Homework Problem 5 – Due February 16

Q1

Is it possible to wholly convert a given amount of mechanical energy into thermal (=internal) energy? Is it possible to wholly convert a given amount of thermal energy into mechanical energy? Justify and cite examples to illustrate your answers.

Q2

Water put into the freezer compartment of your refrigerator goes to a state of less molecular disorder (=less entropy) when it freezes. Is this an exception to the 2nd Law of Thermodynamics that claims that total entropy can only increase? If not, where does the "extra entropy go"?

Q3

Everybody knows that warm air rises. So it might seem that the air temperature should be higher at the tops of mountains than in the valley down below But the opposite is most often the case. Why? (Explain why the air cools as it rises).

Q4

Explain how a hot air balloon works: What happens to the air inside the balloon as you heat it up? Use the ideal gas law, $PV = nRT$, for your explanation. Which **other** quantities in this equation changes as T increases? (Careful! Remember that the hull of a hot-air balloon is made out of non-stretchy material, and that the balloon is open at the bottom.) How does this lead to an excess of the buoyant force over the weight of the balloon? 3 XC: What limits the height to which the balloon can ascend?