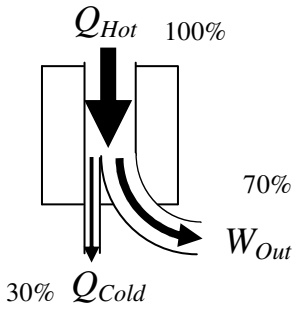
Heat and Thermo 11

1. A ball is dropped.
   A. As it falls its amount of potential energy _____ and its kinetic energy _____.
   B. Since entropy is about the quality of energy or the amount of usable energy, an object dropped from a lower height has more or less entropy?
   C. After a ball hits the ground, its kinetic energy: increases or decreases?
   D. Where has this energy gone?
   E. The total energy of the ball/ground system has:
   F. The total entropy of the ball/ground system has:

Heat Engine



Again, on the diagram, notice that Q_H is 100%. W_{out} is the efficiency. This diagram shows that the efficiency is 70% (which = W_{out}). The inefficiency is Q_C (or 30% for the engine). This allows you to do very simple proportions.

$$\textit{For this engine: } \frac{Q_H}{100\%} = \frac{Q_C}{Q_H} = \frac{W_{out}}{70\%}$$

$$\textit{For any engine: } \frac{Q_H}{100\%} = \frac{Q_C}{\%\ inefficient} = \frac{W_{out}}{\%\ efficient}$$

2. In one complete cycle a heat engine absorbs 450 J of heat from a hot reservoir (a reserve of heat) and expels 200 J of heat to a cold reservoir (a reserve that stays cold). What is the efficiency of the engine?

2. W = 450−200 = 250J, so eff = 250/450 = 55.6%

3. A heat engine is 45% efficient. It absorbs 600 J of heat each second from a hot reservoir.
   A. What percent is 600 J?
   B. What percent is the work done?
   C. How much work is done each second by the engine?

3A: 100%
3B: 45%
W/45% = 600/100%
W = 270 J

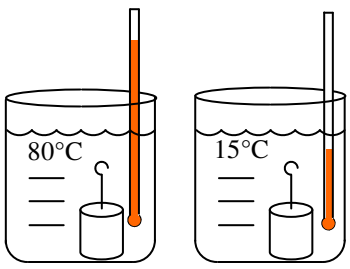
4. A heat engine loses 2500 J of heat to a cold reservoir. The engine has an efficiency of 65%.
   A. How inefficient was the heat engine?
   B. What percentage is Q_H?
   C. How much heat was gained from the hot reservoir?

4A: 35% (100−65)
4B: 100%, always
4C: set up a proportion: 2500/35%, etc.

5. A piston has a circular cross sectional area with a diameter of 12 cm. The piston rises 8 cm in each stroke. 62kJ of work is done and 84kJ of heat is ejected into a river with each power stroke.
   A. Calculate the pressure in the piston. (*See bottom of p1 HW3 for help on work in a piston.)*

   B. How much heat was added at the boiler?

   C. How efficient was the engine?



6. A 400 g copper (c_p = 387J/kg·°C) mass is in a beaker of water at 80°C. The water is allowed to cool to 15°C. Calculate the amount of heat gained or lost by the copper object.