Homework Set #10 Solutions (11/3 - 11/7):

Chapter 14: **Questions** 11, 15, 26 **Exercises** 11, 15, 23

Questions:

11. First: You cannot get more energy out of a heat engine than you put into it. Second: You cannot convert all of the thermal energy back into mechanical work.

15. Heat engine A is more efficient because the exhaust temperature is lower.

26. Any system that maintains the thermal energy in the home against losses through the walls without any input of new energy violates the first law

Exercises:

11. $T_h = \dfrac{T_c}{1-\eta} = \dfrac{300\text{ K}}{1\text{ - }0.6} = 750\text{ K} = 477°\text{C}$

15. $W = Q_{out} - Q_{in} = 1500\text{ J - }800\text{ J} = 700\text{ J (per second)}$

23. 113, 131, 311, 122, 212, 221; therefore 6/216 = 1/36 = 2.78%

Chapter 9: **Questions** 1, 5 **Exercises** 1, 6

Questions:

1. No. Newton's first law is only true in inertial reference frames, and indeed serves to define such frames.

5. Both frames of reference are inertial and therefore no experiment can distinguish between the two.

Exercises:

1. a) $v_{og} = v_{of} + v_{fg} = 12\text{ m/s} + 25\text{ m/s} = 40\text{ m/s}$
   b) $v_{og} = v_{of} + v_{fg} = -15\text{ m/s} + 25\text{ m/s} = 10\text{ m/s}$

6. *a*) $a_{eff} = g - a_{in} = -10\text{ m/s}^2 - 4\text{ m/s}^2 = -14\text{ m/s}^2$ (downward)
   b) $a_{eff} = g - a_{in} = -10\text{ m/s}^2 - 0 = -10\text{ m/s}^2$ (downward)