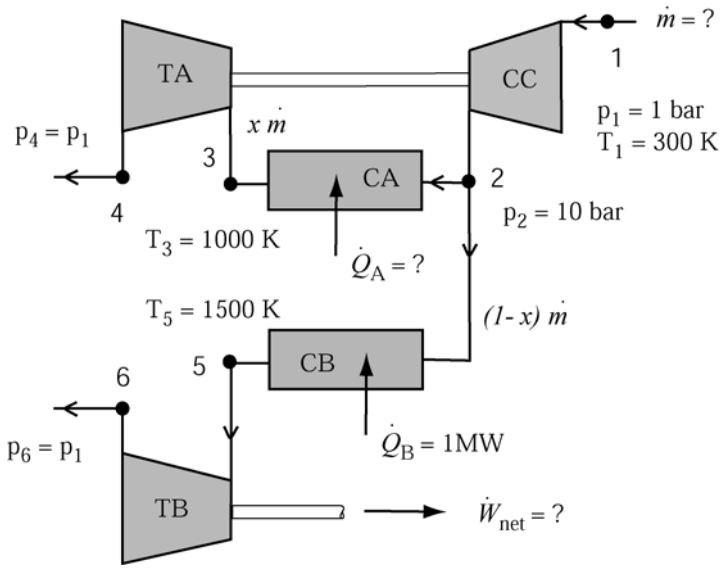
Unified Engineering **Name:**
Thermo Quiz 2 **Fall 2008**

Consider the gas-turbine arrangement shown below. The unit consists of two turbines TA and TB, two combustors CA and CB, and a single compressor CC. Turbine TA drives compressor CC to furnish all air required. At the exit of the compressor CC the flow is split where a fraction of the flow *x* flows into combustor CA and *1-x* flows into combustor CB which receives heat in the amount of $\dot{Q}_B = 1$ MW. The turbine inlet temperatures are T_3=1000 K and T_5=1500 K respectively. Turbine TB delivers a net cycle power of $\dot{W}_{net}$. The compressor inlet state is at ambient conditions p_1= 1 bar, T_1=300 K and the compressor exit pressure is p_2 = 10 bar. Both turbines exhaust to ambient pressure, $p_4 = p_6 = p_1$= 1 bar. There is no pressure drop in the combustors. Assume that the working fluid is air with γ = 1.4 and R = 287 J/kgK and that kinetic and potential energy effects can be neglected.



a) Sketch the cycle in a *p-v* diagram and label all states.

b) What is the compressor exit temperature T_2?

c) How much heat per unit mass flow is transferred to combustor CA, $q_A = \dot{Q}_A/(x\dot{m})$?

d) What is the exit temperature T_4 of turbine TA?

e) What is the mass flow fraction *x* through turbine TA?

f) What is the exit temperature T_6 of turbine TB?

g) What is the mass flow $\dot{m}$ through the compressor?

h) Find the net cycle power $\dot{W}_{net}$.

i) Determine the thermal efficiency for the entire unit.