CONCORDIA UNIVERSITY
DEPARTMENT OF MECHANICAL INDUSTRIAL AND AEROSPACE ENGINEERING

NAME:
ID:
TUTORIAL SECTION: Friday morning   Friday afternoon

WRITE YOUR ANSWERS IN THE BOXES. SHOW ALL YOUR WORK, NEATLY, IN THE FOLLOWING SPACE.

Some useful formulas for the work:

$$W = PV \ln \left(\frac{V_2}{V_1}\right) \quad ; \quad W = P\,(V_2 - V_1) \quad ; \quad W = \frac{P_2 V_2 - P_1 V_1}{1-n} \qquad n \neq 1$$

All gases can be considered as ideal gases.

PROBLEM I [5 pts]
A piston-cylinder device initially contains 0.30 kg of Nitrogen at 130 kPa and 210°C, which is now allowed to expand isothermally to a final pressure of 75 kPa.

Compute the boundary work, in kJ

R=0.2968 kJ/kg K

Work	

PROBLEM II [11 pts]

A cylinder device fitted with a piston contains initially argon gas at 100 kPa and 27°C occupying a volume of 0.4 m³. The argon gas is first compressed while the temperature is held constant until the volume reaches 0.2 m³. Then the argon is allowed to expand while the pressure is held constant until the volume becomes is 0.6 m³.

Determine the total amount of heat transferred to the argon in kJ

Assume: C_p=0.5203 kJ/kg.K; C_v=0.3122 kJ/kg K and R=0.2081 kJ/kg K.

Heat	

PROBLEM III [11 pts]

A cylinder device fitted with a piston contains initially 0.8 kg of Nitrogen gas at 100 kPa and 27°C. The gas is compressed <u>polytropically</u> (n=1.3) until the volume is reduced by one-half. Determine:

- The work done in kJ
- The heat transferred in kJ

Assume: C_p=1.0408 kJ/kg.K; C_v=0.744 kJ/kg K and R=0.2968 kJ/kg K.

Work	
Heat	