ADVANCED PHYSICS CLUB

APRIL 18, 2021

Useful resources

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
`https://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2020`
The practical information about the club and contacts can be found on the same web page.

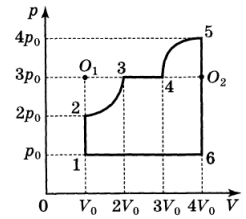
Today's meeting

Today's homework is about the first law of thermodynamics.

Homework

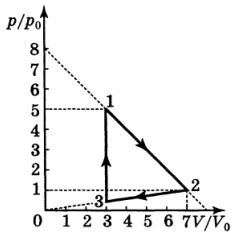
1. In order to heat 1 kg of some gas by 1 K at constant pressure one needs 912 J while at constant volume heating by 1 K requires 649 J. Which gas is it?

2. Find energy conversion coefficient of the cyclic process shown on the figure. The process is done with an ideal monatomic gas. Segments 2-3 and 4-5 on the figure are arcs of circles with centers in points O_1 and O_2 respectively.

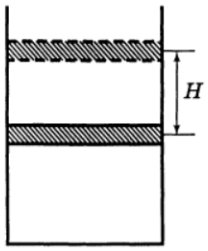


3. n moles of ideal diatomic gas take part in the cyclic process shown on the figure. In processes 1-2 and 2-3 pressure and volume have linear dependence (and line 2-3 goes through the zero), process 3-1 is isochoric. p_0 and V_0 are given. Find the following:

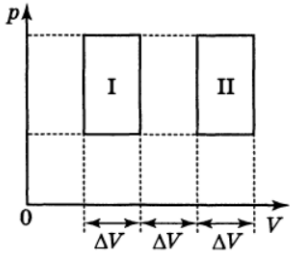
(a) Temperature and pressure of the gas at point 3;
(b) Work A done during the cycle;
(c) Energy conversion coefficient η.



***4.** Air with the same temperature as the environment is under a heavy piston in a vertical vessel. The piston is slowly moved from the equilibrium position and lifted to height H. After temperature of air in the vessel reaches the environment temperature again, the vessel is made thermally insulated and after that the piston is released. What will the displacement of the piston with respect to the initial position be after oscillations have stopped? Heat capacities of vessel and piston are negligible, atmospheric pressure is small.



***5.** One mole of ideal monatomic gas is used in a heat engine. Cycles I and II performed on this gas are shown on the figure. Find energy conversion efficiency of these cycles, η_1 and η_2, if it is known that $\dfrac{\eta_1}{\eta_2} = 1.6$.



For the next meeting

IMPORTANT: The next club's meeting is at 3:00pm, via Zoom, on Sunday, **April 25**.