ADVANCED PHYSICS CLUB

JANUARY 24, 2021

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

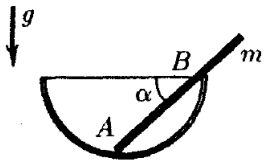
Today's meeting

Today's homework is about static equilibrium.

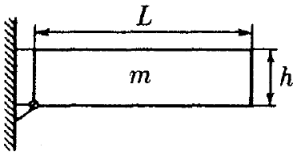
Homework

1. Solve the following problems from the previous $F = ma$ exams:
(a) 13, 24 (2009: `https://www.aapt.org/physicsteam/2010/upload/2009_F-ma.pdf`)
(b) 11 (2010: `https://www.aapt.org/physicsteam/2010/upload/2010_Fma.pdf`)
(c) 3, 14 (2012: `https://www.aapt.org/physicsteam/2013/upload/exam1-2012-unlocked.pdf`)

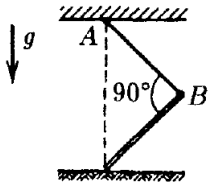
2. A rod of mass m lies in a fixed smooth hemisphere so that it makes an angle α with the horizon and one of its ends is outside the hemisphere. With what forces does the rod act on the hemisphere at the points of contact A and B?



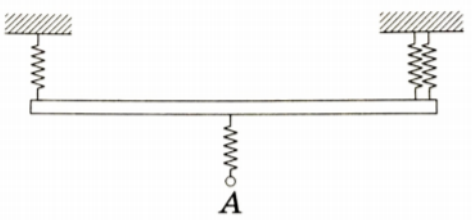
3. A uniform horizontal beam has mass m, length L and height h. Beam's lower left corner is attached to the wall via a hinge. Beam's upper left corner is connected to the wall by a horizontal rope. Find tension in the rope and force with which the beam acts on the hinge axis.



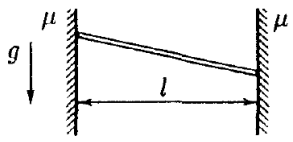
4. For which values of the friction coefficient between a uniform rod and the floor the rod could be in equilibrium in the position shown on the picture? Length of the rope AB is equal to the length of the rod.



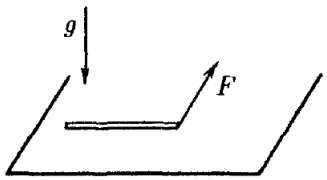
***5.** A rigid thin rod is lying on a smooth horizontal surface. Four identical springs are attached to the rod as shown in the picture. Initially, all springs are orthogonal to the rod and have nonzero but very small tension. A point A of the middle spring is moved along the direction of the spring by 1 cm. Find the tension of all springs in the new equilibrium position. The stiffness of springs is $k = 100$ N/cm.



***6.** The distance between two vertical walls is l. A rod inserted obliquely between the walls does not fall. The coefficient of friction between the walls and the rod is μ. What could the length of the rod be?



***7.** A uniform thin rod of mass m lies on a horizontal plane. Friction coefficient between the plane and the rod is μ. What minimal force should one apply to an end of the rod perpendicularly to it in order to move it?



For the next meeting

IMPORTANT: The next club's meeting is at 3:00pm, via Zoom, on Sunday, **January 31**.