PHY101 Homework 8 Solutions

Chapter 8 Exercises

(13) Air pressure increases because the tires heat up due to friction. The tires heating up, heats up the air within. For constant volume, an increase in temperature results in an increase in pressure via the Ideal gas law.

(15) Since water has a high specific heat it will remain heat for longer and keep you warm throughout the night. A brick will cool off faster.

(21) In summer, the air is warmer than the water so the air is cooled by the water to produce a temperature cooler than inland temperatures.
In winter, the air is colder than the water, so the air is warmed by the water to produce a temperature warmer than inland temperatures.

(27) Cool the inner (contracts) and heat the outer (expands).

(36) Since H_2O expands as it freezes, a pipe containing H_2O that freezes will break the pipe.

Chapter 8 Problems

(2) The work done to hammer in the nail gets converted into heat ($\Delta E = W - Q = 0$).

So $W = Q = Fd = mc\Delta T \Rightarrow \Delta T = \dfrac{Fd}{mc} = \dfrac{(500N)(.06m)}{(.005kg)(450 J/kg^\circ C)}$

minus sign since heat out of nail

$$\Delta T = \frac{30\ J}{2.25\ J/^\circ C} = \underline{13.3^\circ C}$$

(7) Reading the italics above problems 6-8, simply use $\Delta L = L\alpha\Delta T$

$$= (300m)(11\times10^{-6}/^\circ C)(15^\circ C)$$

$$= \underline{0.21\ m}$$

Other problems

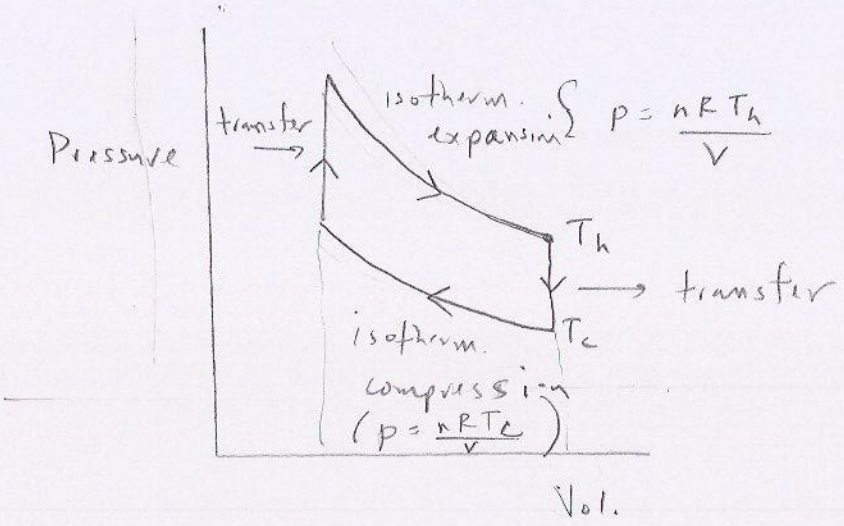
(8) Use $Q = mc\Delta T$ to find heat energy required to boil 1kg of H_2O and then use $\text{Power} = \dfrac{Q}{\Delta t}$ to find Δt (the time it takes).

So. $Q = (1kg)(1\ cal/kg\cdot^\circ C)(80^\circ C) = 80\ cal$. Now, $(80\ cal = 80\ cal)\left(4184\ \frac{J}{cal}\right) = 334{,}720\ J$. The power of the stove is $2100\ J/s$, so $\Delta t = \dfrac{Q}{\text{Power}}$

($80^\circ C$ = $(100^\circ C - 20^\circ C)$)

or $\Delta t = \frac{33470\ J}{2100\ J/s} = \underline{15.9\ sec!}$

(9) (a)



(b) The power stroke is the isothermal expansion.

(c) The isothermal compression stroke.

(d) The work done during the power stroke ($W = (\text{pressure})(\Delta Vol)$) is the full area under the top curve. The negative work subtracted from the system is the area under the lower curve. No work is done during the transfers since $\Delta V = 0$. So the total work done by the system is the area between the top and bottom curves. It is a positive area so the engine (Stirling) puts more mechanical energy into the spinning parts than is removed for each cycle.