Heat Conduction Lab

1. Hot coffee can burn you when heat energy conducts quickly through the mug to your hand. What two features of a good mug prevent this from happening?

2. Draw the temperature profile through the wall of a 5mm thick ceramic mug (i.e. make a graph with temperature on the vertical axis, and distance on the horizontal axis).
Note: The inner surface is at coffee temperature, and the outside surface is at room temperature. No need for specific numbers.

3. Do the same for a 5mm thick copper cup.

4. Which one conducts more heat? Why? Is this represented in your graphs?

5. The rate that heat energy conducts through the cup (Q) is proportional to how steep the temperature change is, by a material property called the conductivity (*k*). Write this statement as an equation.

6. The conductivity of copper is about 400 Watts/(meter °C). The conductivity of ceramic is about 1 Watt/(meter °C). How many times more energy escapes a copper cup than an identical ceramic cup?

7. The Earth's mantle is about 1300°C. The lithosphere in Bend, Oregon is about 45 km (45,000 meters) thick. Average conductivity of the lithosphere is about 3.5 Watts/(meter °C). At approximately what rate does energy conduct through the lithosphere in Bend? [Assume the average temperature in Bend is 0ºC.]

8. The lithosphere in Iowa is about 200 km (200,000 meters) thick. How fast does energy flow through the lithosphere there?