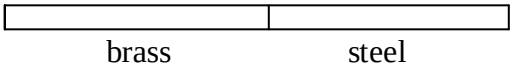
1. A spherical balloon has a radius of 0.305 m and contains nitrogen, N_2, at 27.2 ^oC and one atmosphere total pressure.

a) What is the volume of the nitrogen in the balloon?

b) How many moles of nitrogen are in the balloon?

c) What is the mass of the nitrogen in the balloon?

2. At 5.8 ^oC a metal rod is 1.420 m total length with half the length brass and the other half steel. If the entire rod is heated to 145.6 ^oC, what is its total change in length?



3. A 32.5 gram ice cube at 0.0 ^oC is added to 200.0 g of water at 85.0 ^oC in a styrofoam (insulated) container. What is the final temperature of the mixture? The affect of the container is negligible.

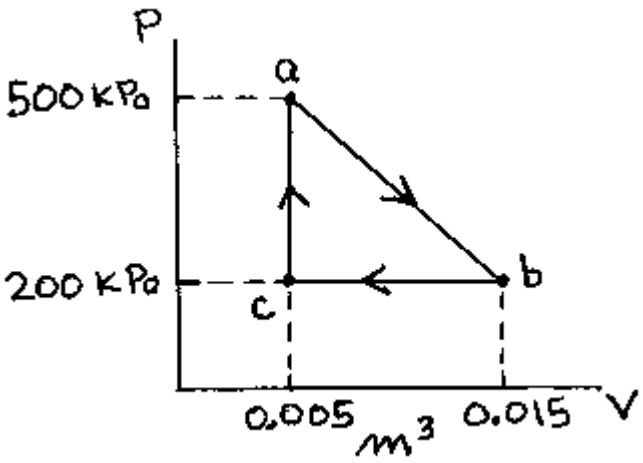
4. A light bulb has a metal filament that has an emissivity of 0.330 and a surface area of 4.71×10^{-5} m^2. It is heated to 2450 ^oC in a room of temperature 25 ^oC. What is the power dissipated through radiation by the filament?

5. A heat engine has an energy source at 400^oC and a cooling system at 80^oC.

a) What is the maximum possible efficiency of this engine?

b) If it does 100,000 J of work what is the least amount of heat it must exhaust?

6. A thermodynamic cycle (heat engine) with a fixed amount of ideal working gas is represented on the following diagram:



a) If the gas temperature at point c is 400 K, how many moles of gas are in the engine?

b) What is the temperature at point b?

c) Is process stroke bc a heat intake or cooling stroke?

d) How much work is done by process stroke bc?

e) How much net work is produced for the whole cycle?