

MEMS 0051 - Introduction to Thermodynamics
Quiz #2

Name: [Solutions](#)

Problem #1

Consider a 100 [kg] object moving at a velocity of 2 [m/s] with an internal energy of 300 [kJ]. Ignoring potential energy, determine:

- a) the kinetic energy of the car in [kJ]

$$KE = \frac{mV^2}{2} = \frac{(100 \text{ [kg]})(2 \text{ [m/s]})^2}{2} = 0.2 \text{ [kJ]}$$

- b) the total energy of the car in [kJ]

$$E = U + KE = 300 \text{ [kJ]} + 0.2 \text{ [kJ]} = 300.2 \text{ [kJ]}$$

- c) the specific internal energy of the car in [kJ/kg]

$$u = \frac{U}{m} = \frac{300.2 \text{ [kJ]}}{100 \text{ [kg]}} = 3 \text{ [kJ/kg]}$$

Problem #2

Answer the following questions based on the T - ν diagram for H₂O given. What phase(s) of H₂O are present in the following conditions?

- a) 100 °C, 3 [m³/kg] [vapor](#)
- b) 300 °C, 10⁻⁴ [m³/kg] [liquid](#)
- c) 1 [MPa], 0.2 [m³/kg] [liquid+vapor](#)

Problem #3

- a) Determine the phase(s) for each of the following states of water:

- i.) 50 °C, 100 [kPa] $P > P_{\text{sat}}(50 \text{ °C}) \implies$ [compressed liquid/liquid](#)
- ii.) 100 °C, 0.1 [m³/kg] $\nu_f(100 \text{ °C}) < \nu < \nu_g(100 \text{ °C}) \implies$ [saturated water/liquid+vapor](#)

- b) Determine the following properties for water:

- i.) ν for saturated vapor at 100 °C [saturated water](#), $\nu=1.67290 \text{ [m}^3\text{/kg]}$
- ii.) ν at 100 [kPa] and 400 °C [superheated vapor](#), $\nu=3.10263 \text{ [m}^3\text{/kg]}$