This project was imagined by Frédéric Bouquet (Paris-Saclay University) and Giovanni Organtini (Sapienza Università di Roma, Italy).

Physics: Frédéric Bouquet, Giovanni Organtini, Julien Bobroff

Videos, photos, gifs: Amel Kolli

Graphic design and illustrations: Anna Khazina

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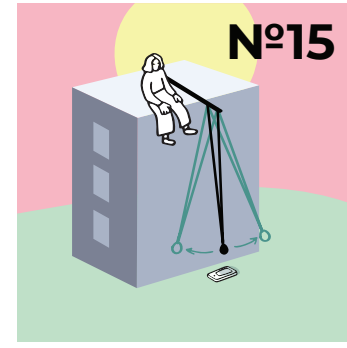
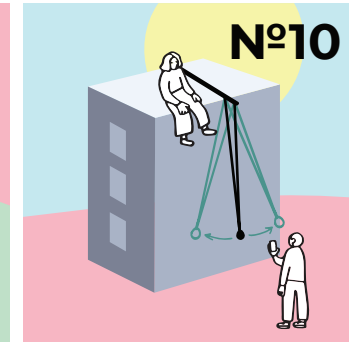
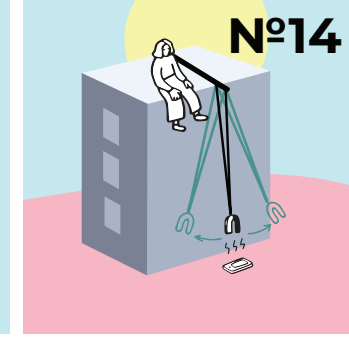


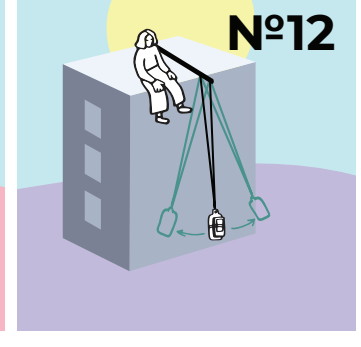


Challenge

GIANT PENDULUM

Get inspired by Galileo and measure the height of a building... using a smartphone!

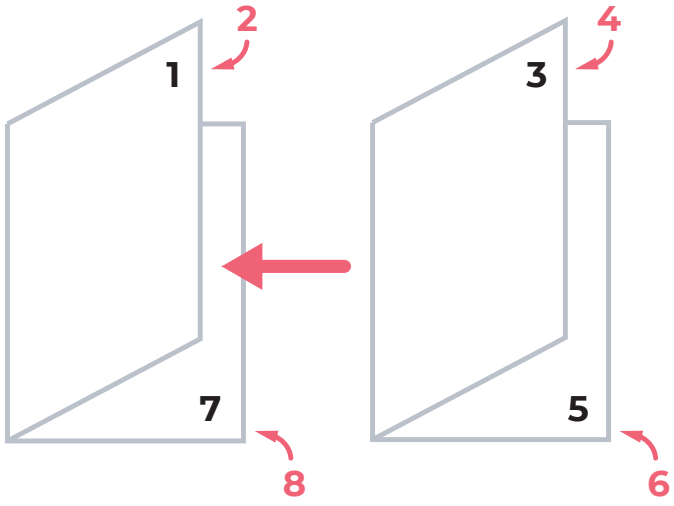




Discover The Smartphone Physics Challenge at VULGARISATION.FR

«Physics Reimagined» team (Paris-Saclay University)

To assemble the booklet:



Print on two A4 sheets using both sides (select short-edge binding), then assemble the booklet by folding the sheets in two.

To do measurements with your smartphone:

Install Phyphox app on your phone. This app is developed by Aachen University, it's free and open-source, translated in English and available for Android and iOS. Phyphox allows to conduct measurements using your smartphone built-in sensors.

Precision: high

Difficulty: intermediate

№17. Giant Pendulum with Sound

Formula

$$H = g\left(\frac{T}{2\pi}\right)^2$$

Material

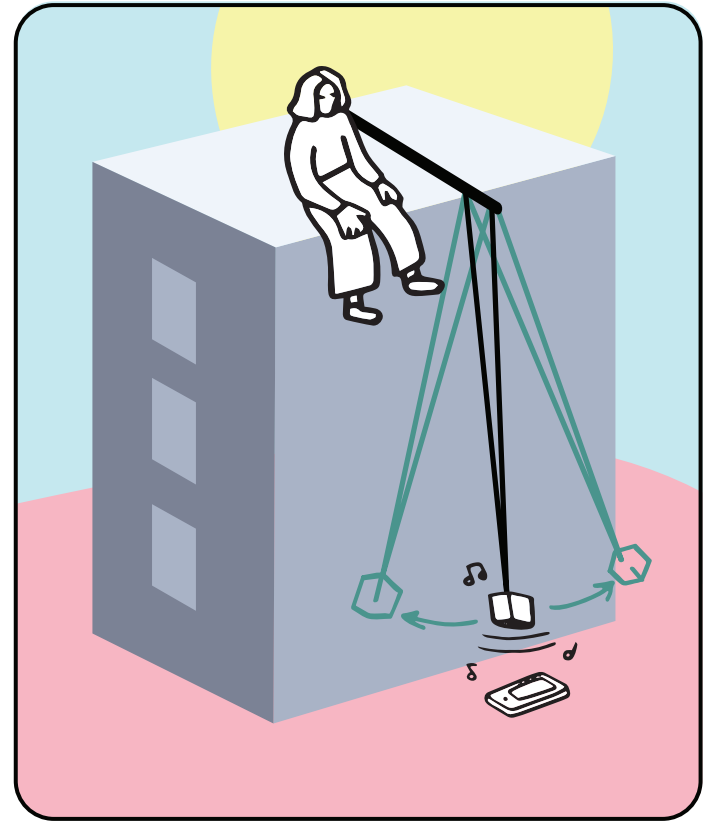
1 long rope

1 mass

1 bluetooth speaker

1 smartphone

Sensor: **micro-phone**



Make a giant pendulum the size of the building. Attach the speaker to the pendulum, and send a constant sound. Position the smartphone vertically, and use the variation in the amplitude of the recorded sound to determine the period.

T = pendulum period,
g = 9.8 ms^{-2}

The pendulum must not rotate in all directions, it must only swing.

Precision: high

Difficulty: intermediate

№15. Giant Pendulum & Light

Formula

$$H = g\left(\frac{T}{2\pi}\right)^2$$

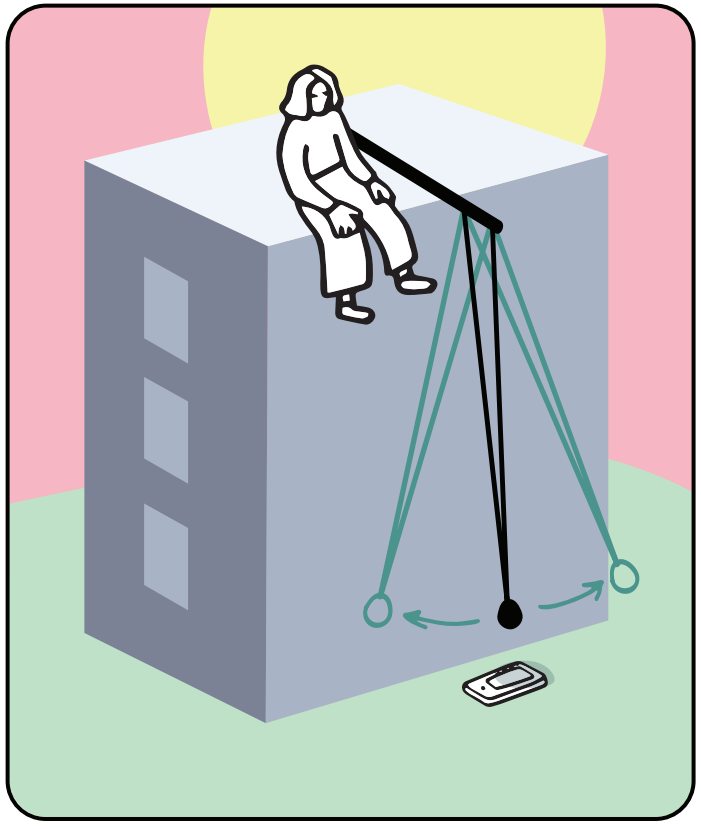
Material

1 long rope

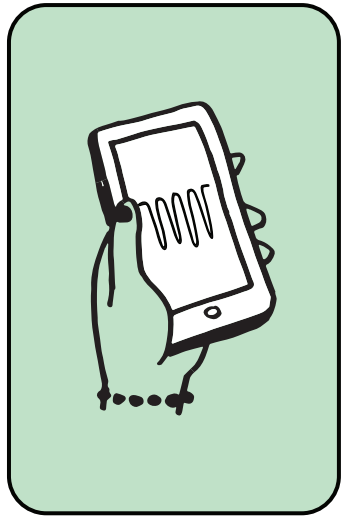
1 mass

Sensor: **light sensor**

1 smartphone



Make a giant pendulum the size of the building. Position the smartphone vertically to detect the shadow of the pendulum.



T = pendulum period,
g = 9.8 ms^{-2}

The pendulum must not rotate in all directions, it must only swing.

Precision: maximum

Difficulty: intermediate

№10. Giant Pendulum Timed

Formula

$$H = g\left(\frac{T}{2\pi}\right)^2$$

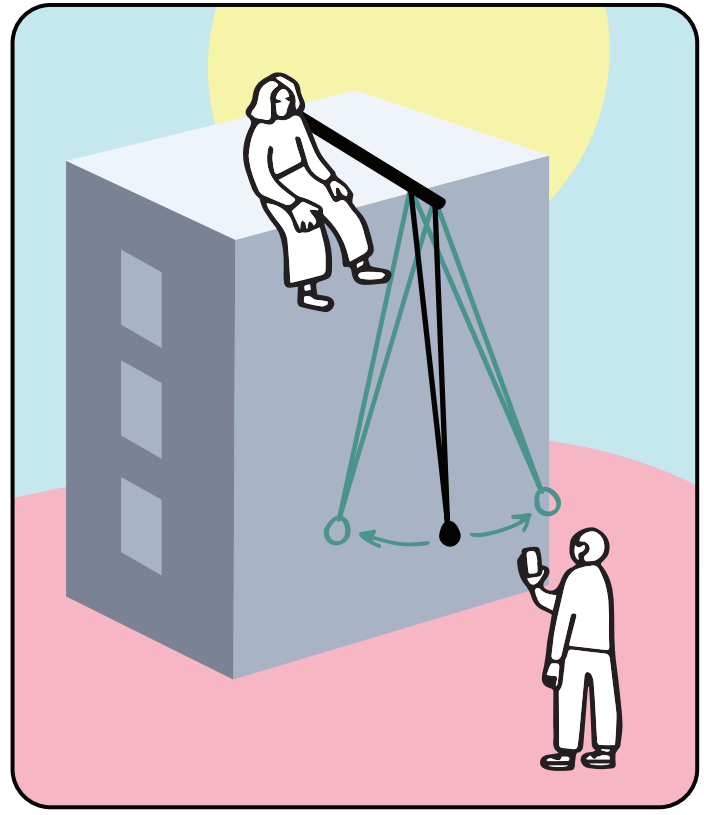
Material

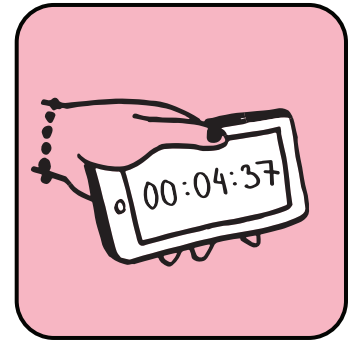
1 long rope

1 mass

Sensor: **stopwatch**

1 smartphone





Make a giant pendulum the size of the building. Use the smartphone timer to determine the period.

T = pendulum period,
g = 9.8 ms^{-2}

The pendulum must not rotate in all directions, it must only swing.

Precision: low

Difficulty: intermediate

№12. Giant Pendulum & Accelerometer

Formula

$$H = g\left(\frac{T}{2\pi}\right)^2$$

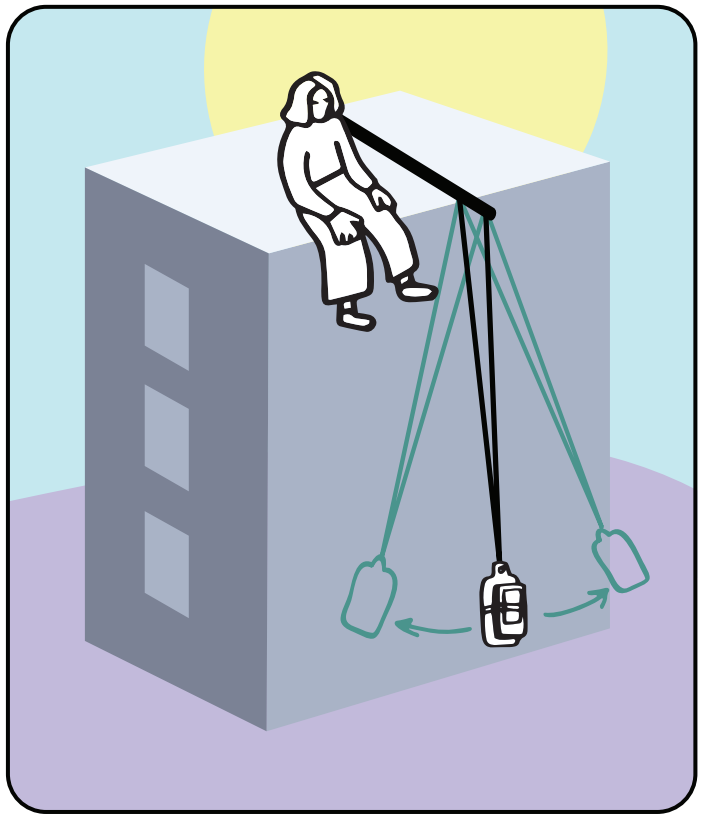
Material

1 long rope

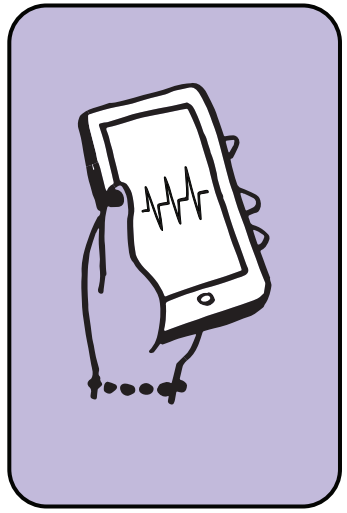
1 mass

Sensor: **accelerometer**

1 smartphone



Make a giant pendulum the size of the building. Attach the smartphone to the pendulum, and use the accelerometer to determine the period.



T = pendulum period,
g = 9.8 ms^{-2}

The higher the building, the smaller the acceleration, and the harder the measure will be.

Precision: high

Difficulty: intermediate

№14. Giant Pendulum & Magnet

Formula

$$H = g\left(\frac{T}{2\pi}\right)^2$$

Material

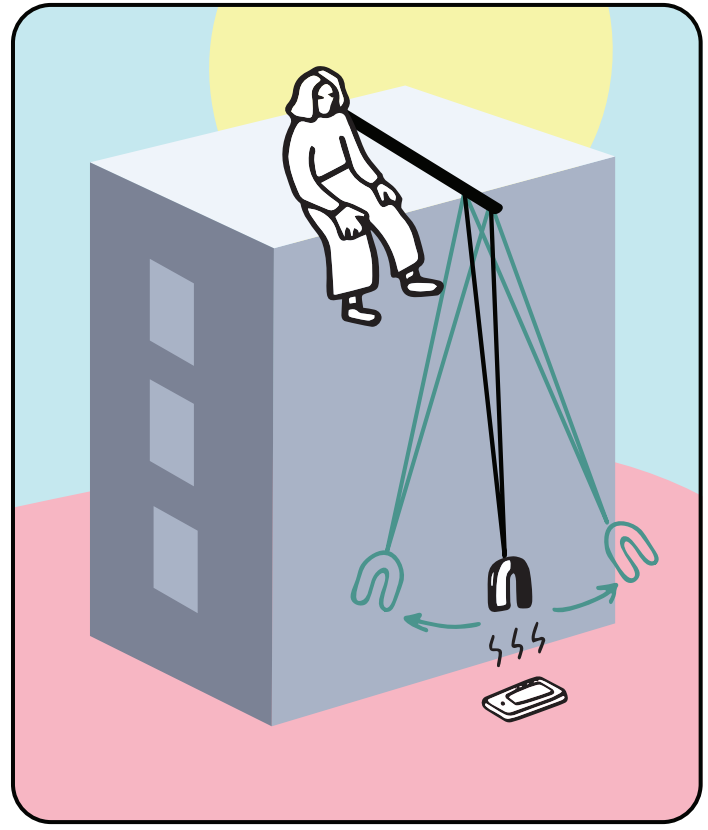
1 long rope

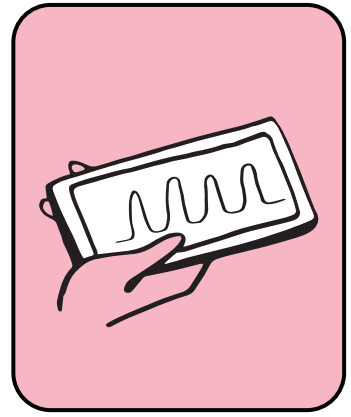
1 mass

1 magnet

Sensor: **magne-tometer**

1 smartphone





Make a giant pendulum the size of the building. Attach a magnet to the pendulum. Position the smartphone vertically to detect the passage of the magnet.

T = pendulum period,
g = 9.8 ms^{-2}

The Earth's magnetic field can be used in place of the magnet; the smartphone must then be fixed on the pendulum.