



On the first year students of the physics teacher training programme at ELTE

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International Conference on Teaching Physics Innovatively, 17-19 August 2015, Budapest

In Hungary...

- ▶ To enter university only high school final exam is needed; two of:

biology, geography, math, physics,
information technology, chemistry

- ▶ Low minimum score



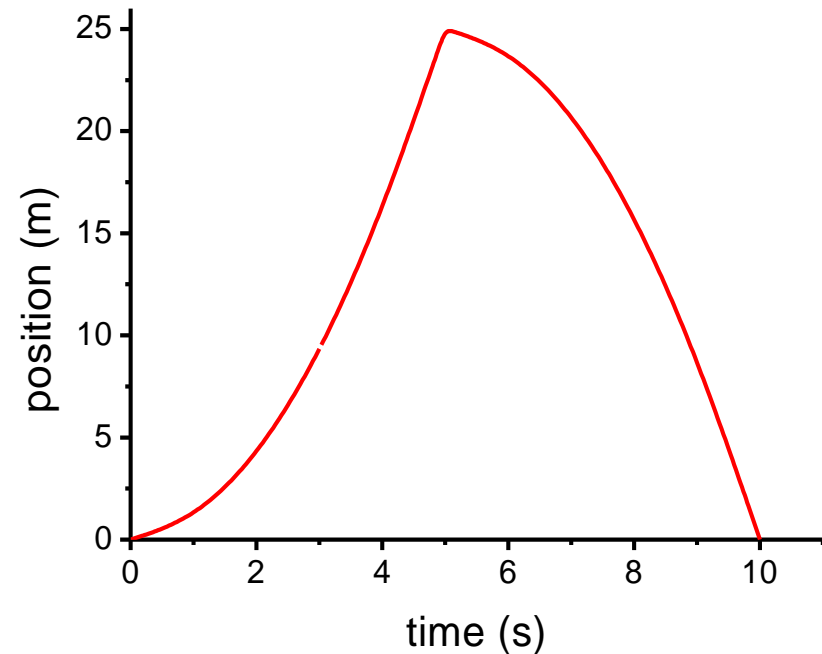
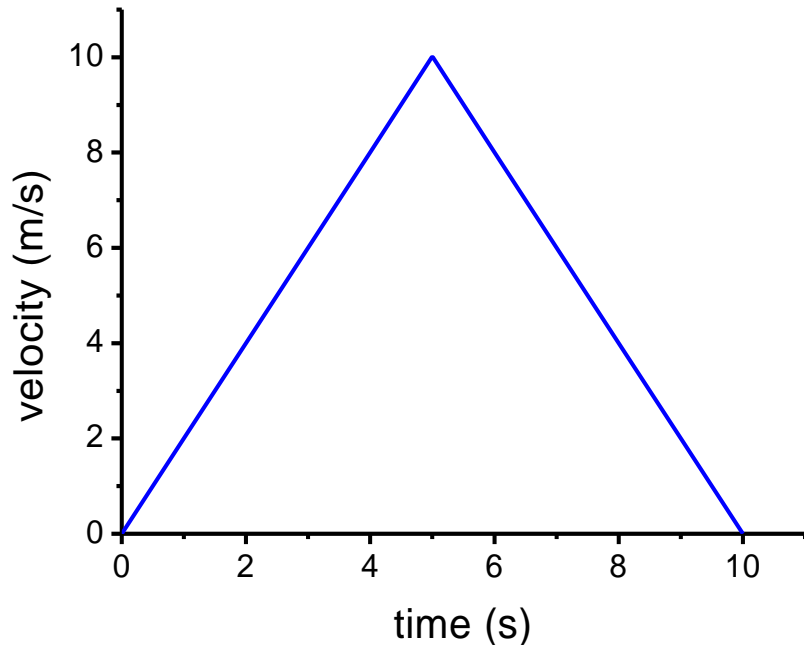
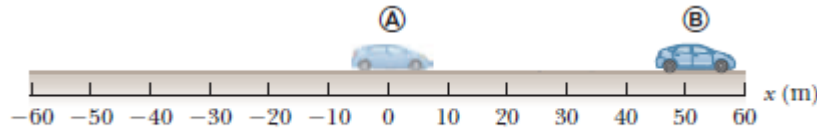
students with poor physics knowledge



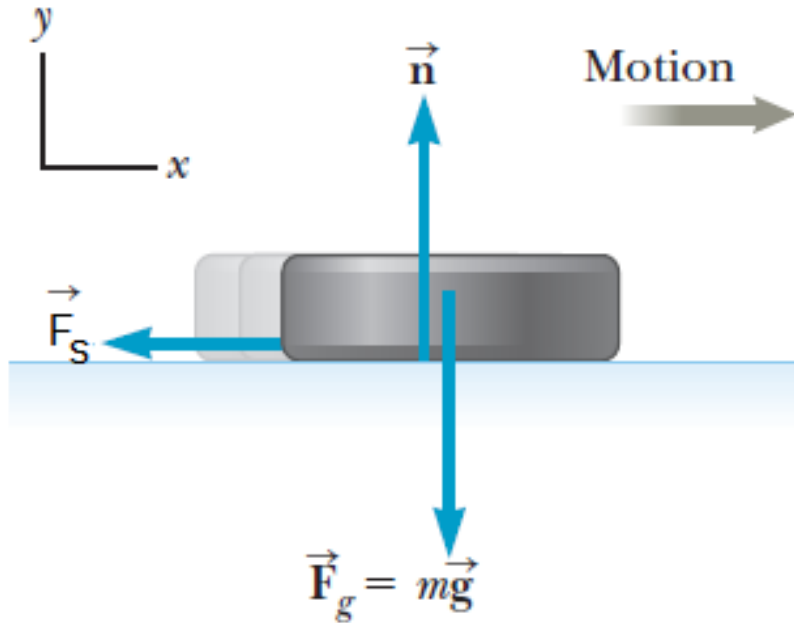
extra courses

Motion graphs

Problem: A car moving along the x -axis according to the graph of velocity versus time. Determine the position of the car as a function of time. Starting position: $x=0$ m.

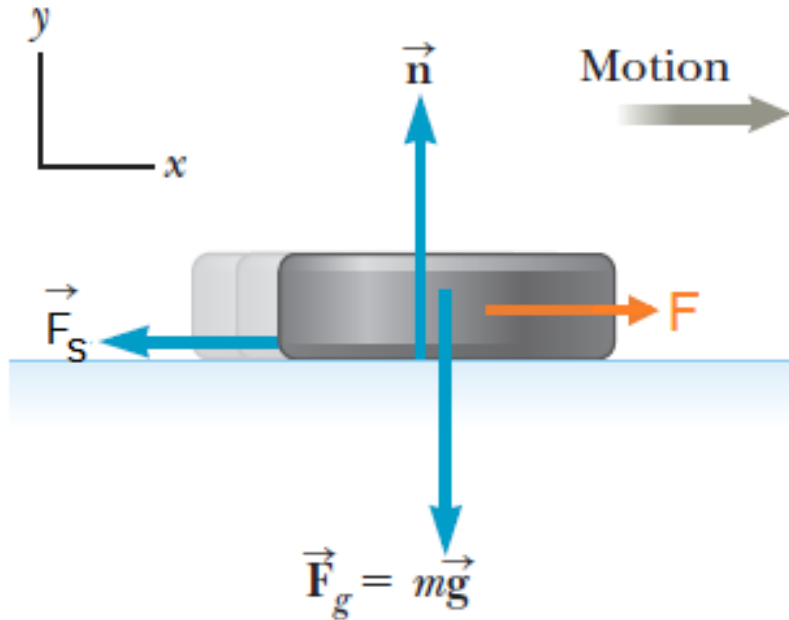


Misconceptions



Problem: A hockey puck struck by a hockey stick is given an initial speed of 20 m/s. The puck slides on the ice 120 m, slowing down steadily until it comes to rest. Determine the coefficient of kinetic friction between the puck and the ice.

Misconceptions

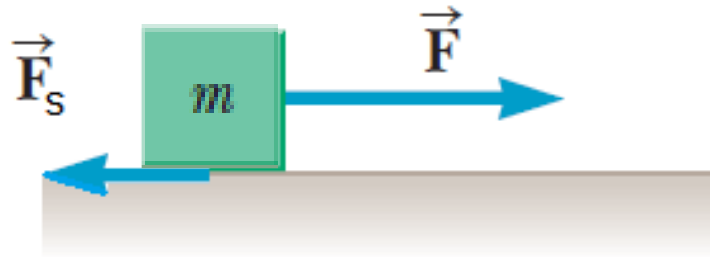


Problem: A hockey puck stuck by a hockey stick is given an initial speed of 20 m/s. The puck slides on the ice 120 m, slowing down steadily until it comes rest. Determine the coefficient of kinetic friction between the puck and the ice.

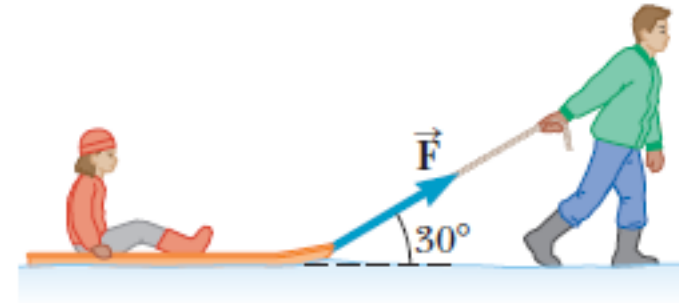
$$F - F_s = m \cdot a$$

Friction force

Problem: Determine the friction force.

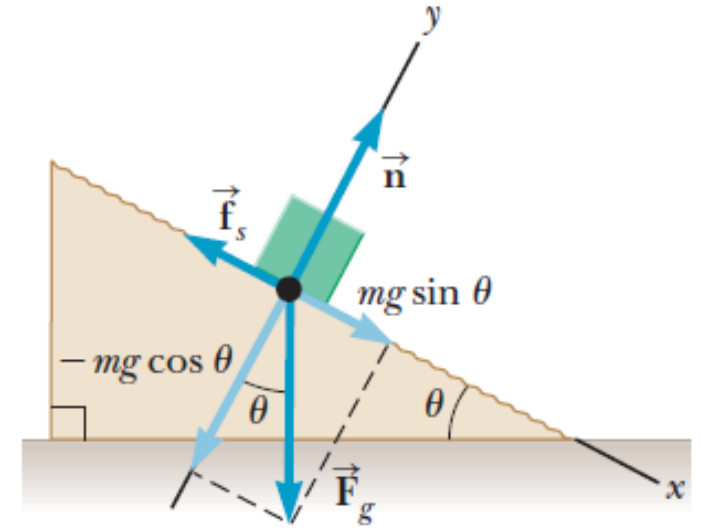
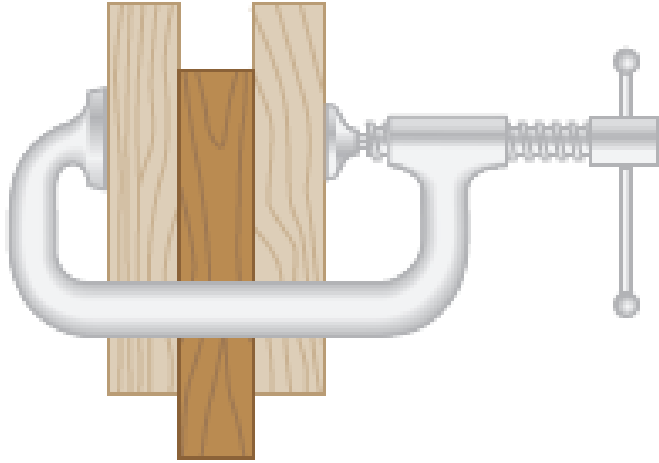


$$F_s = \mu mg$$



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Friction force

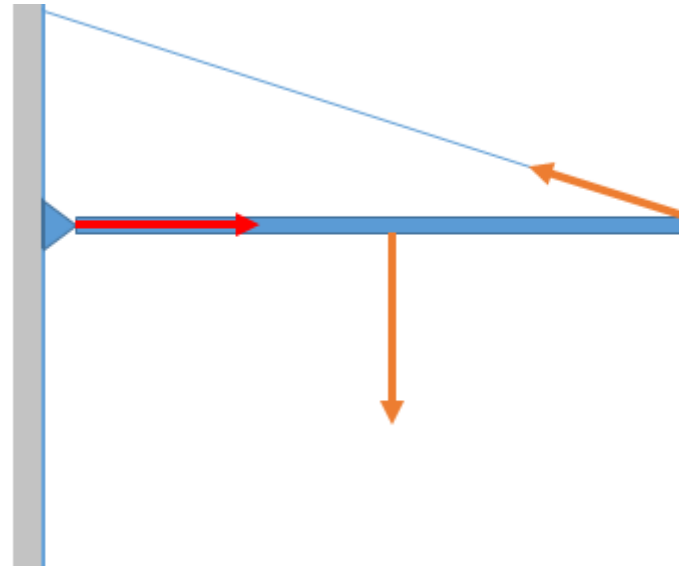
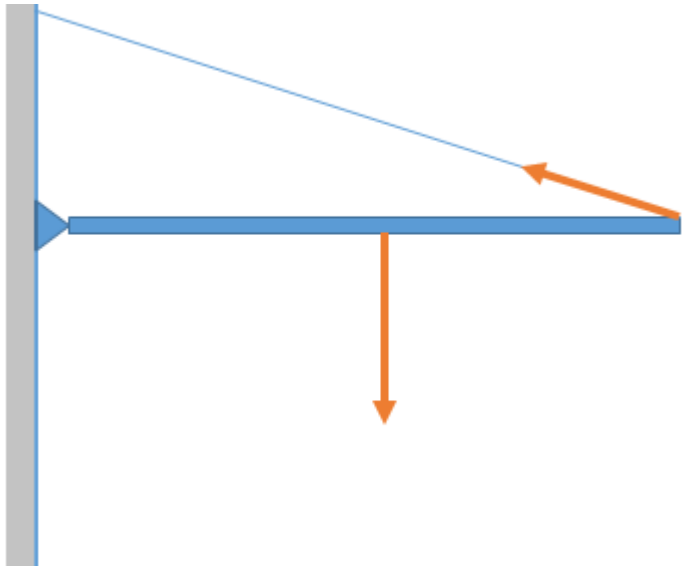


Problem: A board sandwiched between two other boards weights 100 N. $\mu=0.1$. What must be the compression forces acting on both sides of the center board to keep it from slipping?

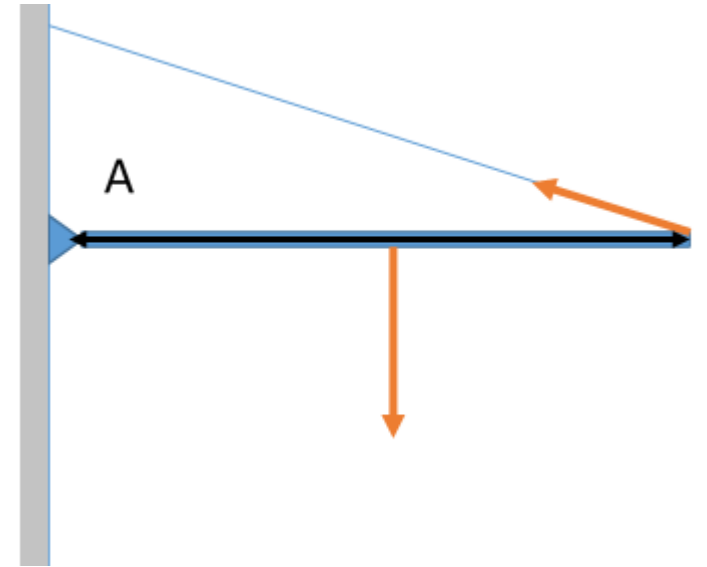
$$F_s = \mu mg \cdot \cos \theta$$

Torque

Problem: A uniform horizontal beam 2 m long and weighing 300N is attached to a wall by a pin connection that allows the beam to rotate. Its far end is supported by a cable that makes an angle of 30° with the horizontal. Find the magnitude of the tension in the cable.

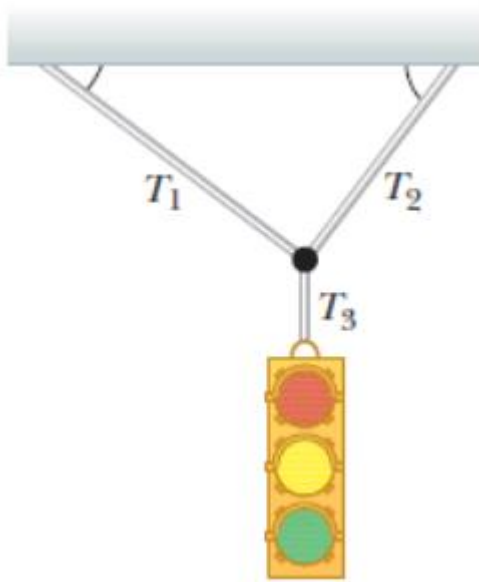


missing or misdirected
force

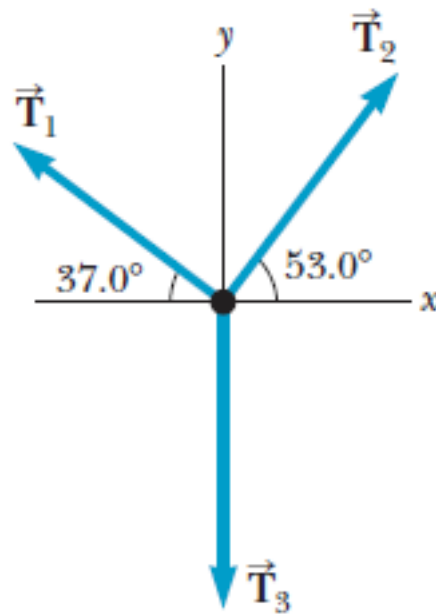


lever arm

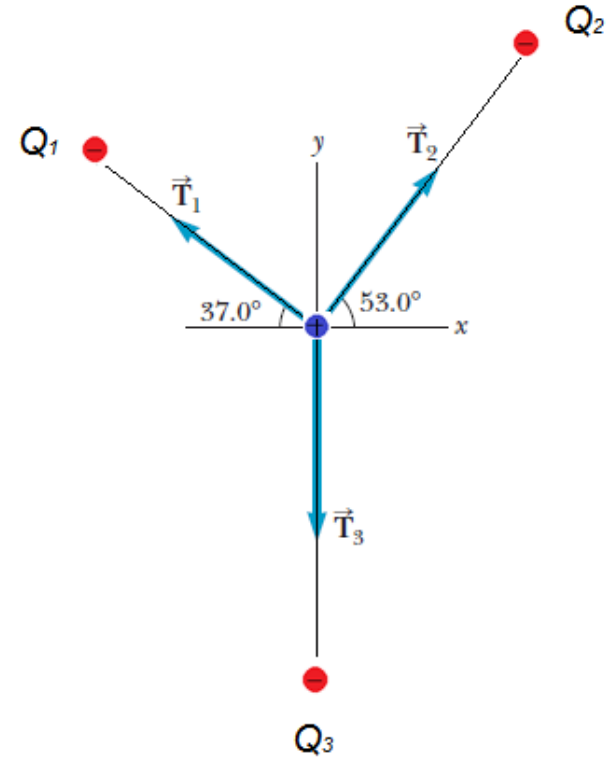
Is it in an equilibrium?



Problem: traffic light suspended by cables



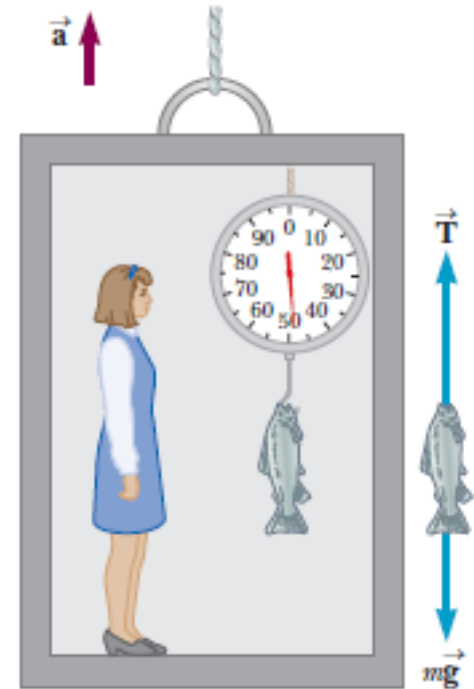
Same free-body diagram



Problem: charges at given distance

Using short term memory

Problem: At the market the weight of a fish is 40 N. What weight does the scale read in an elevator accelerates upward at 2 m/s^2 ?



Required skills/knowledge

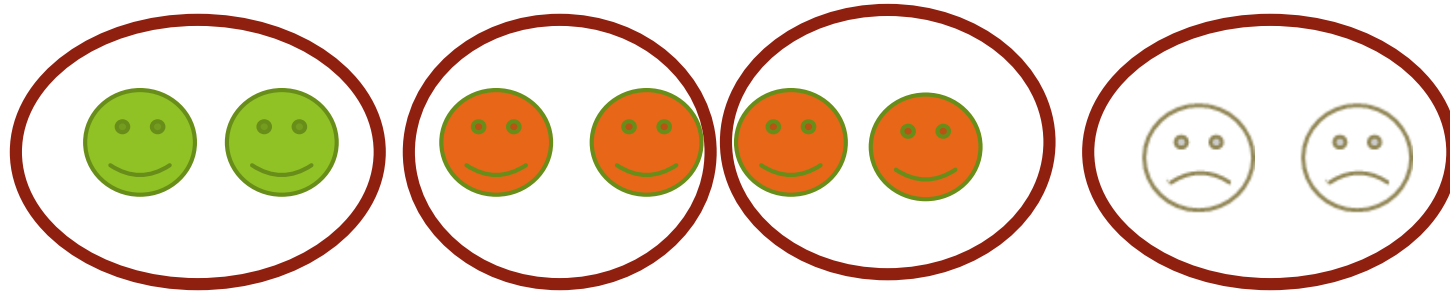
- ▶ Reading comprehension
- ▶ Study skills
- ▶ Note-taking skills
- ▶ Mathematical knowledge
 - Vectors
 - Graphs of functions
 - Equations
 - Basic trigonometry
- ▶ Physics knowledge

„What’s the problem/goal?”

Inaccurate definitions, formulas

Equation rearrangement,
Miscalculations

Misconceptions: e. g. Aristotle’s
conception



Can extra courses replace studying physics at high school?

Thank you for your attention!