

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](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

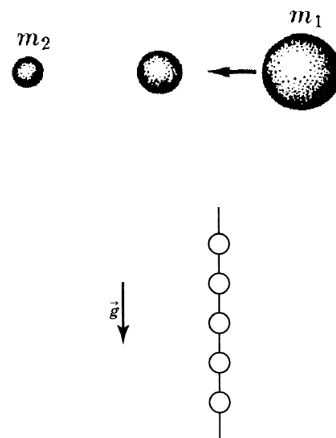
Today we solved problems on energy conservation. Several remaining problems are reassigned; the next topic is harmonic oscillations.

F=MA PREPARATION

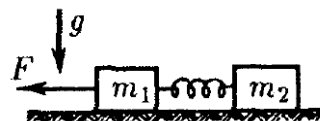
Solve  $F = ma$  exam 2020 and time yourself. You can download exam problems here:  
<https://www.aapt.org/Common/upload/2020-Fma-Exam-A.pdf>  
 If you don't have time for the entire exam, at least look through the problems to choose the ones most interesting/unclear to you. We will discuss them problems at the beginning of the next meeting.

REASSIGNED HOMEWORK

1. In a system of three balls two of them are initially at rest. The moving ball has mass  $m_1$  and collides with the intermediate ball which then collides with the last ball of mass  $m_2$ . For which mass of the intermediate ball will the speed of  $m_2$  after the collision be maximal for a given initial speed of  $m_1$ ? All collisions are perfectly elastic and central.
2. Five identical beads are initially held at rest on a vertical wire. They could slide along the wire without friction, collisions between the beads are perfectly elastic. The beads are simultaneously released with random (in value and direction) initial velocities. What is the maximal possible number of collisions between the beads during their subsequent motion?



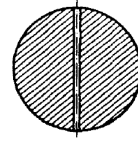
- \*3. Two bodies of masses  $m_1$  and  $m_2$  are connected with an undeformed spring and lie on a horizontal plane. Find what minimal constant force should be applied to the left body so that the other body eventually starts moving. Friction coefficient is  $\mu$ .



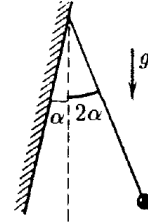
NEW HOMEWORK

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.

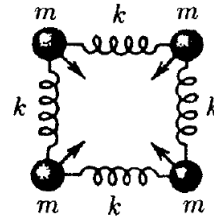
2. Imagine there is a straight tunnel dug through the Earth from one pole to the other. What time would it take a stone to fly from one end to the other? Neglect air resistance, assume the Earth density to be constant. Earth's radius is 6400 km.



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. 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 ?



FOR THE NEXT MEETING

**IMPORTANT:** The next club's meeting is at 3:30pm, via Zoom, on Sunday, January 29.