Name: <u>Solutions</u>

Problem 1

Determine the polytropic index for a process where a fluid goes from an initial state with a pressure 101.325 [kPa] and a volume of 0.5 [m³] to a final state with a pressure of 500 [kPa] and a volume of 0.15 [m³].
Solution:

$$n = \frac{\ln\left(\dfrac{P_2}{P_1}\right)}{\ln\left(\dfrac{\forall_1}{\forall_2}\right)} = \frac{\ln\left(\dfrac{500\,[\text{kPa}]}{101.325\,[\text{kPa}]}\right)}{\ln\left(\dfrac{0.5\,[\text{m}^3]}{0.15\,[\text{m}^3]}\right)} = 1.326$$

Problem 2

Determine the change in internal energy when air is heated from 298.15 to 600 [K] during a constant volume process.
Solution:

Best method, use Table A7.1:

$$\Delta u = u_f - u_1 = 435.10 - 213.04\,[\text{kJ/kg}] = 222.06\,[\text{kJ/kg}]$$

Second method, use $C_\forall$:

$$\Delta u = u_2 - u_1 = C_\forall(T_2 - T_1) = 0.717\,[\text{kJ/kg-K}](600 - 298.15\,[\text{K}]) = 216.426\,[\text{kJ/kg-K}]$$

Problem 3

Determine the change in internal energy when saturated water vapor is heated from 100 to 150 °C.
Solution:

Using Table B.1.1:

$$\Delta u = u_g(150[°\text{C}]) - u_g(100[°\text{C}]) = 2,559.54 - 2,506.5\,[\text{kJ/kg}] = 53.04\,[\text{kJ/kg}]$$