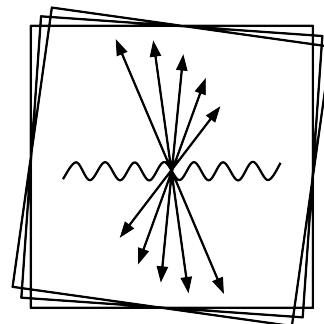


International Physics Competition

The Education Program & Talent Search in Physics

Edition of 2025

Qualification Round



Problem A: The Head-Start Race (5 Points)

A human and a turtle compete in a 1 km race. The turtle moves at a constant speed of 0.2 km/h and receives a 980 m head start. The human runs at a constant speed that is 100 times greater than the turtle's speed. Both start moving at the same moment from their respective starting points.

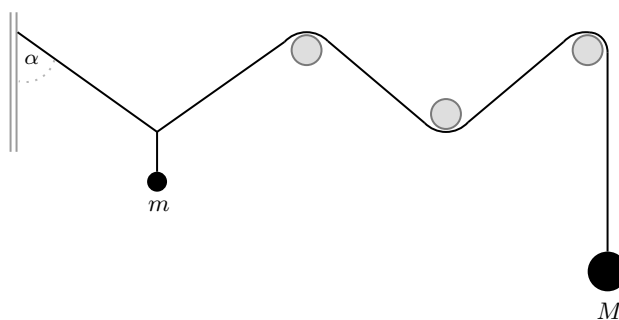
Question: Who reaches the finish line first?



Problem B: Static Balance (5 Points)

A mass $m = 2$ kg hangs at rest from a vertical string. At the top of this string, two other strings are attached: one is fixed to a wall, and the other passes over three ideal pulleys to a mass M . The two upper strings each make an angle of $\alpha = 80^\circ$ with the vertical.

Task: Determine the mass M .



Problem C: Pressure in a Bottle (5 Points)

You bring an empty cylindrical bottle in your backpack. Its length is 20 cm and its radius is 3 cm. The bottle is closed at ground level, where the temperature is 20°C and the pressure is 100 kPa. You then hike to the top of a mountain, where the temperature is 16°C .

Question a: How many air molecules are contained inside the bottle?

Question b: What is the pressure inside the bottle at the top of the mountain?

Note: Assume the air behaves as an ideal gas.

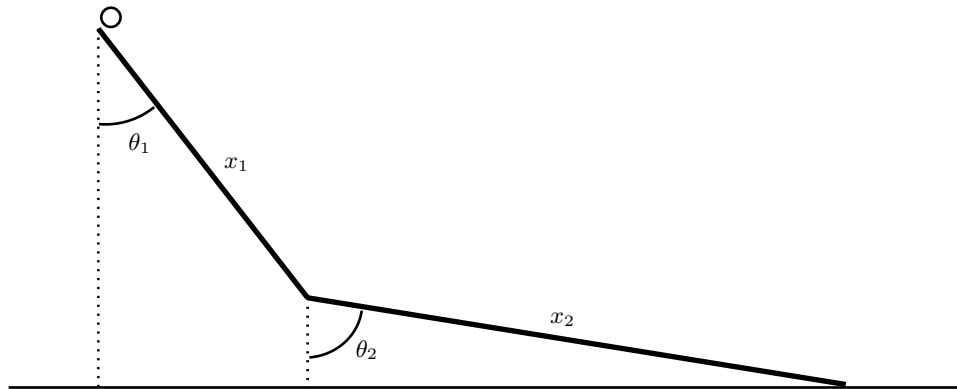
Problem D: Rolling Ball (5 Points)

A small ball is placed at the top of a straight slope of length x_1 , inclined at an angle θ_1 to the vertical. At the bottom, this slope joins a second straight slope of length x_2 , inclined at an angle θ_2 to the vertical. The ball is released from rest and slides without friction along both slopes.

Task: Show that the time T needed for the ball to reach the end of the second slope can be expressed as

$$T = \sqrt{\frac{2x_1}{g \cos \theta_1}} \cdot \left(1 + \frac{\cos \theta_1}{\cos \theta_2} \left[\sqrt{1 + \frac{x_2 \cos \theta_2}{x_1 \cos \theta_1}} - 1 \right] \right),$$

where g is the gravitational acceleration.



Problem E: The Blue Sky (5 Points)

When you look up on a clear day, the sky above you appears bright blue, even though the light coming from the Sun looks white. At sunrise and sunset, however, the sky can become red or orange.

Task: Use physical principles from optics and the interaction of light with matter to explain why the sky appears blue during the day.



Participation Instructions:

- ✓ Write your solutions by hand on separate sheets of paper or type them on a computer.
- ✓ Submit your solutions online by **Sunday, 1 February 2026**, 23:59 UTC+0 via the submission form: <https://iphyc.org/submission>
- ✓ You do not need to include the problem statements in your solution document.
- ✓ Show your work to receive full marks.
- ✓ Clearly label each problem and highlight your final answers.
- ✓ You need to score at least 15/17/20 points as Junior/Youth/Senior to qualify for the Semi-Final Round (see <https://iphyc.org/age-groups> for details).
- ✓ If you have questions, feel free to reach out to us at any time: info@iphyc.org