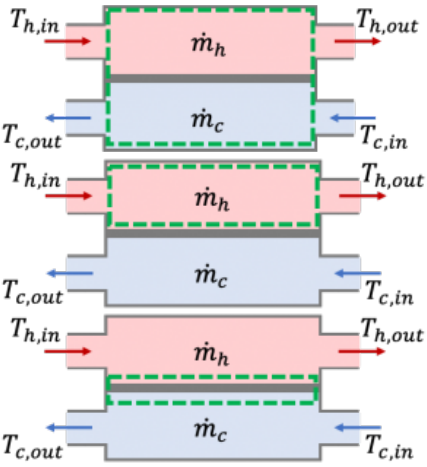
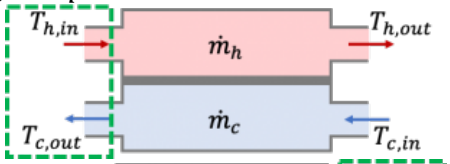
Heat Transfer Questions
Double Pipe

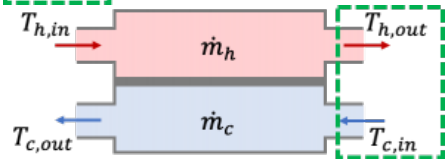
Q1:
Below is a simple heat exchanger schematic with different system boundaries indicated by green dashed boxes. Using an energy balance to determine the rate of heat transfer, Q, into the cold fluid from the hot fluid, which would you pick as the system to analyze? Think about which temperatures you would need to solve for $Q=mCp\Delta T$.

a.


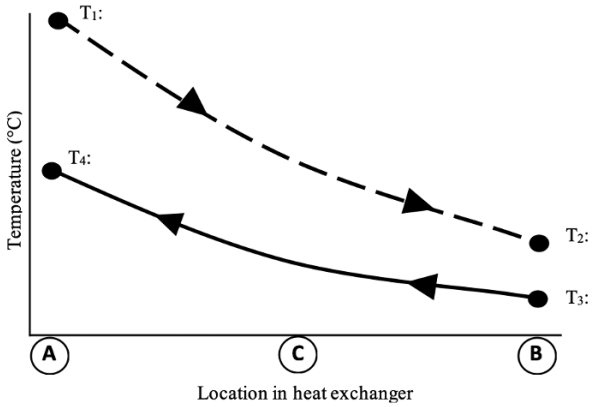
b.

c.

d.


e.


Q2:
In the diagram, each line represents a temperature profile for one fluid along the length of a countercurrent exchanger. Which temperature differences drive heats transfer? Select all that apply.



a. ☐ T1 and T4
b. ☐ T1 and T2
c. ☐ T1 and T3
d. ☐ T2 and T4
e. ☐ T2 and T3
f. ☐ T4 and T3

Does the driving potential for heat transfer change throughout the exchanger?

- Yes
- No

If you answered yes to the previous question, is there a value or factor to account for this change?

- Yes
- No
- Not applicable

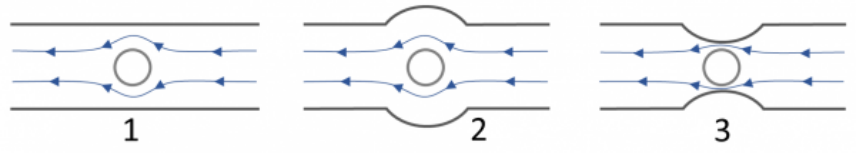
Q3:
Consider two double-pipe, parallel-flow heat exchangers that are identical except that one is two times longer than the other one. If flow rates and inlet conditions are the same, which of the exchangers is more likely to have a higher heat transfer rate?

a. Longer one
b. Shorter one
c. Same in both heat exchangers

Because...

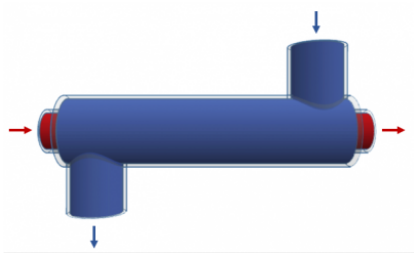
a. Heat transfer does not depend on the length of the heat exchangers
b. Having a constant mass flow rate and heat capacity should yield the same heat transfer rate
c. The longer tube length offers a higher surface area for heat transfer
d. The longer tube length provides a larger residence time
e. Shorter tube length offers higher velocity through the tube which offers higher heat transfer rates

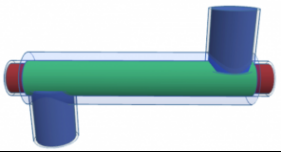
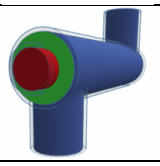
Q4:
To remove heat at the highest possible rate from a hot tube placed in a duct with cold flow, which setup would you choose, assuming flow rate is the same in each case?



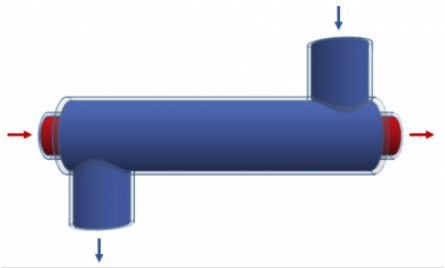
a. Setup (2) because it will provide the lowest fluid velocity passing over the duct
b. Setup (1) because it offers a balance between velocity and pressure drop passing over the duct
c. Setup (3) because it will offer the highest possible fluid velocity passing over the duct
d. All setups will give the same rate of heat transfer because flow rate is the same in each case

Q5:
Cold water flows through the annulus of a see-through heat exchanger shown below. Match the areas in green to their descriptions (the clear outline represents the outer tubing):



	Area for cold water flow
	Area for hot water flow
	Area for heat transfer

Q6:
Select all options that would increase the temperature of the hot water outlet (if all other parameters remain the same) in the heat exchanger below:



a. Reduce the cold-water flow rate
b. Reduce the hot-water flow rate
c. Add an insulated jacket to the outer cold-water pipe
d. Increase the cold-water temperature