Assignment #1

1. What does the 1st Law of Thermodynamics entail about the relation between Q_{in}, Q_{out}, and W for a heat engine?

2. Show that, if Clausius' version of the 2nd Law if false, then so is Thomson's (*i.e.*, Kelvin's).
   <u>Hint 1</u>: Draw a heat engine that violates Clausius's version of the 2nd Law, and hook it up to an appropriately constructed, *allowable* heat engine in such a way that the product is a heat engine that violates Thomson's version of the 2nd Law.
   <u>Hint 2</u>: An "allowable" heat engine is a heat engine that obeys *both* the 1st Law and the 2nd Law!

3. Show that, if Thomson's version of the 2nd Law if false, then so is Clausius'.
   <u>Hint 1</u>: Draw a heat engine that violates Thomson's version of the 2nd Law, and hook it up to an appropriately constructed, *allowable* heat engine in such a way that the product is a heat engine that violates Clausius' version of the 2nd Law.
   <u>Hint 2</u>: An "allowable" heat engine is a heat engine that obeys *both* the 1st Law and the 2nd Law!