1. How much work is required, using an ideal Carnot refrigerator, to change 0.500 kg of tap water at 10.0°C into ice at -20.0°C? Assume the temperature of the freezer compartment is held at -20.0°C and the refrigerator exhausts energy into a room at 20.0°C.
2. A heat engine operates between two reservoirs at *T*2 = 600 K and *T*1 = 350 K. It takes in 1 000 J of energy from the higher-temperature reservoir and performs 250 J of work. Find (a) the entropy change of the Universe ∆*SU* for this process and (b) the work *W* that could have been done by an ideal Carnot engine operating between these two reservoirs. (c) Show that the difference between the amounts of work done in parts (a) and (b) is *T*1∆*SU.*

1. Two identically constructed objects, surrounded by thermal insulation, are used as energy reservoirs for a Carnot engine. The finite reservoirs both have mass *m* and specific heat *c*. They start out at temperatures *Th* and *Tc* , where *Th* > *Tc* . (a) Show that the engine will stop working when the final temperature of each object is (*Th Tc*)1/2. (b) Show that the total work done by the Carnot engine is *W*eng = *mc*(*Th*1/2 – *Tc* 1/2)2