

Astronomy Demonstration Video – Thermal Transport 3: Conduction – Worksheet

(to follow up the video at: <https://www.youtube.com/watch?v=Y2G92GKY5wI>)

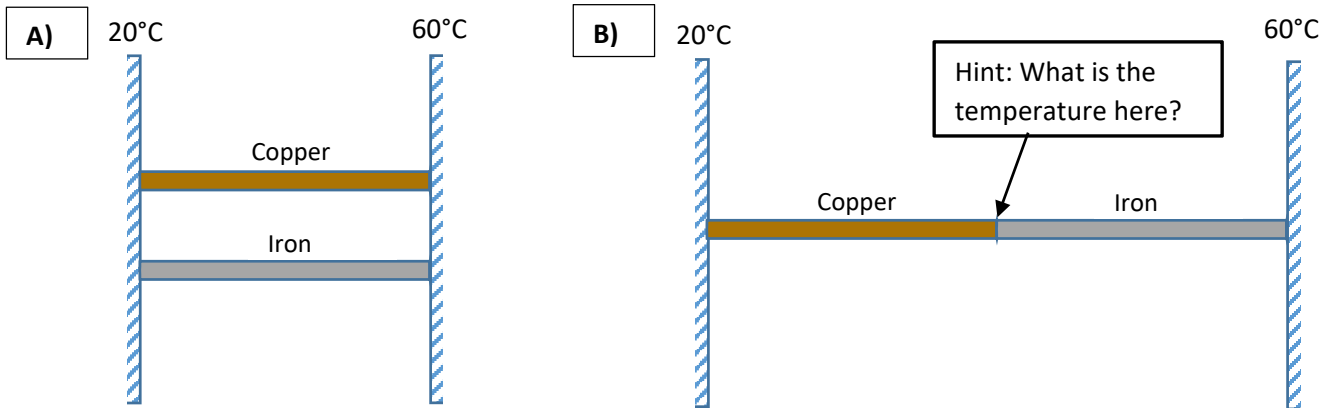
1. The equation below describes the heat flow through an insulated (only gaining and losing heat on its ends) cylindrical aluminum ($\kappa_{Al}=217 \text{ W/m}\cdot\text{K}$) rod. For each variable, provide the name, a short description, and add them to the diagram if applicable. Then check one box (in each unshaded row) indicating how the quantities effect heat flow.



$$\frac{\Delta Q}{\Delta t} = \kappa_{Al} \frac{A \Delta T}{L}$$

Variable			Effect on Heat Flow ($\Delta Q/\Delta t$) (check one)		
Symbol	Name	Description	Proportional To	Inversely Proportional To	Neither
ΔQ					
Δt					
κ					
L					
A					
ΔT					

2. Copper and iron rods are fixed between walls of different temperatures. Compare the heat flow through the two situations below for the copper ($\kappa_{Cu}=395 \text{ W/m}\cdot\text{K}$) and iron ($\kappa_{Fe}=67 \text{ W/m}\cdot\text{K}$) rods. In which situation (A or B) will the greatest heat flow occur? Explain your reasoning using the equation for heat flow.



Situation _____

Reasoning: _____

3. Please provide a short explanation for each of the following:

A) You get up on a very cold winter morning and walk around the house barefooted. The carpeted living room floor feels very different to your feet than the tiled kitchen floor. Explain how they feel different and why.

Hint: Are the two surfaces at the same temperature?

B) Many insulating materials – styrofoam, goose down jackets, double-pane windows, fiber glass insulation, and to some extent space shuttle tiles – are all good insulators for the same reason. Explain how these materials insulate and why they are effective.

Hint: What do all of these objects have in common?

C) Note that there are three mechanisms of thermal transport: Conduction, Convection, and Radiation.

- Your physics instructor emphasizes conduction working several example calculations.
- Your astronomy instructor thoroughly covers convection and radiation showing images of where they are visible occurring in the universe.

Explain why these classes have such different emphasis.

Hint: What needs to be true for conduction to occur?
