

## Unit 4 - Week 02 : Thermodynamic Property Relations

Course outline
How to access the portal
Week 0: Prerequisites
Week 1 : Review of Thermodynamic Principles
Week 02 : Thermodynamic Property Relations
<input checked="" type="radio"/> Thermodynamic potentials & Maxwell relations <input type="radio"/> Generalized relations for entropy & specific heats <input type="radio"/> Joule-Thomson coefficient & Clapeyron equation <input type="radio"/> Quiz : Assignment 2 <input type="radio"/> New Lesson <input type="radio"/> Assignment 2 solution <input type="radio"/> Feedback Form
Week 3 Properties of pure substances
Week 4: Air Standard Cycles
Week 5: Real Cycles for Reciprocating Engines
Week 6 :Gas Turbine Cycles
Week 7: Vapor Power Cycles
Week 8: Cogeneration & Combined Cycles
Week 9: Refrigeration Cycles
Week 10: Gas Mixtures
Week 11: Gas-vapor Mixtures
Week 12: Chemical Reactions
Live Session-1
Live Session-2
Live Session-3

### Assignment 2

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

**Due on 2019-08-21, 23:59 IST.**

1) Isothermal compressibility is defined as 1 point

- $-v\left(\frac{\partial p}{\partial v}\right)_T$   
  $v\left(\frac{\partial p}{\partial v}\right)_T$   
  $\frac{1}{v}\left(\frac{\partial p}{\partial v}\right)_T$   
  $-\frac{1}{v}\left(\frac{\partial p}{\partial v}\right)_T$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $-\frac{1}{v}\left(\frac{\partial p}{\partial v}\right)_T$

2) For a particular substance,  $\beta$  represents isothermal compressibility and  $\alpha$  represents volume expansivity, then, among the following relations, which one is true? 1 point

- $\beta = \alpha\left(\frac{\partial T}{\partial P}\right)_v$   
  $\beta = \alpha\left(\frac{\partial P}{\partial T}\right)_v$   
  $\beta = \alpha\left(\frac{\partial v}{\partial P}\right)_T$   
  $\beta = \alpha\left(\frac{\partial P}{\partial v}\right)_T$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $\beta = \alpha\left(\frac{\partial P}{\partial T}\right)_v$

3) Consider a sample of air maintained at 300 K and 0.75 kg/m<sup>3</sup>. Treating air as an ideal gas with R = 0.287 kJ/kg.K, the change in pressure of the sample for 1% increase in specific volume at constant temperature is 1 point

- 2.873 kPa  
 - 1.339 kPa  
 zero  
 2.873 kPa

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
- 1.339 kPa

4) A particular gas substance follows the relation,  $(p - \frac{a}{v^2})(v - b) = RT$ . Using the Maxwell relations, find  $\left(\frac{\partial v}{\partial T}\right)_P =$  1 point

- $\frac{R}{v-b}$   
  $\frac{aR}{v-b}$   
  $\frac{P-a}{v-b}$   
  $\frac{R}{b}$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $\frac{R}{v-b}$

5) Joule-Thomson coefficient for an ideal gas is 1 point

- positive  
 negative  
 zero  
 undefined

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
zero

6) A substance can be used as a refrigerant when 1 point

- its temperature is greater than the maximum inversion temperature and the Joule-Thomson coefficient is positive.  
 its temperature is greater than the maximum inversion temperature and the Joule-Thomson coefficient is negative.  
 its temperature is lesser than the maximum inversion temperature and the Joule-Thomson coefficient is positive.  
 its temperature is lesser than the maximum inversion temperature and the Joule-Thomson coefficient is negative.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
its temperature is lesser than the maximum inversion temperature and the Joule-Thomson coefficient is positive.

7) Among the followings, which conclusion can be drawn from the Mayer relation? 1 point

- Isobaric specific heat is always greater than isochoric specific heat.  
 Difference between isobaric and isochoric specific heats vanishes at absolute zero temperature.  
 Both specific heats are identical for a purely incompressible substance.  
 All of the above.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
All of the above.

8) A fixed quantity of Helium at 100 kPa, 293 K, is taken to 600 kPa, 573 K, during a particular process. Helium follows the relation  $P(v-b) = RT$ . If, for Helium,  $C_p = 5.1926 \text{ kJ/kgK}$  and  $R = 2.0769 \text{ kJ/kgK}$ , then the change in specific entropy during the process (correct to 1 decimal place) is \_\_\_\_\_ J/kg.K.

Hint

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) -245,-230

1 point

9) During a particular heating process, temperature of air increases from 20°C to 300°C. Air is found to follow the relation  $P(v - b) = RT$ . If air can be assumed to have constant value of isochoric specific heat ( $C_v$ ) = 0.731 kJ/kgK, then the change in specific internal energy during the process (correct to 1 decimal place) is \_\_\_\_\_ kJ/kg.

Hint

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 202,208

1 point

10) Saturation temperatures for steam at 275 kPa, 300 kPa & 325 kPa are 130.58°C, 133.52°C and 136.27°C, respectively. If the change in specific volume during the phase change process at 300 kPa is 0.60475 m<sup>3</sup>/kg, then the enthalpy change associated with this phase change at 300 kPa (correct to 1 decimal place) is \_\_\_\_\_ kJ/kg.

Hint

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 2150,2170

1 point