ADVANCED PHYSICS CLUB

OCTOBER 26, 2025

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.

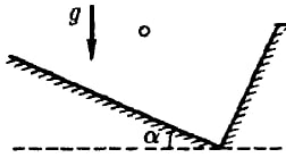
Today's meeting

Today we solved several problems on projectile motion. Three remaining problems are reassigned. Our next topic is circular motion.

Reassigned Homework

1. A ball is initially held at height H above an infinitely long inclined plane with the inclination angle α to the horizon. The ball is released with no initial velocity. Find the distances between the points of impact between the ball and the inclined plane in the subsequent motion. Assume that all collisions are perfectly elastic.

2. A ball is bouncing back and forth between two walls of a rectangular box along the same trajectory. One of the walls makes angle α to the ground. The time interval between two consecutive bounces is Δt. Find speed of the ball right after the collision for both of the collision points.

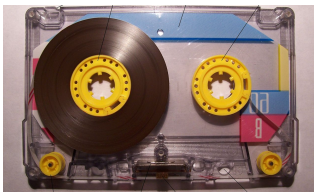


***3.** What minimal velocity should a ball have in order to go over a rectangular house of height H and width L, if it's thrown by a teenager of height h who can choose an arbitrary position on the ground to make the throw?

New Homework

1. A small object moves on a circle of radius r with speed linearly growing in time: $v = kt$. Find how full acceleration of the object depends on time.

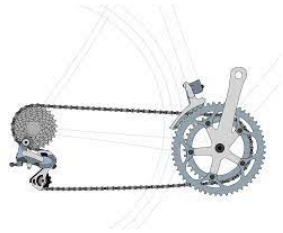
2. While listening to music on a tape a young physicist has noticed that the outer radius of the cassette tape decreased by half in 20 minutes. How long would it take after that for the outer radius to decrease by half again?



3. Problem 8 from the 2018 F=ma A exam that can be found at the following link:
`https://www.aapt.org/physicsteam/2019/upload/Fma-2018-A.pdf`

4. Consider a wheel rolling *without slipping* on a flat horizontal surface. If you track a single point on the rim of the wheel, it follows an interesting trajectory along a curve known as a cycloid (shown on the figure). Find the radius of curvature of a cycloid at the highest point of its arc (this might seem more like a geometry problem, but it has a kinematic solution). The wheel radius R is given.

5. a) Explain why bicycles need gears.
b) If you increase the radius on the front gear, will it be easier or harder to pedal? How about the rear gear?



For the next meeting

IMPORTANT: The next club's meeting is at 3pm, in Zoom, on Sunday, **November 2**.