3 October 2013

CHE 260 – Thermodynamics and Heat Transfer

Quiz 1 – 2013

You have 60 minutes to do the following three problems. You may use your textbook and any type of non-communicating calculator.

1) A frictionless piston-cylinder device contains 0.15 kg of air initially at P_1=2 MPa, T_1=350°C. The air is first expanded isothermally to P_2=500 kPa and then compressed in a polytropic process for which $PV^{1.2}$= constant to the initial pressure. It is then compressed at constant pressure to the initial state. Draw this cycle on a *P-V* diagram. Determine (*a*) the boundary work for each process and (*b*) the net work done during this cycle.

(35 Marks)

2) A piston-cylinder device contains 1.5 kg of nitrogen initially at 100 kPa and 17°C. The nitrogen is now compressed slowly in a polytropic process for which $PV^{1.3}$= constant until the volume is reduced by one-half. Determine the work done and the heat transfer for this process.

(35 Marks)

3) An adiabatic air compressor compresses 10 L/s of air from 120 kPa and 20°C to 1000 kPa and 300°C. Determine the power required to drive the compressor.

(30 Marks)