



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

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# In Hungary...

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

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

- ▶ Low minimum score



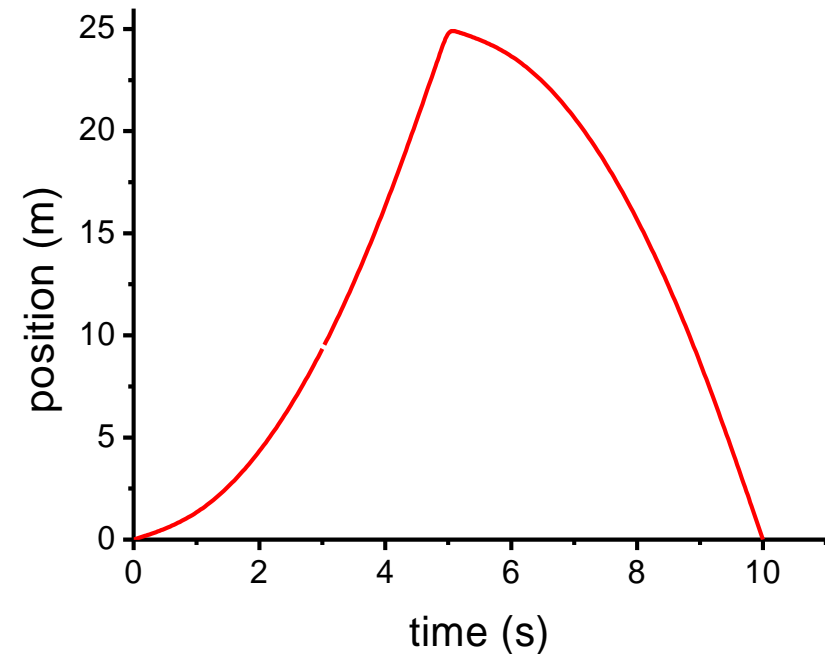
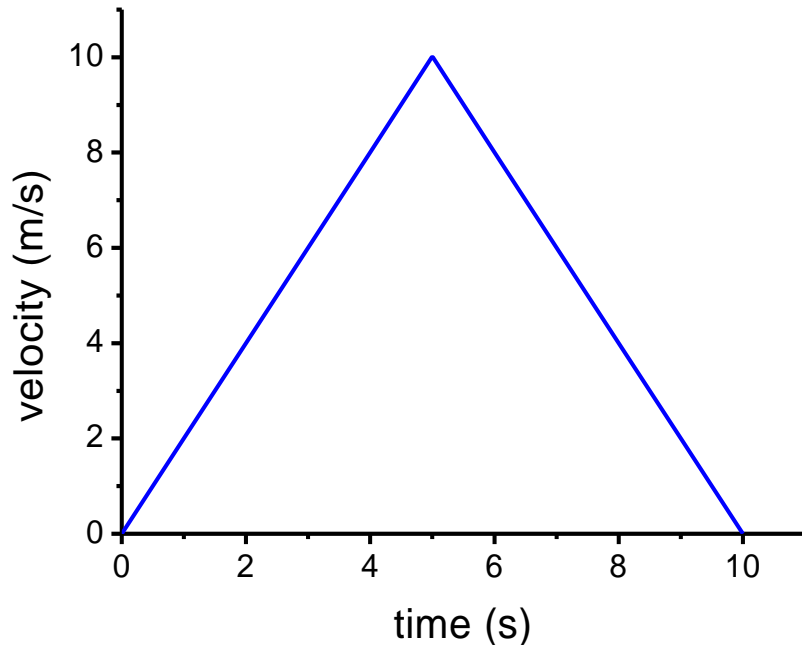
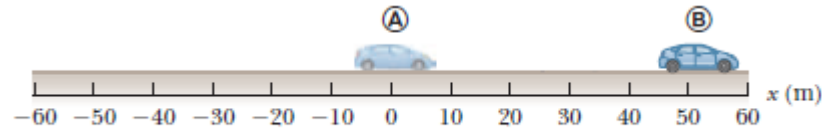
students with poor physics knowledge



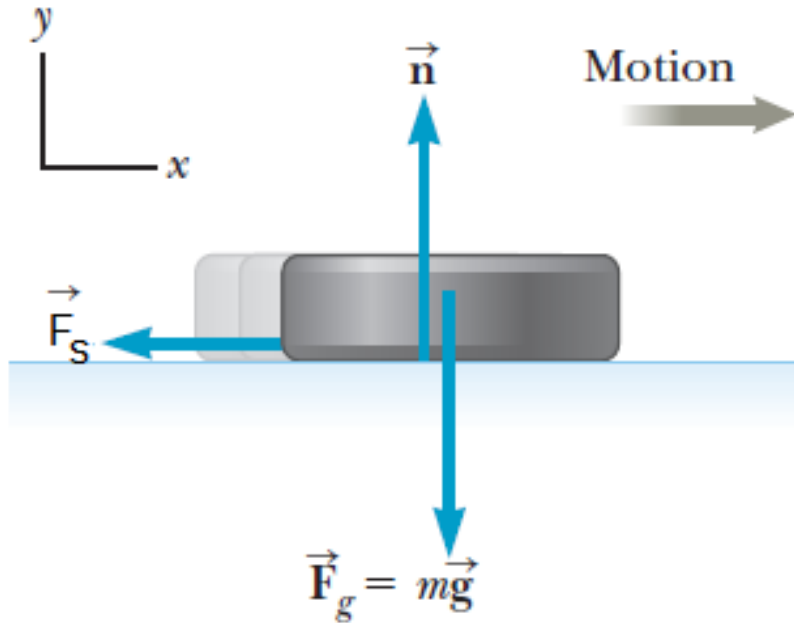
extra courses

# 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.

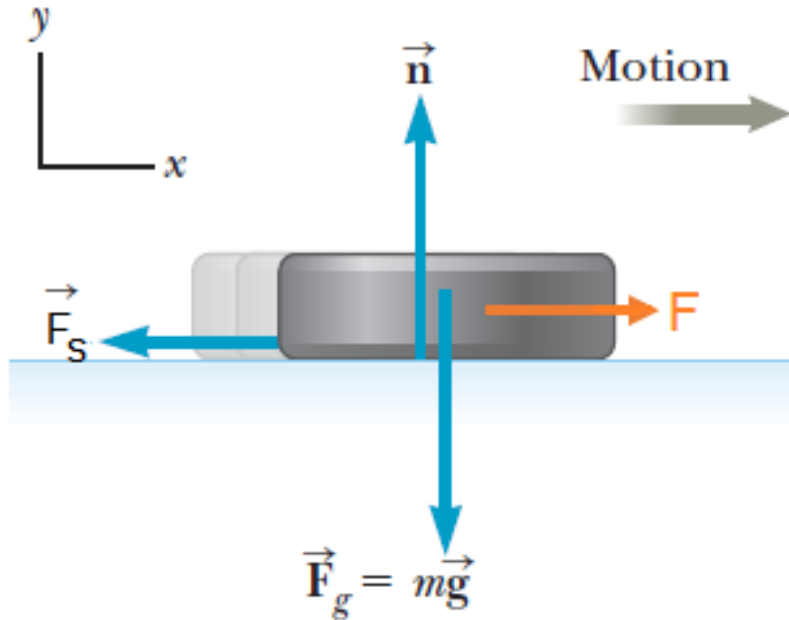


# Misconceptions



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

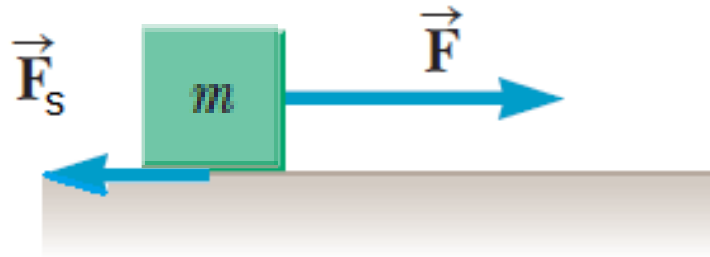


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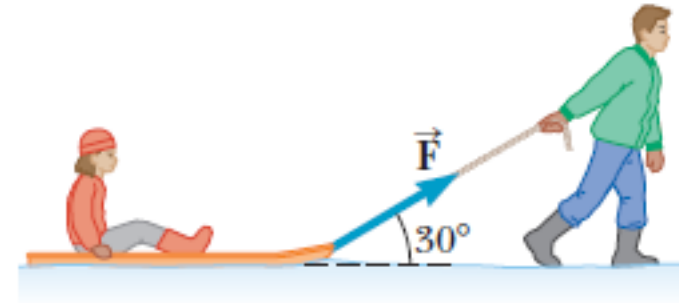
$$F - F_s = m \cdot a$$

# Friction force

Problem: Determine the friction force.

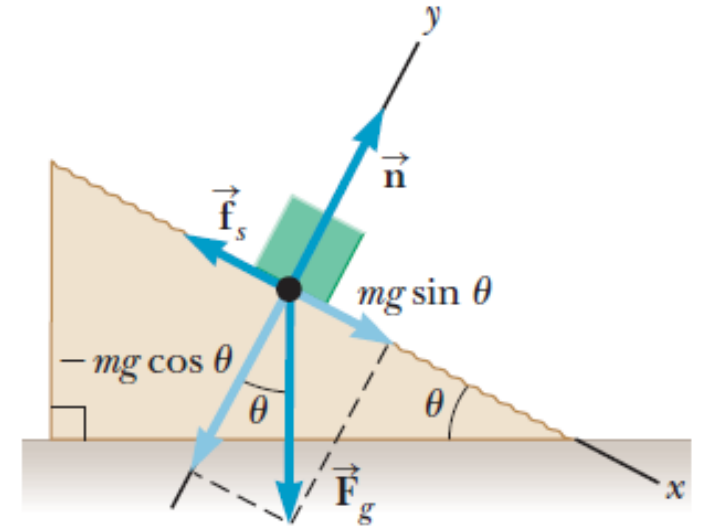
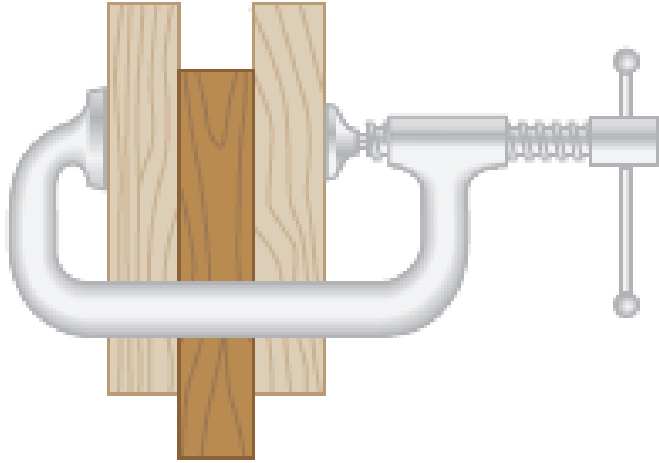


$$F_s = \mu mg$$



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# Friction force

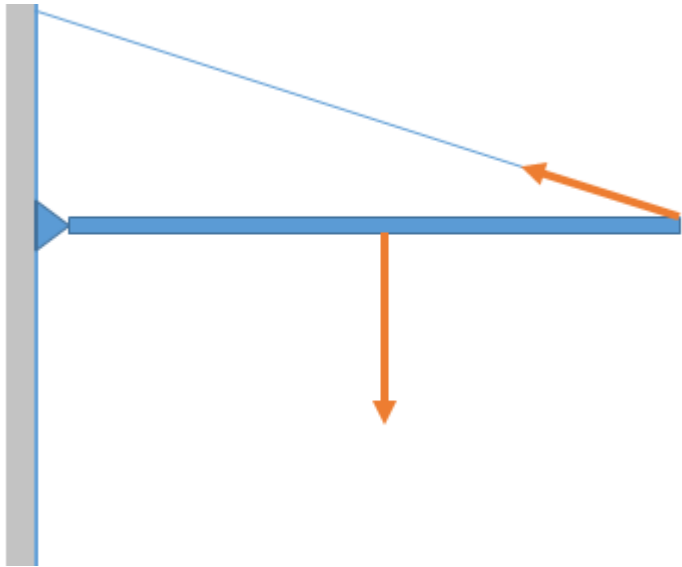


Problem: A board sandwiched between two other boards weights 100 N.  $\mu=0.1$ . What must be the compression forces acting on both sides of the center board to keep it from slipping?

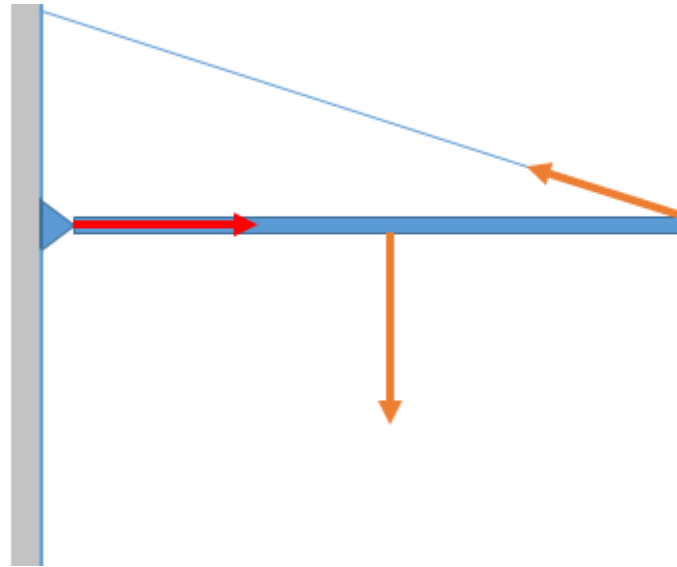
$$F_s = \mu mg \cdot \cos \theta$$

# Torque

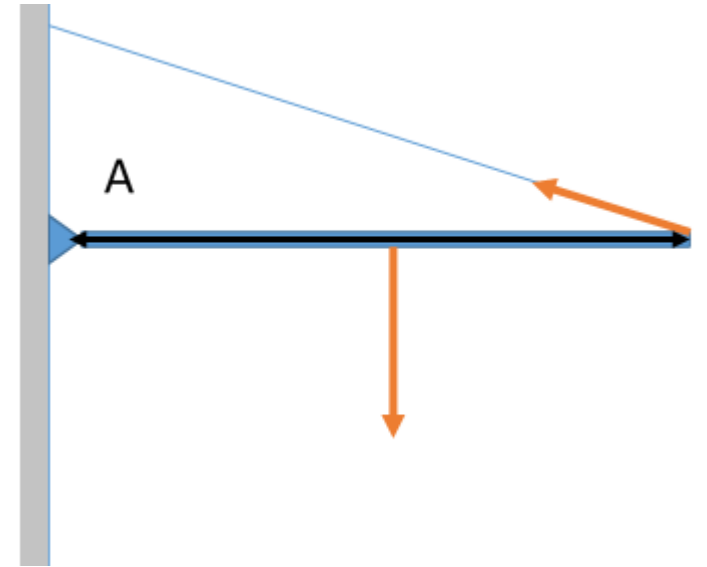
Problem: A uniform horizontal beam 2 m long and weighing 300N is attached to a wall by a pin connection that allows the beam to rotate. Its far end is supported by a cable that makes an angle of  $30^\circ$  with the horizontal. Find the magnitude of the tension in the cable.



missing or misdirected  
force

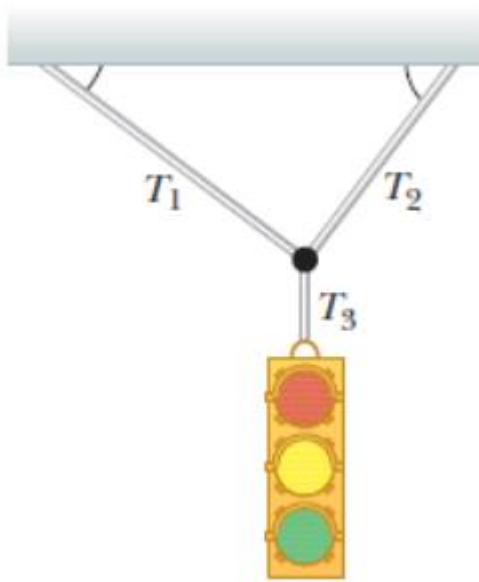


lever arm

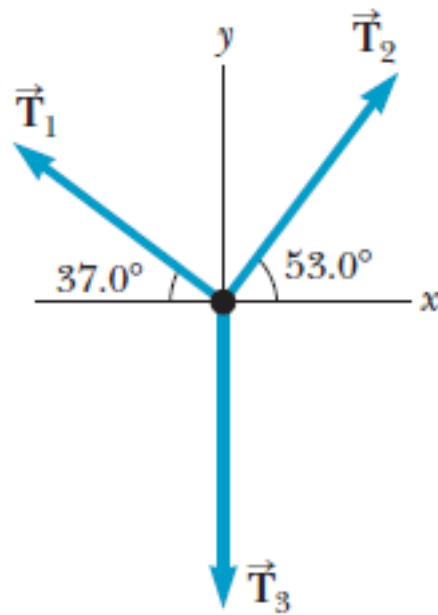




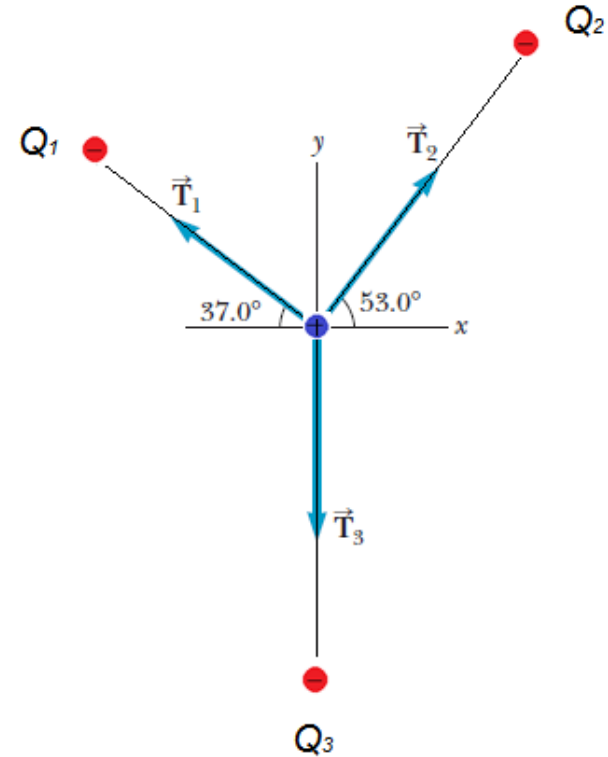
# Is it in an equilibrium?



Problem: traffic light suspended by cables



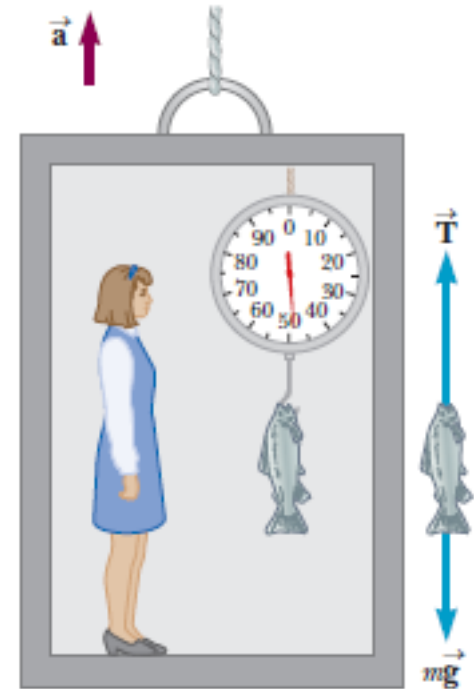
Same free-body diagram



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  $2 \text{ m/s}^2$  ?



## 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!**