FE-Style Questions

**(Remember, you must document your reasoning for the FE-style questions. This might include showing equations and numbers used, and/or thought process.   
Circle all correct answers)**

6-1 In which of the following situations is mass conserved?   
 a) water flows from a reservoir, through a penstock, through a turbine, and out to a river  
 b) liquid water in a cylinder is subjected to several thousand psi prior to a fracking operation

c) a hydrocarbon fuel is burned in an internal combustion engine

d) nuclear fission in a reactor core

6-2 Which of the following properties are independent in the two phase, liquid-vapor region?  
 a) temperature and pressure  
 b) temperature and specific volume  
 c) temperature and specific internal energy  
 d) specific enthalpy and specific volume

6-3 Which of the following apply to calculating molar specific volume for an ideal gas?  
 a) pressure must be on an absolute scale  
 b) the universal gas constant must be used  
 c) the molecular weight must be used  
 d) temperature can be in degrees Celsius

6-4 What is true about the behavior of isobars on a T-*v* diagram for water?  
 a) these are horizontal   
 b) these are vertical   
 c) these slope from the upper left to the lower right  
 d) these slope from the lower left to the upper right

6-5 What is true about the behavior of isochores on a P-*v* diagram for water?  
 a) these are horizontal  
 b) these are vertical  
 c) these slope from the upper left to the lower right  
 d) these slope from the lower left to the upper right

## Practice Problems on Next Page

## Practice Problems

1. You are going to model the change in specific internal energy of a solid block of aluminum. The block starts at 300 K, and is heated to 500 K. This is done under atmospheric pressure. Calculate the change in specific internal energy [kJ/kg] using an assumption that specific heat stays constant over the temperature change.
2. You have helium in a sealed, rigid container. Initially it is at -200 °F, and is heated to 500 °F. Even though the initial temperature is low, assume ideal gas behavior to find:
   1. The ratio of the final pressure to the initial pressure [unitless]
   2. The change in the specific internal energy of the gas [Btu/lbm­]
   3. The change in specific enthalpy of the gas [Btu/lbm­]
3. You are going to calculate the specific volume of propane. But to be thorough, you are going to calculate it a few different ways. You have a cylinder of propane that is at 1000 psia, and 300 °F.
   1. Using the ideal gas equation of state (EOS), calculate the specific volume [ft3/lbm]
   2. Using the Clausius EOS (and the van der Waals value for b (Table C15.a), calculate the specific volume [ft3/lbm]
   3. Of these two, which do you expect is more accurate (closer to the true value)? How do you know?

## Answers to FE-Style Problems

1. a, b, and c
2. b, c, and d
3. a and b
4. a and d
5. b

## Answers to Practice Problems

1. Change in specific internal energy is ~189.6 kJ/kg
2. Assuming Ideal Gas
   1. Pressure ratio is ~3.696
   2. Change in specific internal energy is ~520.8 Btu/lbm
   3. Change in specific enthalpy is ~868.0 Btu/lbm
3. Ideal Gas Approximation
   1. Ideal Gas EOS gives specific volume of ~0.1846 ft3/lbm
   2. Clausius EOS gives specific volume of ~0.2179 ft3/lbm
   3. For class discussion….which one do you think is more correct?