Homework Refrigeration 2015

1. A Carnot vapor refrigeration cycle uses Refrigerant 134a as the working fluid. The refrigerant enters the condenser as saturated vapor at 28oC and leaves as saturated liquid. The evaporator operates at a temperature of -10oC. Determine, in kJ per kg of refrigerant flow,
(a) the work input to the compressor.
(b) the work developed by the turbine.
(c) the heat transfer to the refrigerant passing through the evaporator.
What is the coefficient of performance of the cycle?

2. An ideal vapor-compression refrigeration cycle operates at steady state with Refrigerant 134a as the working fluid. Saturated vapor enters the compressor at -10oC, and saturated liquid leaves the condenser at 28oC. The mass flow rate of refrigerant is 5 kg/min. Determine
(a) the compressor power, in kW.
(b) the refrigerating capacity, in tons.
(c) the coefficient of performance.

3. A vapor-compression refrigeration system circulates Refrigerant 134a at a rate of 6 kg/min. The refrigerant enters the compressor at -10oC, 1.4 bar, and exits at 7 bar. The isentropic compressor efficiency is 67%. There are no appreciable pressure drops as the refrigerant flows through the condenser and evaporator. The refrigerant leaves the condenser at 7 bar, 24oC. Ignoring heat transfer between the compressor and its surroundings, determine
(a) the coefficient of performance.
(b) the refrigerating capacity, in tons.
(c) the rates of exergy destruction in the compressor and expansion valve, each in kW.
(d) the changes in specific flow exergy of the refrigerant passing through the evaporator and condenser, respectively, each in kJ/kg.
Let T0 =21oC, p0 = 1 bar.