

Thermodynamics Qualifier – Spring 2008

Problem 1) Air undergoes a steady process, entering at 1000K and 10 atm, exiting at 500K and 1 atm. The local environment is also at a temperature of 500K.

- a) Is a heat transfer interaction required between the air and the environment? Is this process possible? Demonstrate.
- b) Using appropriate idealizations, estimate the maximum specific work possible to produce in this process.
- c) Sketch a process diagram using real components (compressors, HXs, valves, etc.) which would produce power, for the given inlet and exit conditions.
- d) Show on an h-s diagram the real process from part c) and the ideal process from part b).

Problem 2) Saturated nitrogen vapor is contained in a piston-cylinder device, such that the pressure remains constant. Heat is slowly added to the nitrogen until it reaches a temperature of 6000K.

- a) Sketch qualitatively the variation of C_v with respect to temperature.
- b) Describe the physical mechanisms responsible for the changes in C_v which you show in your plot.