Heat Problems

1) A tub full of 9.5 kg of water is placed in a refrigerator and cooled from 20.0°C to 5.0°C. How much heat was removed from the water?

2) 65 grams of water is cooled down from 20.0°C to ice at -10.0°C. How much energy would a freezer use to change the water to ice at -10.0°C?

3) A 25.0°C pan of water that contains 1200 cm^3 of water is heated to bring the water to a boil. If the pan was left unattended so that all the water was converted to steam at 100.0°C, then how much energy was wasted?

4) Suppose a 6.5 kg lead weight at 25.0°C is heated so that is liquid lead at 327.5°C. If the melting point of lead is 327.5°C, then how much is heat is need to raise the lead from a solid at 25.0°C to a liquid at 327.5°C? The latent heat of fusion of lead is 6.26 cal/g. You will have to look up the specific heat of lead.

5) A 10,000.0 kg bus is traveling 30.0 m/s. If the bus driver applies the brakes to bring the bus to a stop, then how much work is done by the brakes to stop the bus? If all of the kinetic energy of the bus is converted to heat in the brakes, then how many calories of heat were transferred into the brakes?

6) A 9.5 kg bag of soil at 25.0°C falls from a high bridge and reaches a terminal velocity of 58 m/s. If the bag of soil stays intact upon impacting the ground, and all the energy of the fall is transferred to heat, then what is the change in temperature of the bag of soil caused by the fall? Assume the specific heat of soil is 0.200 kcal/kg°C. (Hint: First compute the kinetic energy of the falling bag and then convert the result from Joules to calories. Apply the law of conservation of energy.)

Answers:

1) 1.4×10^2 kcal (1.4×10^5 cal)
2) 68 kcal (6.8×10^3 cal)
3) 7.4×10^5 cal (7.4×10^2 kcal)
4) 101 kcal
5) 4.50×10^6 J and 1.08×10^6 cal
6) 2.0°C