Due Tues., Mar 6

2012 Heat and Thermo 8

1. When you are hot your body sw_______. The liquid water on your skin ev_______________. As a result your skin is c_______ down. For the water, it e___________ from a l______ to a g_____, which requires h______. The left over water is therefore cooler and at a lower t______________ , drawing h_______ from your skin. This is why e_____________ is a c___________ process.

2. * A gas is compressed and 1500 J of work is done on the gas. During this process 1800 J of heat is added to the system. What is the change of internal energy of the system?

3. Ice (a cold reservoir) is put around a piston so that the exchange of heat is 1200 J. The piston is pulled out doing 800 J of work. What is the change of internal energy of the system?

4. In an isovolumetric process, heat is added to the piston. If the internal energy changes by 45000 J, how much work was done on the gas?

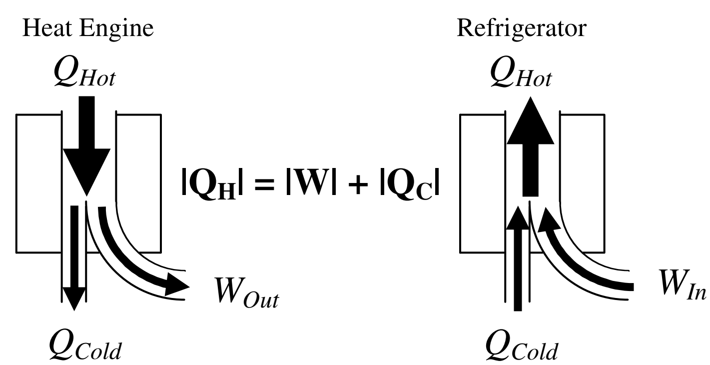
2. 3300 J

Let's imagine a Teddy Bear Machine. On the front side of the machine are stacks of stuffing and buttons and furry fabric to be put into the machine. This is all useful "stuff", since it can be made into Teddy Bears. The final Teddy Bears are more organized than the materials from which they are made. After the manufacture of the Teddy Bears there is also "stuff" laying around the machine: pieces of fabric, etc.

5. A. Is there more "stuff" before or after the creation of the Teddy Bears?
   B. Is there more or less refuse (garbage) after the Teddy Bears are made?
   C. The machine itself also used electricity or g_____ and creates h_____.
   D. Is heat more or less useful than the power source of the machine?

   The "stuff" (the materials) represents "energy". The organization or usefulness is "entropy".
   E. In any process the amount of energy increases, decreases, or stays the same?
   F. In any natural process the amount of useful energy:
   G. In any natural process the amount of entropy:

6. On the heat engine diagram, label the boiler, piston, and radiator. Refer to the previous homework, if necessary.
7. On the refrigerator diagram, label the inside of the refrigerator (inside), the compressor, and the outside of the refrigerator.



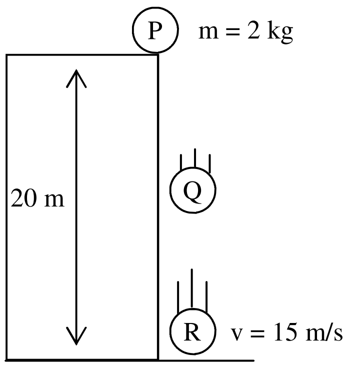
8. Q_H, Q_C, W or ΔU?

   A. ____ * Heat removed by the coils outside of a refrigerator.
   B. ____ When the refrigerant passes thru the expansion valve of a refrigerator.
   C. ____ Heat absorbed by the refrigerant inside the refrigerator.
   D. ____ Changes inside the compressor of a refrigerator.
   1500 J of energy is added at the boiler of a heat engine. 600 J is lost when the steam is cooled. 900 J of useful energy is produced by the engine.
   E. ____ * 1500 J
   F. ____ 600 J
   G. ____ 900 J
   H. ____ * Is 0 for a cyclic process.
   I. ____ * Is 100% both diagrams.
   J. ____ * Is the "lost" energy in a heat engine.
   K. ____ * Can never be as big as Q_H.

A. Q_H
E. Q_H
H. ΔH
I. Q_H (big arrow)
J. Q_C (this is the part of Qh that doesn't do work)
K. W, must have Q_C to recompress the gas.

Let's remind ourselves about efficiency.

9. An object falls off of an 20 m tall ledge. We will assume that point Q is half way down.



A. Calculate the energy of the object at the top. Use g = 10 m/s^2.

B. Calculate the energy at the bottom.

C. Give a logical reason why these are not the same.

D. Efficiency is what you get out of a process divided by what you put into a process. Divide what you ended up with by what you started with.

$$Eff = \frac{W_{out}}{W_{in}} \times 100$$

E. * You ended up with a decimal. To make it a percent: multiply by 100. This is the efficiency of this process.

9E: 56%