

Problem Set 15, PS4 due Wednesday June 23

PS15-1 In a reheat steam power cycle steam enters the high pressure turbine at 8 MPa and 500 C and leaves the high pressure turbine at 3 MPa. The steam is reheated at 3 MPa to 500 C and then expanded through the low pressure turbine to a pressure of 20 kPa. The high and low pressure turbines have an efficiency of 82% and the pump has an efficiency of 60 %. Determine in kJ/kg the turbine work output and the cycle thermal efficiency. Sketch a temperature-entropy diagram of the cycle.

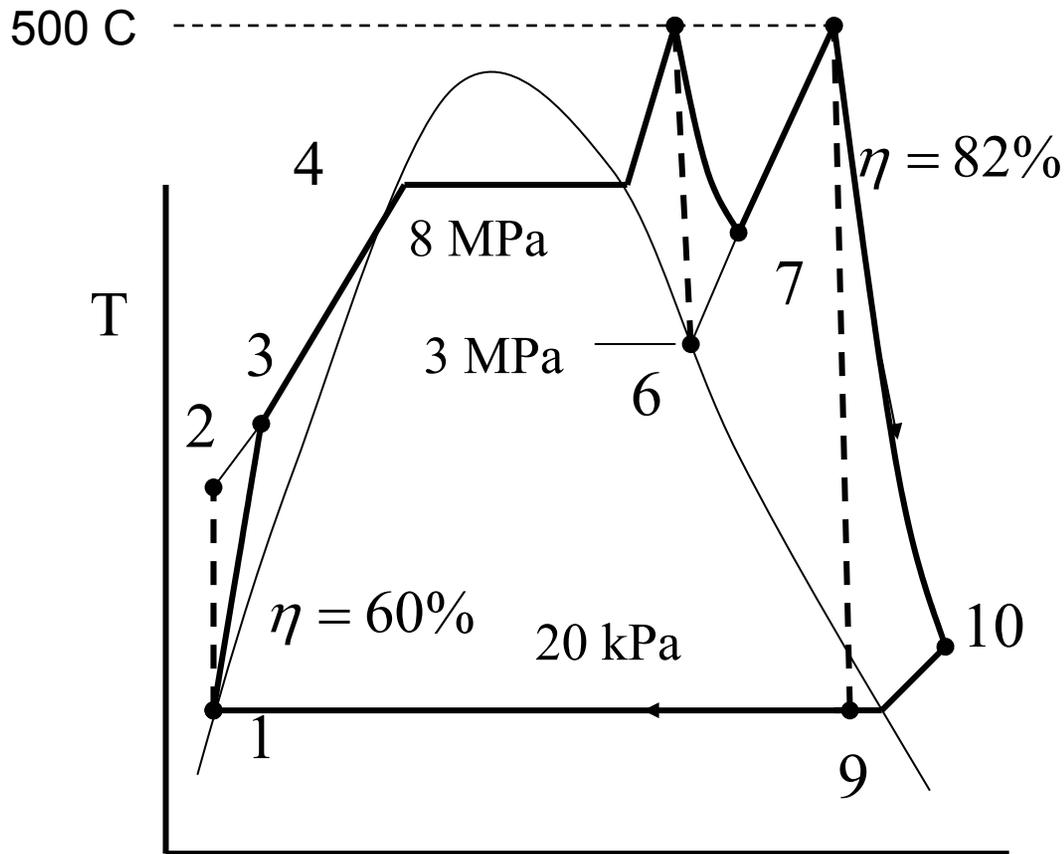
PS15-1

"HW 15-1"

"INPUT"

p1=20
 p2=8000
 p6=3000
 T5=500
 T8=500
 Efft=.82
 Effp=.60
 fluid\$='Steam_IAPWS'

h1=enthalpy(fluid\$,p=p1,x=0)
 s1=entropy(STEAM,p=p1,x=0)
 s2=s1
 h2=enthalpy(STEAM,p=p2,s=s2)
 h3=h1+(h2-h1)/Effp
 p5=p2
 h5=enthalpy(fluid\$,T=T5,p=p5)
 s5=entropy(fluid\$,T=T5,p=p5)
 s6=s5
 h6=enthalpy(fluid\$,P=p6,s=s6)
 h7=h5-Efft*(h5-h6)
 p8=p6
 h8=enthalpy(fluid\$,T=T8,p=p8)
 s8=entropy(fluid\$,T=T8,p=p8)
 s9=s8
 p9=p1
 h9=enthalpy(fluid\$,p=p9,s=s9)
 h10=h8-Effp*(h8-h9)
 Qin=(h5-h3)+(h8-h7)
 Qout=h10-h1
 WorkNet=Qin-Qout
 EffCYCLE=WorkNet/Qin



SOLUTION

Unit Settings: [kJ]/[C]/[kPa]/[kg]/[degrees]

EffCYCLE = 0.3225

h1 = 251.4

h5 = 3400

h9 = 2385

p6 = 3000

Qout = 2327

s6 = 6.727

T8 = 500

Effp = 0.6

h10 = 2578

h6 = 3105

p1 = 20

p8 = 3000

s1 = 0.8318

s8 = 7.236

WorkNet = 1107

Efft = 0.82

h2 = 259.4

h7 = 3158

p2 = 8000

p9 = 20

s2 = 0.8318

s9 = 7.236

fluid\$ = 'Steam_IAPWS'

h3 = 264.8

h8 = 3457

p5 = 8000

Qin = 3434

s5 = 6.727

T5 = 500