Dr. Sasha

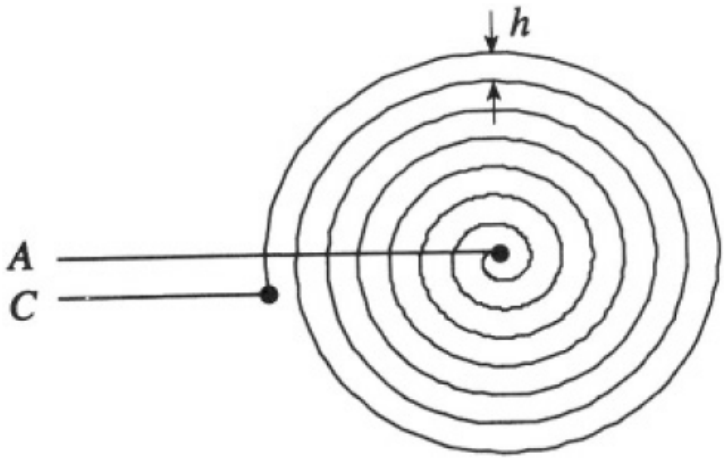
Please, solve this problem and also show the steps to solve it.

7.06.2015 – N16

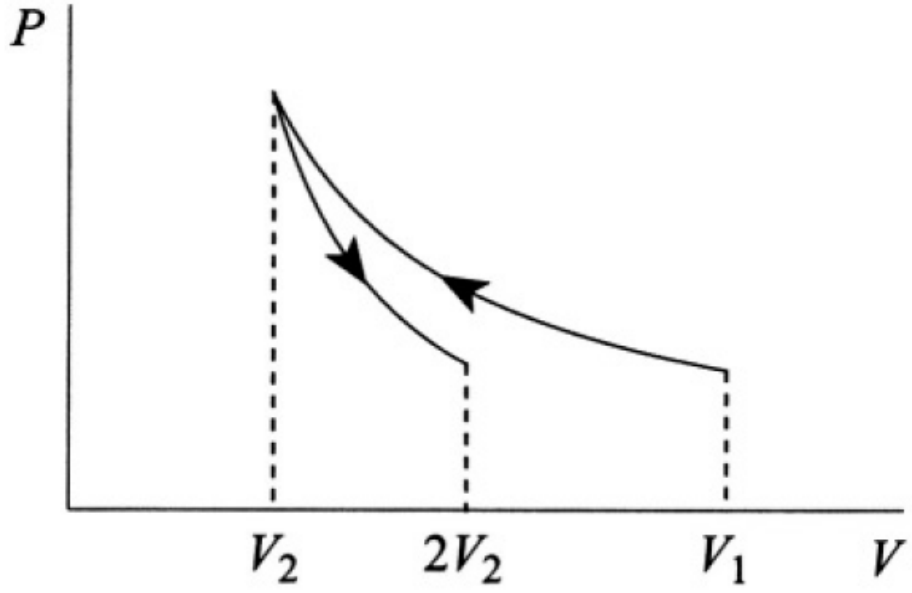
1) A virtual image is often described as one through which the light rays do not actually travel, as they do for a real image. Can a virtual image be photographed?

2) A 2-L container is divided in half: One-half contains oxygen at 1 atm, the other nitrogen at the same pressure, and both gases may be considered ideal. The system is in an adiabatic enclosure at a temperature T=300 K. The gases are allowed to mix. Does the temperature of the system change in this process? If so, by how much? Does the entropy change? If so, by how much?

3) A flat metal spiral (with a constant distance h between coils) and a total number of coils N is placed in a uniform magnetic field $B = B_0 \cdot cos(\omega t)$ perpendicular to the plane of the spiral (see figure below). Evaluate the total electromotive force induced in the spiral (between points A and C). Assume $N >> 1$.



4) An ideal gas is compressed at constant temperature τ from volume V_1 to volume V_2 (see figure below).



a) Find the work done on the gas and the heat absorbed by the gas.

b) The gas now expands adiabatically to volume $2 \cdot V_2$. What is the final temperature T_f?

c) Estimate T_f for $T_i = 300$ K for air.

5) A monatomic gas obeys the van der Waals equation $P = \frac{N \cdot T}{V - N \cdot b} - \frac{N^2 \cdot a}{V^2}$, where N is the total number of particles, parameter a measure of the attraction between the particles and the parameter b is the volume of the molecules per mole. This gas has a heat capacity $C_V = \frac{3N}{2}$ in the limit $V \to \infty$.

a) Prove, using he equation of state, that $\left.\frac{\partial C_V}{\partial V}\right|_T = 0$.

b) Use the preceding result to determine the entropy of the van der Waals gas, $S(T,V)$ to within an additive constant.

c) Calculate the internal energy $\varepsilon(T,V)$ to within an additive constant.

d) What is the final temperature when the gas is adiabatically compressed from (T_1,V_1) to final volume V_2 .

e) How much work is done in this compression?