ADVANCED PHYSICS CLUB

JANUARY 29, 2023

Useful resources

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 finished the assignment on energy conservation. All problems on harmonic motion are reassigned; there are two new problems on the same topic as well.

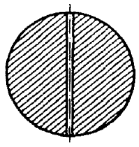
F=ma preparation

Solve F = ma exam 2016 and time yourself. You can download exam problems here:
`https://aapt.org/physicsteam/2016/upload/exam1-2016-3-1-2.pdf`
If you don't have time for the entire exam, at least look through the problems to choose the ones most interesting/unclear to you. We will discuss them problems at the beginning of the next meeting.

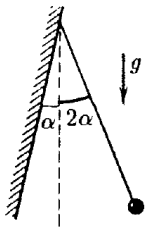
Homework

1. A block hanging still on a vertical spring extends it by length l. Find the period of small vertical oscillations of the suspended block.

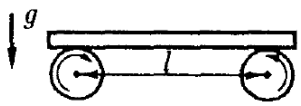
2. Imagine there is a straight tunnel dug through the Earth from one pole to the other. What time would it take a stone to fly from one end to the other? Neglect air resistance, assume the Earth density to be constant. Earth's radius is 6400 km.



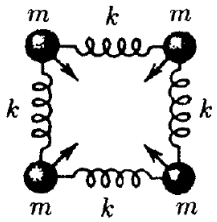
3. A pendulum on a thread of length l is hung on a slightly inclined wall. The pendulum was deflected from the vertical to a small angle which is twice the angle of the wall's incline to the vertical. Then the pendulum was released. Find the period of its' oscillations if collisions with the wall are absolutely elastic.



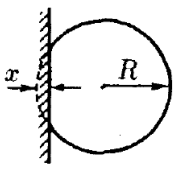
4. A wooden plank lies on two rolls rotating in the opposite directions, as shown on the figure. The distance between axes of the rolls is l, friction coefficient between each roll and the plank is μ. Rotation of the rolls is very fast. Find the frequency of longitudinal oscillations of the plank after it's displaced from the equilibrium position.



***5.** Four beads of mass m are connected by four identical springs with spring constant k and make a square. All beads are simultaneously pushed towards the center of the square so that they start moving with equal speeds. In what time after that will the springs be a) the most contracted b) the most elongated ?



***6.** A balloon colliding with a ball is deformed as shown on the figure. Its' maximal deformation x is small compared to the radius R. Air pressure in the balloon exceeds atmospheric pressure by Δp. Estimate the duration of the collision if mass of the balloon is m.



For the next meeting

IMPORTANT: The next club's meeting is at 3:30pm, via Zoom, on Sunday, **February 5**.