ADVANCED PHYSICS CLUB

APRIL 2, 2023

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
`http://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2022`
The practical information about the club and contacts can be found on the same web page.

Today's meeting

Today we have almost finished the assignment on ideal gas equation of state. Our next topic is the first law of thermodynamics.

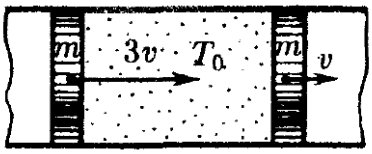
Reassigned Homework

***1.** A sealed container is filled with water in such a way that there is an air bubble on its bottom. Pressure at the bottom level is p_0. What will the pressure become if the bubble floats all the way up? Height of the container is H, water density is ρ.

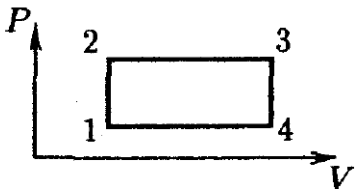
New Homework

1. Air in a room was heated from temperature T_0 to a higher temperature T so that its' pressure did not change. How did internal energy of the air in the room change?

2. One mole of ideal monatomic gas is put between two pistons of mass m in a long frictionless thermally insulated tube. Initially pistons have speeds v and $3v$ in the same direction. What will be the highest temperature reached by the gas? Pistons do not conduct heat. Neglect mass of the gas compared to mass of the pistons.

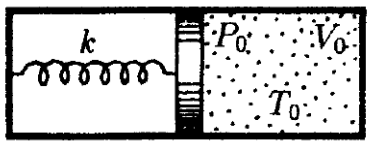


3. A cyclic process 1-2-3-4-1 shown on the figure is performed with one mole of ideal gas. Temperatures of gas at points 1 and 3 are T_1 and T_3 respectively. Points 2 and 4 lie on the same isotherm. Find work done by the gas during the cycle.



4. Two experiments are performed with the same amount of ideal gas. In both experiments the gas is heated by the same burner for the same amount of time, so that the same heat is transmitted to the gas in both cases. However in one case the heating happens isobarically (at constant pressure) and in the other case it happens isochorically (at constant volume). Initial values of pressure and volume are equal to p and V and are the same in both cases. The respective final values are V_1 and p_2. The gas is thermally insulated. Find the ratio of molar heat capacities $\gamma = C_P/C_V$ from this data.

***5.** A system consists of gas with parameters p_0, V_0, T_0 in a container and a piston which is held by a spring. There is vacuum to the left of the piston. If it were not for the gas, the piston would touch the right wall of the container and the spring would not be deformed then. Find heat capacity of this system.
Hint: if a small amount of heat δQ supplied to the system causes it to increase temperature by δT, heat capacity C is defined as the coefficient in the relation $\delta Q = C\delta T$.



For the next meeting

IMPORTANT: The next club's meeting is at 3:30pm, via Zoom, on Sunday, **April 16**.