

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](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.

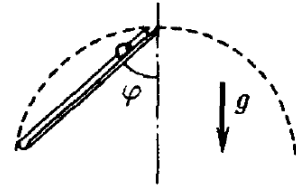
TODAY'S MEETING

Today we continued discussing kinematics, in particular motion with acceleration. Our next topic is projectile motion. This assignment again contains problems of varying difficulty, so everyone could find something interesting for them.

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

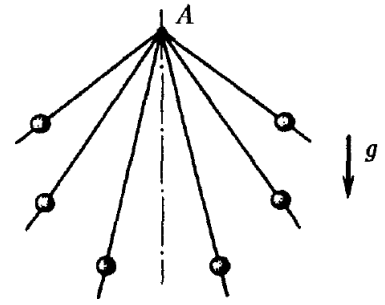
1. In order to model how objects move on the moon, where the acceleration is only  $1.5m/s^2$ , a student prepares an inclined plane and studies how particles move on the inclined plane. At what angle would the inclined plane precisely model motion of particles on the moon?
2. A ball initially is at the top point of a circle of radius  $R$ . The ball starts moving in a smooth gutter at angle  $\phi$  to the vertical. After what time will it reach the circle again? Free fall acceleration is  $g$ .



3. A ball is thrown from the ground with a given velocity  $v$  at an angle  $\alpha$  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?
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  $\alpha$ .
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. A hose is lying on the ground. Water flies out of this hose at an angle  $45^\circ$  to the horizon with speed  $10 \text{ m/s}$ . Cross section area of the hose is  $5 \text{ cm}^2$ . Find the total mass of water which is in the air at any given moment of time.
- \*7. 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?

HOMWORK PART 2

- \*8. Several beads initially at rest are released simultaneously and start sliding along several smooth spokes (see figure). On what curve would the beads lie after time  $t$ ? Free fall acceleration is  $g$ .  
*A big hint: momentum number two of this homework.*



- \*9. Objects are thrown in various directions with initial speed  $v_0$  from the top of a tower of height  $h$ . What is the maximum distance from the foot of the tower that they could reach? Free fall acceleration is  $g$ .

FOR THE NEXT MEETING

**IMPORTANT:** The next club's meeting is at 3:00pm, via Zoom, on Sunday, **November 7**.