1. Convert -62.8°C to Fahrenheit and Kelvin: ***Answer: -81.0°F, 210.4 K***

1. Convert 41.0°F to Celsius and Kelvin: ***Answer: 5°C, 278.2 K***
2. One of the faces of a copper cube with a side of 7.7 cm is maintained at 100°C and the opposite face is 30°C. If the thermal conductivity of copper is 385 W/(m•K), calculate the rate of heat flow through the cube. ***Answer: 2075 W***

1. A fluorescent light bulb contains about 0.10 grams of mercury, which needs to be vaporized to allow the light to work. If the mercury in the light bulb starts at 20°C, and its boiling point is 357°C, how much energy is required to vaporize all of the mercury. *The specific heat of mercury is 140 J/(kg•°C) and the latent heat of vaporization is 2.95 x 105 J/kg.* ***Answer: 34 J***
2. What is the relative humidity of an air parcel that has 2.4 g/kg of water vapor and has a temperature of 50°F? *Use the saturation curve in your lab manual!* ***Answer: About 30%***

1. An air parcel at 40°C has a relative humidity of 10%. What is the dew point of this air parcel? *Use the saturation curve in your lab manual!* ***Answer: About 8°C***

1. A 4 cm diameter and 6 cm long cylindrical rod at 1000 K emits a 385 kJ of radiation in 20 minutes. What is its emissivity? ***Answer: 0.56***
   1. If the rod is in surroundings that are 293 K, what would the difference in radiation emitted be in the same 20 minutes? ***Answer: 4.8 kJ less***

1. A typical doughnut contains 2.0 g of protein, 17.0 g of carbohydrates, and 7.0 g of fat. The average food-energy values of these substances are 4.0 kcal/g for protein, 4.0 kcal/g for carbohydrates, and 9.0 kcal/g for fat.
   1. During heavy exercise, an average person uses energy at a rate of 510 kcal/h. How long would you have to exercise to work the doughnut off? ***Answer: 16.4 min***
   2. If the energy in the doughnut could somehow be converted into kinetic energy of your body as a whole, how fast could you move after eating the doughnut? Take your mass to be 60 kg. ***Answer: 139 m/s***

1. A diesel engine performs 2200 J of mechanical work and discards 4300 J of heat each cycle.
   1. How much heat must be supplied to the engine in each cycle? ***Answer: 6500 J***
   2. What is the thermal efficiency of the engine? ***Answer: 34%***
2. A refrigerator takes heat from Qcold, has a work input of |W|, and discards heat Qhot at a warmer place. Refrigerators are described by their coefficient of performance K, which is defined as:

K = Qcold/W

A refrigerator has a coefficient of performance of 2.10. In each cycle it absorbs 3.40x104 J of heat from the cold reservoir.

* 1. How much mechanical energy is required each cycle to operate this refrigerator?

***Answer: 16200 J***

* 1. During each cycle, how much heat is discarded to the high-temperature reservoir? ***Answer: 50,200 J***

1. A Carnot engine whose high-temperature reservoir is at 620 K takes in 550 J of heat at this temperature in each cycle and gives up 335 J to the low-temperature reservoir.
   1. How much mechanical work does the engine perform during each cycle? ***Answer: 215J***
   2. What is the thermal efficiency of the cycle? ***Answer: 39%***
   3. What is the temperature of the low temperature reservoir? ***Answer: 378 K***