

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=ay2021

The practical information about the club and contacts can be found on the same web page.

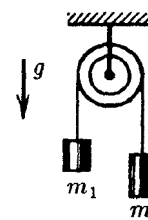
TODAY'S MEETING

Today we discussed our last topic on kinematics - circular motion. Our next topic is Newton's laws.

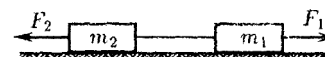
This time again the homework is split in two parts: a simpler part 1 and a more complicated part 2. Solutions of part 1 will be discussed on the next meeting as usual. As for the solutions of part 2 we may not have time to discuss them all. We encourage you to discuss the problems in the Discord channel. Problems marked with a star are in general more difficult than the ones not marked.

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 train is moving with speed v_0 on a straight horizontal rail track. Suddenly $1/3$ of the train cars are detached and after some time the speed of detached cars has decreased by half. Find the speed of the rest of the train at this moment assuming that the traction force didn't change. Assume that friction force is proportional to weight and does not depend on speed.
3. Find acceleration of the blocks and tension forces in the system shown on the figure assuming $m_1 \gg m_2$. Neglect masses of the pulley and ropes, also neglect friction.



4. Two bodies of masses m_1 and m_2 are connected by a thread which withstands tension up to T . 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.

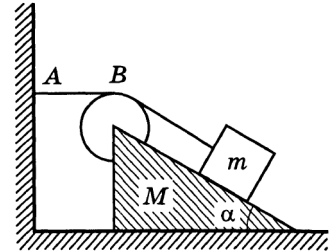


5. A styrofoam cube with mass $M = 100$ grams rests on a horizontal stand. Length of a side of the cube is $h = 10$ cm. An upward-moving bullet with mass $m = 10$ grams hits the cube from below. It enters the cube with a speed $v_1 = 100$ m/s and flies out of the cube with a speed $v_2 = 95$ m/s. Will the cube jump above the stand?
- *6. A constant force starts acting on a body which initially was moving with speed v_0 . After time Δt speed of the body is decreased by half. After one more time interval Δt speed of the body is a quarter of initial speed. Find speed of the body after time $3\Delta t$ since the moment when the force was first applied.

HOMEWORK PART 2

*7. A square curtain with mass 3 kg is hanging from a horizontal rod. The size of the curtain is $1.5 \text{ m} \times 1.5 \text{ m}$. The bottom end of the curtain is lifted to the same level as the top end, so that the curtain is folded in two. Find how the force acting on the rod depends on time after the lifted end of the curtain is let go. Assume that the curtain is thin and soft.

*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, **November 21**.