ADVANCED PHYSICS CLUB
DECEMBER 8, 2024

USEFUL RESOURCES

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
\text{https://schoolnova.org/nova/classinfo?class_id=adv_phy_club\&sem_id=ay2024}
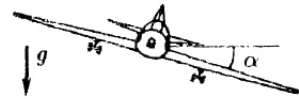The practical information about the club and contacts can be found on the same web page.
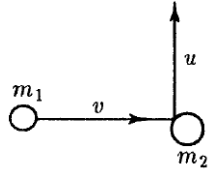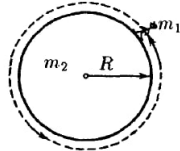
TODAY'S MEETING

Today we discuss momentum conservation law.

REASSIGNED HOMEWORK

1. The air drag force acting on rain droplets depends on the speed of the droplet, its' radius and density of the air. Using dimensional analysis reconstruct the expression for the drag force up to a dimensionless constant factor. Assuming this factor to be 1 estimate the speed that a droplet of radius 1 mm will have near the ground after falling from a great height. Density of air is 1.3 kg/m^3.

2. An airplane makes a turn in the air. It moves horizontally along a circle of radius R with a constant speed v. Find the angle its' wings make with the horizon.

HOMEWORK

1. 1. Solve the following problems from the previous F = ma exams:
   (a) 4 (2012: `https://www.aapt.org/physicsteam/2013/upload/exam1-2012-unlocked.pdf`)
   (b) 6 (2011: `https://www.aapt.org/physicsteam/2012/upload/WebAssign-exam1-2011-1-4.pdf`)
   (c) 20 (2009: `https://www.aapt.org/physicsteam/2010/upload/2009_F-ma.pdf`)

2. A cosmic ship had speed v before the last rocket stage was detached. After detachment ship's speed became $1.01v$ and the rocket stage moves away with speed $0.04v$ relatively to the ship. What is the mass of the rocket stage if ship's mass is m_0?

3. A particle of mass m_1 moving with velocity v hit another particle of mass m_2 and bounced from it with velocity u at the direction perpendicular to its' initial motion. What is velocity of m_2 particle after the collision?

4. An astronaut of mass m_1 stands on the outer surface of a space station which is a hollow cylinder of mass m_2 and radius R. The astronaut starts going around the station while staying on its surface. Find the trajectory of the astronaut. Initially both the astronaut and the station are at rest.

FOR THE NEXT MEETING

IMPORTANT: The next club's meeting is at 3:30pm, via Zoom, on Sunday, **January 5**.