kg-K
- $\Delta S = -1.26\times10^{-3}$ kJ/kg-K

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\Delta S = -2.66\times10^{-3}$ kJ/kg-K

8) For van der Waals equation of state: $P = \frac{nRT}{V-bn} - \frac{an^2}{V^2}$, What is ΔS =? *5 points*

- $\Delta S = nR\ln\left[\frac{V_2-bn}{V_1-bn}\right]$
- $\Delta S = 2nR\ln\left[\frac{V_2-bn}{V_1+bn}\right]$
- $\Delta S = nR\ln\left[\frac{V_2+bn}{V_1-bn}\right]$
- $\Delta S = \frac{1}{2}nR\ln\left[\frac{V_2-bn}{V_1-bn}\right]$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\Delta S = nR\ln\left[\frac{V_2-bn}{V_1-bn}\right]$

9) For van der Waals equation of state: $P = \frac{nRT}{V-bn} - \frac{an^2}{V^2}$, What is $\left(\frac{\partial U}{\partial V}\right)_T$ =? *5 points*

- $\left(\frac{\partial U}{\partial V}\right)_T = \frac{an^2}{V^2} + 1$
- $\left(\frac{\partial U}{\partial V}\right)_T = \frac{2an^2}{V^2}$
- $\left(\frac{\partial U}{\partial V}\right)_T = \frac{an^2}{V^2} - 1$
- $\left(\frac{\partial U}{\partial V}\right)_T = \frac{an^2}{V^2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\left(\frac{\partial U}{\partial V}\right)_T = \frac{an^2}{V^2}$

10) For van der Waals equation of state: $P = \frac{nRT}{V-bn} - \frac{an^2}{V^2}$, What is $\left(\frac{\partial S}{\partial P}\right)_T$ =? *5 points*

- $\left(\frac{\partial S}{\partial P}\right)_T = \frac{nRV^3}{PV^3+an^2V-2abn^3}$
- $\left(\frac{\partial S}{\partial P}\right)_T = \frac{-nRV^3}{PV^3-2an^2V+abn^3}$
- $\left(\frac{\partial S}{\partial P}\right)_T = \frac{-nRV^3}{PV^3-an^2V+2abn^3}$
- $\left(\frac{\partial S}{\partial P}\right)_T = \frac{-2nRV^3}{PV^3-an^2V+2abn^3}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\left(\frac{\partial S}{\partial P}\right)_T = \frac{-nRV^3}{PV^3-an^2V+2abn^3}$