FE-Style Questions **(circle all correct answers; supply supporting reasoning for each of your answers)**

9-1 Which of the following quantities have MLt units of L2/t2?  
 a) kinetic energy   
 b) specific heat transfer  
 c) specific work transfer  
 d) potential energy  
  
  
9-2 Which are valid expressions for work of an ideal gas during an isobaric process?  
 a) p (V2-V1)  
 b) V (p2-p1)  
 c) mR(T2-T1)/(1-n)   
 d) ʃp dV

## Practice Problems

1. When a saturated liquid experiences an isenthalpic (constant enthalpy) drop in pressure (e.g. saturated liquid water flowing through a valve) it will create something called *flash steam*. It happens nearly instantaneously as a portion of the flow turns to steam. In this problem, you have saturated liquid water (this means x1 = 0) at 2.0 MPa. It flows through an isenthalpic valve and exits at 1.0 MPa.
2. Using EES, solve for the temperature of the flow after it exits the valve, and the percentage of flash steam.
3. Using EES, create a parametric table to solve for a range of ending pressures. This range should start at 2.00 MPa and go to atmospheric pressure in intervals of 0.1 MPa.
4. In EES, make a plot that shows steam quality (vertical axis) as a function of ending pressure (horizontal axis).
5. In EES, make a plot that shows valve exit temperature [°C] (vertical axis) as a function of ending pressure (horizontal axis).
6. Use EES to create a p-h (pressure-enthalpy) diagram for water that focuses on saturation behavior up to the critical point. This should show lines of constant quality, as well as isotherms at: 80, 100, 180, 212.4, 275, and 373.9 [°C]. Double click on the pressure axis and change the limits to 1E-02 and 1E+02
7. Illustrate/explain how you can use this chart to validate your solution.

Assignment continued on next page

## Practice Problems Continued

1. Complete the following table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Substance | Temperature  [°F] | Pressure  [psia] | Specific Volume  [ft3/lbm] | Quality  [dim] | Specific Enthalpy  [Btu/lbm] | Specific Internal Energy  [Btu/lbm] |
| Ammonia | 32 | ? | ? | 0.2 | ? | ? |
| Water | ? | 400 | ? | ? | 1000 | ? |
| Water | 500 | 400 | ? | ? | ? | ? |
| R-134a | ? | 185.82 | ? | ? | 51.47 | ? |

* 1. Solve this problem using EES software (0 extra credit points for doing it as an array).
  2. Verify your answers by using your thermodynamic tables supplement.
  3. Discuss the use of EES vs tables to solve this problem. Which method do you prefer, and why?

## Answers to FE-Style Questions

1. b and c
2. a, c, and d

## Answers to Practice Problems

1. You already did this problem as part of HW7. You know quality at 1 MPa is going to be ~ 7.25%. When P\_2 = 2 MPa quality will be zero. And as P\_2 becomes lower quality will increase. At P\_2 = 0.1 MPa the quality will be ~22%
2. Using EES the complete array table for problem 2 would look like:Table

   Description automatically generated