

Homework Problem 4 – Due THURSDay, February 9

Q1

Let's say you are sitting in a badly insulated but not drafty cabin with all the doors and windows closed. The outside temperature is 0°C (freezing). All you have is an electric heater, which consumes 3000 W ($= 3000\text{ J/s}$) of power to keep the cabin at a temperature of 15°C (still quite cold). How much power would your heater need to keep the cabin at a balmy 25°C ? Show your math and explain! **2**

Q2

If you hold one end of a piece of metal with its other end frozen into a piece of ice, the end in your hand soon becomes cold. Does cold flow from the ice to your hand? Explain! **2**

Q3

Give an example where increasing the “draft” in a room (i.e., the movement of air) may improve the feeling of warmth for its inhabitants. What kind of heating system employs this effect, and what form of heat transfer does it involve? **2**

Q4

The heat of vaporization of ethyl alcohol is about 200 cal/g . If 2 kg of this fluid were allowed to vaporize in a refrigerator, show that 5 kg of ice could be formed from 5 kg of water initially at 0°C . (The latent heat of melting for water ice is 80 cal per g). **2**

Q5

You can determine wind direction by wetting your finger and holding it up in the air. How and why? Explain. **2**

Q6

Why is it dangerous to remove the cap on a car radiator after it has been driven for a while? Hint: The water inside the radiator might boil explosively after the cap is removed, but not before. Why (not)? Explain! **3**

