

Thermo (20 points) One mole of an ideal gas

Please derive the expression for the amount of work done during the isothermal expansion of an ideal gas from an initial volume V_1 to a final volume V_2 . (10 points)

Suppose that this gas doubles in volume at $T = 300\text{K}$, how much work was done by the gas? How much heat energy was absorbed by the gas?
(recall $N = 6.02 \times 10^{23}$ for one mole) (5 points each)

Thermo Quickies(6 points)

Ta) State at least 2 equivalent conditions for thermal equilibrium between 2 objects.

1. _____

2. _____

Tb) Calculate the thermal average velocity for a helium atom at room temperature. If the earth's escape velocity is about 11.2 Km/s, why isn't there much He in our atmosphere?

Tc) Which process requires more heat energy to produce the same temperature change.
(Why? 10 words or less)

Constant Volume

Constant Pressure

Statistics and error analysis (10 points each)

1) Suppose you have a uniform distribution of data between 0 and 1. Compute the average and the sigma of this distribution. In other words, what is the expectation value of x for the distribution $f(x)=1$ and what is the expectation value of $(x-\text{average})^2$ for this data in the interval between 0 and 1?

2) Suppose you are giving a lecture demonstration with a simple pendulum. If you can only measure the length of the pendulum to 10 centimeters and it is 1.5 m long, how much error is there in your estimate for the period. Remember that the period for a simple pendulum is a square root of something and it involves a length and g and 2π . (the rest is dimensional analysis) Should you worry about it for the demonstration? (why? 10 words or less)