

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=ay2020](https://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2020)

The practical information about the club and contacts can be found on the same web page.

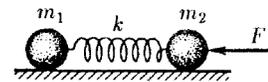
TODAY'S MEETING

Today we discuss strings and springs. This homework is divided in two parts again.

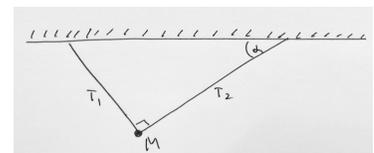
HOMEWORK PART 1

1. Find equilibrium point of a spring with spring constant  $k$  suspended from the ceiling with an attached block of mass  $M$  to which another spring is connected with constant  $k'$  and another block of mass  $M'$  hanging from it.
2.  $N$  springs with constants  $k_1, k_2, \dots, k_N$  are connected in a series from the ceiling. What effective spring can replace them (in the sense of having the same total stretch when a mass is hung at the bottom)? What if they are connected in parallel (they all have the same equilibrium length and support a long rod which is always kept horizontal)?

3. Two bodies with masses  $m_1$  and  $m_2$  are connected with a spring with spring constant  $k$ . A constant force  $F$  acts upon  $m_2$  in the direction of  $m_1$ . Find deformation of the spring if there are no other external forces and oscillations have already stopped. What would accelerations of bodies be immediately after one stops applying the force  $F$ ?



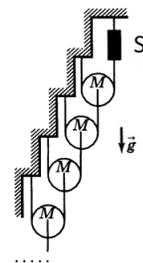
4. A chain of mass  $m$  is hung by its ends in such a way that it makes angle  $\alpha$  with the horizon near the ends. Find the tension in the chain at the lowest point and near the ends.
5. A weight of the mass  $M$  is suspended on two strings as shown in the picture (the angle at the vertex  $M$  is the right one). Find the ratio of tensions in strings  $T_1/T_2$ .



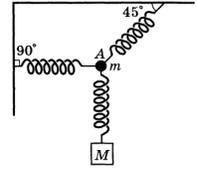
6. Heavy rod is bent at the right angle in its' middle point. Then it is hung from one of its' ends. What is the angle between the vertical direction and the upper half of the rod?

HOMEWORK PART 2

- \*7. A half-infinite system is made out of massless ropes and similar pulleys each of mass  $M$ . Find what force is displayed by a spring scale  $S$ .



- \*8. A block of mass  $M$  and a ball of mass  $m$  hang on three massless springs with the same spring constant (see picture). The topmost spring is detached from the ball in point  $A$ . Find acceleration  $\vec{a}$  (magnitude and direction) of the ball immediately after the spring is detached.



FOR THE NEXT MEETING

**IMPORTANT:** The next club's meeting is at 3:00pm, via Zoom, on Sunday, **December 13**.