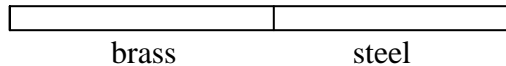


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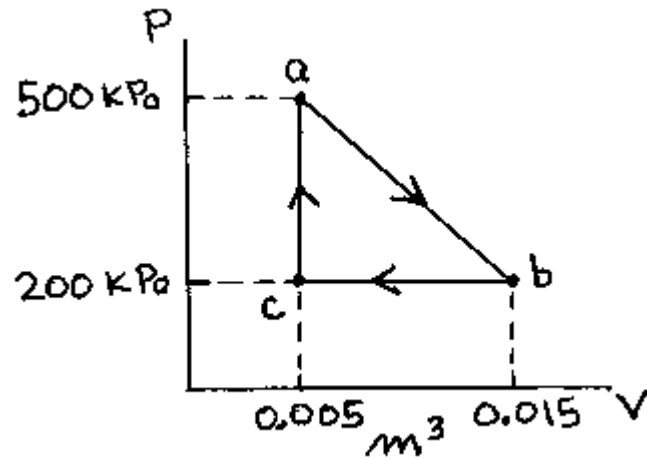
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1. A spherical balloon has a radius of 0.305 m and contains nitrogen,  $N_2$ , at  $27.2^\circ C$  and one atmosphere total pressure.
  - a) What is the volume of the nitrogen in the balloon?
  - b) How many moles of nitrogen are in the balloon?
  - c) What is the mass of the nitrogen in the balloon?
2. At  $5.8^\circ C$  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  $145.6^\circ C$ , what is its total change in length?



3. A 32.5 gram ice cube at  $0.0^\circ C$  is added to 200.0 g of water at  $85.0^\circ C$  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  $4.71 \times 10^{-5} m^2$ . It is heated to  $2450^\circ C$  in a room of temperature  $25^\circ C$ . What is the power dissipated through radiation by the filament?
5. A heat engine has an energy source at  $400^\circ C$  and a cooling system at  $80^\circ C$ .
  - 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:



- If the gas temperature at point c is 400 K, how many moles of gas are in the engine?
- What is the temperature at point b?
- Is process stroke bc a heat intake or cooling stroke?
- How much work is done by process stroke bc?
- How much net work is produced for the whole cycle?