Name _____

ES201
Examination III
November 6, 1998

Problem	Score
1	/35
2	/30
3	/35
Total	/100

Show all work for credit
AND
Box your answer with appropriate units
AND
Turn in your signed help sheet

Name _____ 35 pts

ES201 Examination III **Problem 1** November 6, 1998

Analyze the cycle described below.

State 1. P_1 = 100 KPa, V_1 = .06 m^3, U_1= 1.5 KJ
Process 1 -> 2: constant volume
State 2. P_2 = 360 KPa, V_2 = .06 m^3, U_2= 12.8 KJ
Process 2->3: Adiabatic Compression
State 3. P_3 = 1200 KPa, V_3 = .02 m^3, U_3= 22.4 KJ
Process 3->4 Constant Pressure
State 4. P_4 = 1200 KPa, V_4 = .005 m^3, U_4= 1.5 KJ
Process 4->1 PV=constant

a) Complete the table given (Show work for full credit)

Process	Q (KJ)	W (KJ)	ΔU (KJ)
1->2			
2->3			
3->4			
4->1			
NET			

b) Is the process a power cycle or a heat pump? EXPLAIN your answer.

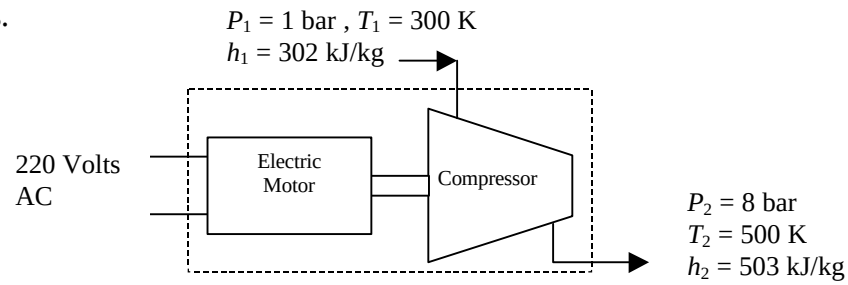
c) Based on your answer for part b), give the appropriate measure of performance: thermal efficiency for a power cycle or coefficient of performance for a heat pump.

Name _____ 30 pts

An electric motor drives an air compressor that delivers air with inlet and outlet conditions as shown on the figure. The motor-compressor set operates at steady-state conditions. The electric power supplied to the motor is 25 kilowatts at 220 volts ac, and the measured heat transfer rate from the combined motor and compressor is 4.4 kilowatts. Experience shows that changes in kinetic and potential energy are negligible for this system.

a) (25 pts) Determine the mass flow rate through the compressor in kilograms per second.

(b) (5 pts) Assuming a power factor of 1 (purely resistive circuit), calculate the electric current drawn by the motor, in amps.



Name _____ 35 pts

ES201 Examination III **Problem 3** November 6, 1998

Blocks A and B both have speeds of 0.5 m/s in the position shown. Neglect friction. The stiffness of the spring in the retaining tube is 200 N/m and block A has a mass of 0.4 kg. Determine:

a) the mass of block B that will cause A to reach the left end of the retaining tube C with zero velocity. (30 pts)

b) Discuss how your solution would change if the spring has a force displacement relationship $F=200x^3$? You do not need a numerical answer, but be sure to include enough detail so that one could be obtained given enough time. (5 pts)