H.W.2

A power plant operates on a regenerative vapor power cycle with one closed feedwater heater. Steam enters the first turbine stage at 10 MPa, 500 °C and expands to 1 MPa, where some of the steam is extracted and diverted to a closed feedwater heater. Condensate exiting the feedwater heater as saturated liquid at 1 MPa passes through a trap into the condenser. The feedwater exits the heater at 10 MPa with a temperature of 175 °C. The condenser pressure is 6 kPa. The mass flow rate into the first stage turbine is 270 kg/s. For isentropic processes in each turbine stage and the pump, determine (a) the mass flow rate of steam extracted from the turbine, (b) the thermal efficiency of the cycle and (c) the net power developed.

Answers: (a) 78.83 kg/s, (b) 42.44%, (b) 300.5 MW