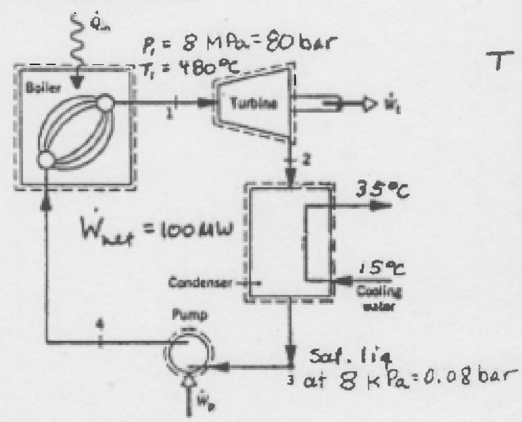
QUIZ 7 – ME 304 (Spring '03) **Name:** Bryan Tilt 6/10/2003

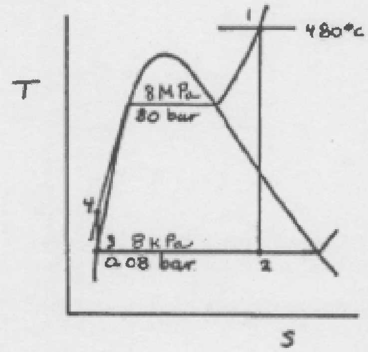
Circle the appropriate answer. Also show calculation details.

17/20

A steam power plant has a boiler, a turbine, a condenser and a pump. Ignore kinetic, potential energy changes, and any stray losses between components.

SCHEMATIC & GIVEN DATA:





$P_1 = 8\,MPa = P_4$

$P_2 = .008\,MPa = P_3$

$T_1 = 480°C$

$T_2 = T_3$

(a) Determine the rate of heat transfer to the steam through the boiler. 10

- (i) 251.8 MW
- (ii) 251.8 kW
- (iii) 25.18 MW
- (iv) 25.18 kW

$h_1 = 3348.4$

$h_4 =$

$h_f = 173.88$, $h_g = 258.47$ (.08 bar, 41.51°C, Sat. Liquid)

$\dot{Q}_{in}/\dot{m} = h_1 - h_4$

$T_2 = 41.51°C$

(b) Find the thermal efficiency. 3

- (i) 49.7%
- (ii) 39.7%
- (iii) 59.7%
- (iv) 29.7%

$\eta = \frac{\dot{W}_{cycle}}{\dot{Q}_{in}} = \frac{100\,MW}{251.8\,MW} = 39.7\%$

(c) Find the mass flow rate of the condenser cooling water that enters at 15ºC and exits at 35ºC. 7

- (i) 18.14 kg/s
- (ii) 181.4 kg/s
- (iii) 1814 kg/s
- (iv) 1.814 kg/s

X −3

$0 = \dot{Q} - \dot{W} + \dot{m}[u_i - u_e]$

$100 - 251.8\,MW = \dot{m}[u_i - u_e]$

$\frac{-151.8 \times 10^3}{173.87 - 2433.2} =$

$\dot{m} = \frac{\dot{W}_{cycle}}{\dot{W}_T - \dot{W}_p}$

15° $u_f = 62.99$

35° $u_g = 2423.4$