# ADVANCED PHYSICS CLUB

APRIL 16, 2023

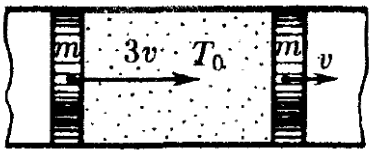
The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
`http://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2022`
The practical information about the club and contacts can be found on the same web page.

## Today's meeting

Today we have started solving problems on the first law of thermodynamics. Some problems are reassigned, there are also three new problems.

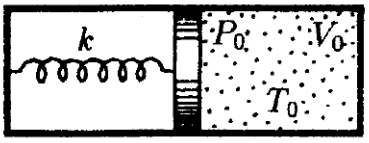
## Reassigned Homework

**1.** 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.




**2.** 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.

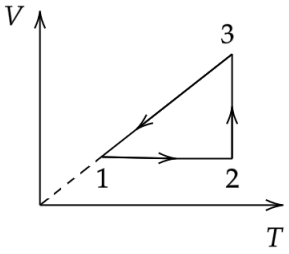
***3.** A system consists of gas with parameters $p_0, V_0, T_0$ in a container and a piston which is held by a spring. There is vacuum to the left of the piston. If it were not for the gas, the piston would touch the right wall of the container and the spring would not be deformed then. Find heat capacity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




## New Homework

**1.** A gas is expanding in such a way that $pV^2 = const$. Does it become hotter or cooler?

**2.** Does an ideal gas do positive or negative work during a cycle shown on the figure?




***3.** Find molar heat capacity of a monatomic gas expanding in such a way that $pV^n = const$ where $n$ is some number. For which values of $n$ molar heat capacity is equal to zero? To infinity?

## For the next meeting

**IMPORTANT:** The next club's meeting is at 3:30pm, via Zoom, on Sunday, **April 23**.