CONCORDIA UNIVERSITY
FACULTY OF ENGINEERING AND COMPUTER SCIENCE
DEPARTMENT OF MECHANICAL ENGINEERING

Student's Name: _____

I.D.: _____

PROBLEM I [40 pt]

A piston-cylinder device whose piston is resting on top of a set of stops initially contains 0.5 kg of helium gas at 100 kPa and 25°C. The mass of the piston is such that 500 kPa of pressure is required to rise it. How much heat (in kJ) must be transferred to the helium before the piston starts rising?

Heat	

PROBLEM II [40 pt]

Argon gas enters an adiabatic turbine steadily at 900 kPa and 450°C with a velocity of 80 m/s and leaves at 150 kPa with a velocity of 150 m/s. The inlet area of the turbine is 60 cm^2. If the power output of the turbine is 250 kW.
Determine the exit temperature of the argon?

Temperature	

PROBLEM III [20 pt]

- Explain physically why C_p is higher than C_v for an ideal gas?
- Determine the expression of the compressive/expansion work when the process is: a) isobaric; b) isochoric; c) isothermal (consider an ideal gas); d) polytropic.
- Knowing that for an ideal gas the internal energy is only a function of temperature, show then that the enthalpy is also only a function of temperature.

CONSTANTS FOR HELIUM	**CONSTANTS FOR ARGON**
C_v = 3.1156 kJ/kg K **C_p = 5.1926 kJ/kg K**	**C_v = 0.3122 kJ/kg K** **C_p = 0.5203 kJ/kg K**