

Name: \_\_\_\_\_.

## Mini-Exam 3

CM 3110

11 November, 2008

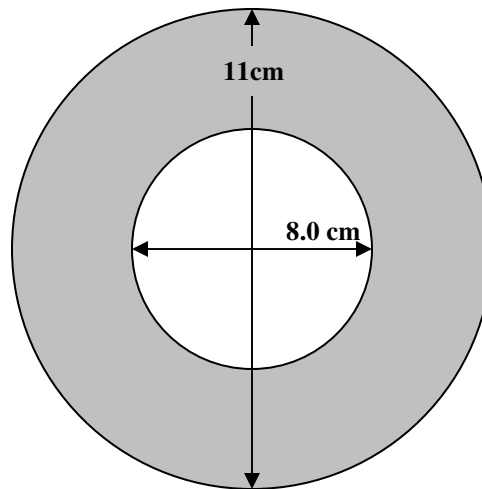
Note:

Significant figures count.

Please box your final answers.

Please be neat.

- (50 points) Water (density =  $1003 \text{ kg/m}^3$ , thermal conductivity =  $0.561 \text{ W/mK}$ , heat capacity =  $4.187 \text{ kJ/kg } ^\circ\text{C}$ , viscosity =  $0.998 \text{ cP}$ ) flows on the inside of a double-pipe heat exchanger (overall heat-transfer coefficient =  $1200 \text{ W/m}^2\text{K}$ , heat exchanger area for heat transfer =  $2.1 \text{ m}^2$ ). The water enters at  $25^\circ\text{C}$  and exits  $19^\circ$  hotter. The outside stream of the heat exchanger contains Silthermo (density =  $988 \text{ kg/m}^3$ , thermal conductivity =  $1.24 \text{ W/mK}$ , heat capacity =  $11.1 \text{ kJ/kg } ^\circ\text{C}$ , viscosity =  $1.51 \text{ cP}$ ), which enters at  $85^\circ\text{C}$  and exits  $5^\circ$  cooler.
  - What is the mean driving force for heat transfer? Please give your answer in  $^\circ\text{C}$ .
  - What is the total amount of heat transferred from the hot stream to the cold stream? Please give your answer in kW (kilowatts)
- (50 points) A steel tube (density =  $7850 \text{ kg/m}^3$ , heat capacity =  $503 \text{ J/kg } ^\circ\text{C}$ , thermal conductivity =  $54 \text{ W/mK}$ ) with dimensions shown below is wrapped in a heater that constantly puts out  $4200 \text{ kW}$  of heat to the outer tube surface. What is the heat flux at the inner wall of the tube? Please give your answer in SI Units (using Watts, meters, K, kg, etc.),



Length = 1.2m

