ADVANCED PHYSICS CLUB

JANUARY 25, 2026

Useful resources

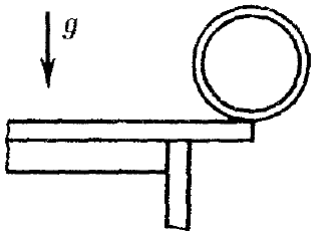
The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
`https://schoolnova.org/classinfo?class_id=2252&sem_id=74`
The practical information about the club and contacts can be found on the same web page.

Today's meeting

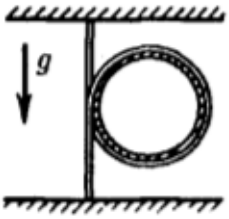
The few remaining problems on rotational motion are reassigned. The new topic is harmonic oscillations.

Reassigned Homework

1. A thin ring is placed vertically at the edge of a desk with the ring's center directly above the edge. The ring starts rolling without slipping off the desk. Find the angle it will turn by by the time it loses contact with the desk. Would this angle be larger or smaller if the ring was replaced with a solid ball?



***2.** A uniform, heavy rope is wrapped around a massless ring; both ends of the rope are fixed along the same vertical line. The system is initially held still. What is the acceleration of the ring if it is suddenly released?

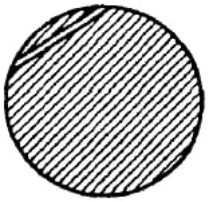


New Homework

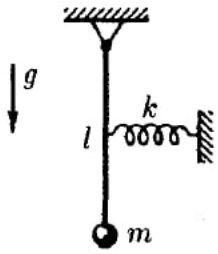
1. Solve the following problems from the previous F = ma exams:
(a) 16, 18 (2009: `https://www.aapt.org/physicsteam/2010/upload/2009_F-ma.pdf`)
(b) 15, 19, 20 (2011: `https://www.aapt.org/physicsteam/2012/upload/WebAssign-exam1-2011-1-4.pdf`)

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

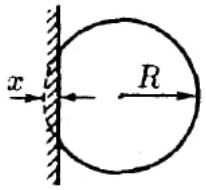
***3.** A straight tunnel is dug through the Earth, not passing through its center. How long would it take a train with engine off to travel from one end to the other end in such a tunnel? Neglect friction and air resistance.



4. A pendulum consists of a weight of mass m at the end of a light rigid rod of length l. A horizontal spring with spring constant k it attached to the center of the rod. Find the frequency of small oscillations of the system. The diagram shows the equilibrium position.



***5.** A spherical balloon is deformed as shown on the figure during a collision with a wall, so that the maximal value of the deformation x is much less than the radius R. Estimate the time of the collision. Mass of the balloon is m. The pressure inside the balloon exceeds the atmospheric pressure by Δp, the change in pressure during the collision can be neglected.



FOR THE NEXT MEETING

IMPORTANT: The next club's meeting is at 2:40pm, in-person on Sunday, **February 1**.