ADVANCED PHYSICS CLUB

NOVEMBER 22, 2020

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.

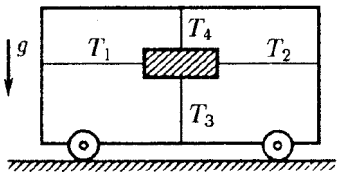
Today's meeting

Today we discuss Newton's laws. As this is a familiar topic to some of you and some problems were already solved last year, this time homework is again divided in two parts again.

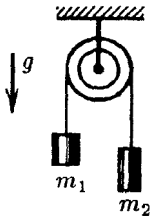
Homework part 1

1. After being hit with a hockey stick a puck slides on the ice for 5 seconds, until it stops 20 meters away from the place it was hit. Mass of the puck is 100 g. Find the force of friction that was acting on the puck while it was sliding (assuming it was constant in time).

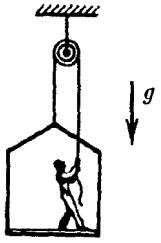
2. A block is attached to the cart using four ropes, as shown in the picture. Force of tension in the horizontal ropes is T_1 and T_2, and in vertical ones - T_3 and T_4, free fall acceleration is g. What is the acceleration of the cart?



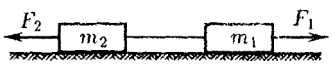
3. Find acceleration of the blocks and tension forces in the system shown on the figure. Neglect masses of the pulley and ropes, also neglect friction.



4. A painter works on a hanging platform. He urgently needs to go up and starts pulling the rope with such a force, that a force with which he presses on the platform becomes less by 400 Newtons. Mass of the painter is 72 kg and mass of the platform is 12 kg. Find the acceleration with which the platform and the painter move.



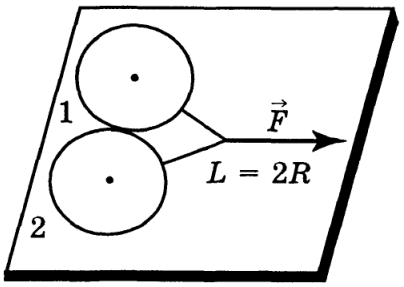
5. Two bodies of masses m_1 and m_2 are connected by a thread which withstands tension T (and bigger tension will tear it). Bodies are acted upon by forces $F_1 = \alpha t$ and $F_2 = 2\alpha t$, where α is a constant coefficient and t is time. Find the time when the thread will be torn.



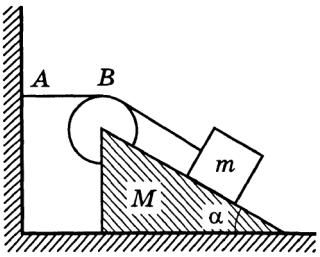
6. A system consists of N identical balls, connected by identical springs in a line and hanged vertically with a thread. Then the thread is cut. Find the accelerations of balls immediately after that.

Homework part 2

***7.** Two pucks 1 and 2 have the same radius R. They lie on a horizontal smooth table so that they touch each other. They are connected by a thin light thread of length $L = 2R$. We start pulling the thread with some constant horizontal force $\vec{F}$ applied to the center of the thread. Find the normal force between the pucks once they move together without changing their relative position. All friction could be neglected. Consider two cases: 1) pucks have the same mass; 2) one of the pucks is two times heavier than the other.



***8.** A wedge with mass M and angle α is placed on a horizontal floor. On the wedge there is a block with mass m which is connected to a wall with a light thread. The thread goes through a massless pulley attached to the top of the wedge. Segment of the thread AB is parallel to the floor. At first the system was held at rest but then it is set free. The block starts to slide along the surface of the wedge. Neglect all friction. 1) Find acceleration of the wedge. 2) For what ratio of masses of wedge and block is such motion possible? (for this part of the problem only α is given).



For the next meeting

IMPORTANT: The next club's meeting is at 3:00pm, via Zoom, on Sunday, **December 6**. Happy Thanksgiving!