ADVANCED PHYSICS CLUB
NOVEMBER 8, 2020

Useful resources

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
The practical information about the club and contacts can be found on the same web page.
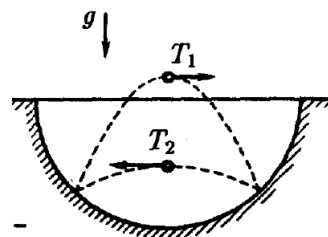
Today's meeting

Today we discuss projectile motion.
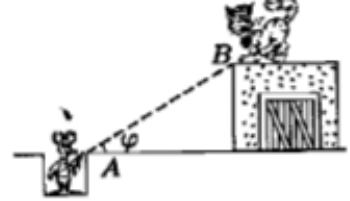
Homework part 1

1. In order to model how objects move on the moon, where the acceleration is only $1.5 m/s^2$, a student prepares an inclined plane and studies how particles move on the inclined plane. At what angle would the inclined plane precisely model motion of particles on the moon?

2. A ball is thrown from the ground with a given velocity v at an angle α to the horizon. At which angle the distance traveled by the ball in the horizontal direction before hitting the ground is maximal? What is this distance?

3. What should be the initial velocity of a cannon missile in order to hit a rocket, starting to move with a vertical acceleration a at the same time as the cannon fires? Cannon and rocket are located on the same horizontal plane, the distance between them is L. The cannon fires at the angle $45°$ to the horizon.

4. A ball is released from rest and hits an inclined plane after falling the distance H. Find the distances between points at which the ball hits the inclined plane after the initial collision. Assume that all collisions are absolutely elastic. The plane is inclined at an angle α.

5. A ball is thrown upwards vertically with velocity v and reaches maximal height H after time T. A ball is released at rest from height H at the same time as the previous ball is thrown. They meet at some point x (measured from the ground) after flight time t. Specify whether $x > H/2$ or $x = H/2$ or $x < H/2$ and also whether $t > T/2$, $t = T/2$, or $t < T/2$.

*6. What minimal velocity should a ball have in order to fly above a rectangular house of height H and length L, if it's thrown by a teenager of height h who could choose an arbitrary position on the ground to make the throw?

Homework part 2

*7. A ball periodically goes back and forth between two points in a spherical hole. These points are at the same height, collisions of the ball with walls of the hole are elastic. Time interval between collisions when the ball moves right is T_1 and when it moves left time interval is $T_2 \neq T_1$. Find the radius of the hole.

*8. Tom (the cat from "Tom and Jerry") sits at the edge of a roof. He notices Jerry (the mouse) below and decides to throw a pebble at him. Jerry also simultaneously throws a pebble at Tom and as a result their pebbles collide exactly at the middle of section AB. We know that $\phi = 30°$, initial speed of the pebble thrown by Jerry is $v_0 = 7m/s$ and Tom threw his pebble horizontally. Find height of the roof above the ground H and ratio of distances traveled by the two pebbles by the time of collision.

FOR THE NEXT MEETING

IMPORTANT: The next club's meeting is at 3:00pm, via Zoom, on Sunday, **November 15**.