ADVANCED PHYSICS CLUB

DECEMBER 14, 2025

Useful resources

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
`https://schoolnova.org/classinfo?class_id=2252&sem_id=74`
The practical information about the club and contacts can be found on the same web page.

Today's meeting

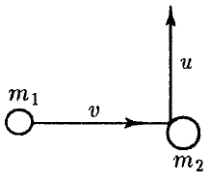
Today we finish with Newton's laws.

Homework

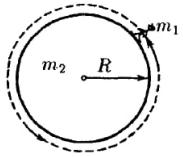
1. 1. Solve the following problems from the previous F = ma exams:
2, 3, 14, 20 (2009: `https://www.aapt.org/physicsteam/2010/upload/2009_F-ma.pdf`)

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?

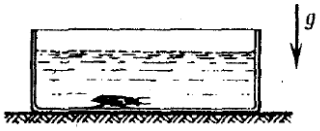


4. An astronaut of mass m_1 stands on the outer surface of a space station which is a hollow cylinder of mass m_2 and radius R. The astronaut starts going around the station while staying on its surface. Find the trajectory of the astronaut. Initially both the astronaut and the station are at rest.



5. A missile is torn into two identical pieces at the highest point of its' trajectory which is at distance L in the horizontal direction from the launch point. On of the pieces returns exactly to the launch point. Where does the other piece land?

***6.** A tank with water with density ρ_0 rests on a frictionless table. Volume of water is V_0. There is a bug with volume V and density ρ at the bottom of the tank. The bug starts to move with horizontal velocity v with respect to the tank. With what velocity will the tank move on the table? Neglect mass of the tank. Water level stays horizontal at all times.



For the next meeting

IMPORTANT: The next club's meeting is at 3pm, in-person on Sunday, **January 11**.