Textbook Reading: 2.6, 4.1-4.12

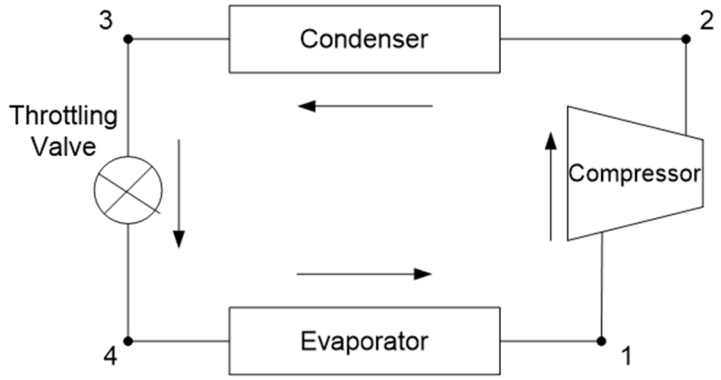
HW – 19(i)

A refrigeration cycle operating at steady state receives heat transfer at the rate of 6 kW from a cooled space while rejecting heat transfer at the rate of 10 kW to the surroundings.

Calculate the coefficient of performance for cooling of the refrigeration cycle.

HW – 19(ii)

A heat pump cycle using R-134a as the working fluid is shown. R-134a enters the adiabatic compressor at an absolute pressure of 1.4 bar and a temperature of -10°C (State 1) and it is compressed to an absolute pressure of 9 bar and a temperature of 60°C (State 2). R-134a leaving the compressor enters the condenser in which energy is rejected by heat transfer and exits at an absolute pressure of 9 bar and a temperature of 30°C (State 3). An adiabatic throttling valve decreases the absolute pressure of R-134a leaving the condenser to 1.4 bar (State 4). R-134a then enters the evaporator in which energy is added by heat transfer from the cooled space.



(a) Calculate the net specific heat transfer for the cycle, in kJ/kg.
(b) Determine the net specific work for the cycle, in kJ/kg.
(c) Find the coefficient of performance for heating of the heat pump cycle.

HW – 20

A rigid tank of volume 0.0189 m^3 initially contains a saturated liquid-vapor mixture of R-134a at 20°C with 90% liquid by mass in the mixture (State 1). A small leak develops at the top of the tank and saturated vapor R-134a slowly exits the tank until there is only saturated vapor at 20ºC left in the tank (State 2) when the leak is stopped.
(a) Calculate the mass of R-134a leaving the tank, in kg.
(b) Find the heat transfer to R-134a in the tank during the process, in kJ.

HW – 21

A piston-cylinder device initially contains 0.6 kg of water substance at an absolute pressure of 10 bar occupying a volume of 0.1 m^3 (State 1). The cylinder is connected to a large supply line that carries steam at an absolute pressure of 40 bar and a temperature of 500°C. The valve between the supply line and the cylinder is opened and the valve is left open until the water substance in the cylinder is at an absolute pressure of 10 bar and a temperature of 240°C occupying a volume of 0.2 m^3 (State 2). Pressure remains constant while piston moves in the cylinder.

Determine the heat transfer to water in the cylinder during the process, in kJ.