## Practice Problems Note: Assume all devices in this homework are operating at Steady-State

1. A hydroelectric power plant discharges 200 cubic feet of water per second (volumetric flow rate). The elevation of the exiting flow is 15 ft below the inlet flow. The temperature at the outlet is 0.01 °F higher than the inlet. Calculate the mass flow energy transport rate:  
   (m\_dot\_in \* e\_in) – (m\_dot\_exit \* e\_exit).   
   Assume that the inlet and outlet velocities are identical. For properties of water you can use c\_water = 1 Btu/lbm-R and a rho\_water of 62.4 lbm/ft3.
2. An air compressor operating under steady-state conditions takes in air at atmospheric pressure and discharges it at 100 psia. The incoming air is ~41 °F and outgoing air is ~281° F. During this process, heat is transferred out of the compressor at a rate of 1600 Btu/min. If the mass flow rate of air through the compressor is 10 lbm/min, what horsepower must be supplied to the compressor? Neglect the kinetic and potential energies.   
   **Hint:** You can use the air tables to get enthalpy values at the inlet and outlet states.
3. R-134a enters a tubular heat exchanger at 100 °F with a quality of 75%. Heat is transferred out of the system in an aergonic process, until the fluid leaves as saturated liquid at 0 °F. Determine the heat transfer per lbm of R-134a flowing through the heat exchanger. Neglect any changes in kinetic and potential energies. Assume steady-state operation.

## Answers

1. Mass Flow Energy Transport Rate = 115.6 Btu/sec
2. Compressor power input = 51.3 hp  
   If you assumed this was isentropic the compressor power would come out as 20.5 hp
3. Specific heat transfer = -85.6 Btu/lbm