Name:_____ Test 6 March 23, 2017 Section:_____

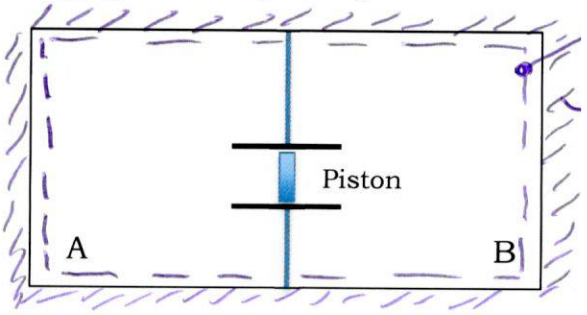
Solutions

Question 1 [10 marks]

An insulated, rigid tank is divided into two compartments by a frictionless, and thermally conductive piston that is initially locked. One compartment initially contains 1 m^3 of saturated water vapor at 400 kPa and the other compartment contains 1 m^3 of water vapor at 800 kPa and 400°C. The piston is released and equilibrium is attained.

a) (5 marks) Determine the final equilibrium specific volume in m^3/kg and the final equilibrium specific internal energy in kJ/kg;

b) (5 marks) If we assume that the final equilibrium pressure and temperature are 600 kPa and 275°C, respectively, determine the amount of entropy generated, in kJ/K.



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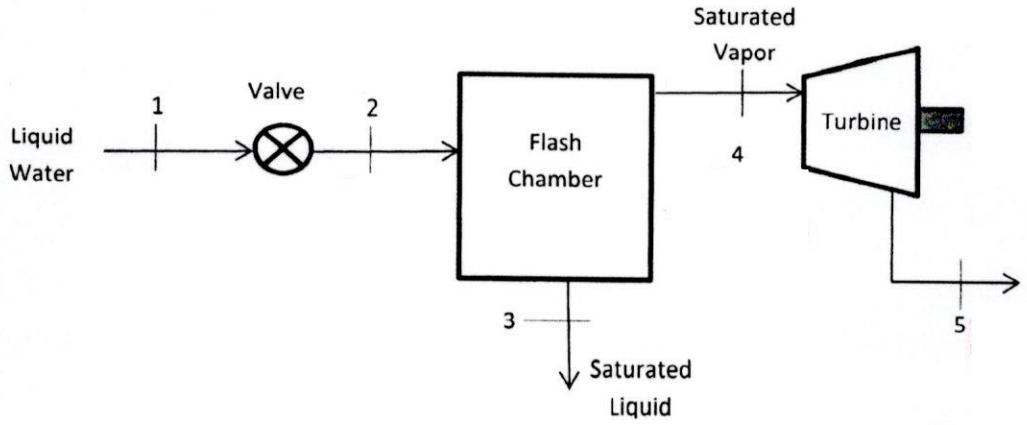
2. (25 marks) Figure below shows liquid water at 20 bars and 120°C entering a flash chamber through a valve at a rate of 4,000 kg/h. At the valve exit, the pressure is 5 bars. Saturated liquid at 1.5 bars exits from the bottom of the flash chamber and saturated vapor at 1.5 bars exits from near the top. The saturated vapor is fed to a steam turbine having an isentropic efficiency of 80% and an exit pressure of 5 kPa. Assume the operation is steady-state and there is negligible heat transfer with surroundings.



a. (7 marks) Determine the rate of entropy generation in kW/K for the valve

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b. (9 marks) Determine the rate of entropy generation in kW/K for the flash chamber

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c. (9marks) Determine the power generated in kW for the turbine