Question 2

Wednesday, March 31, 2021 11:47 AM

"I pledge my honor I have abided by the Stevens Honor system."
- Alex Gaskins

A turbine operates steadily with a flow of air and produces 200 kJ/kg of work out. The air enters the turbine at a temperature and pressure of 800°C and 400 kPa at a rate of 5 m^3/s. The flow leaves the turbine at 500°C and 200 kPa. Calculate the amount of heat lost from the air in this process [Answer in *kW*].

$$E_{in} - E_{out} = 0$$

$$W_{out} + c_p(T_2 - T_1) = \Delta Q$$

$$200 + (1)(500 - 800) = \Delta Q$$

$$\Delta Q = -100 \text{ kJ/kg}$$

$$\dot{V} = \frac{\dot{m}RT}{P}$$

$$5 = \frac{\dot{m}\,R\,(1073)}{400}$$

$$T = 1073 \text{ K}$$

$$P = 400 \text{ kPa}$$

$$\dot{m} = 6.493 \text{ kg/s}$$

$$Q = \dot{m}\,\Delta Q$$

$$Q = (6.493)(-100)$$

$$\boxed{Q = -649.3 \text{ kW}}$$