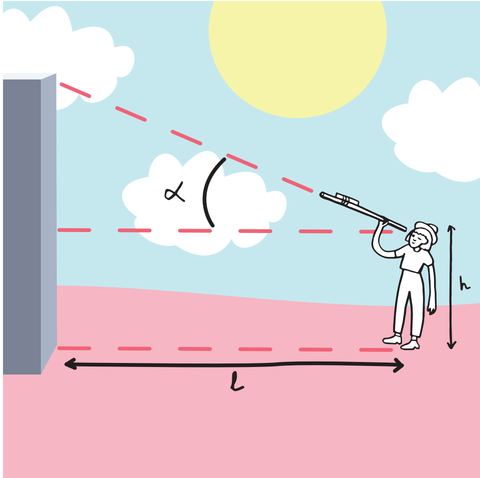
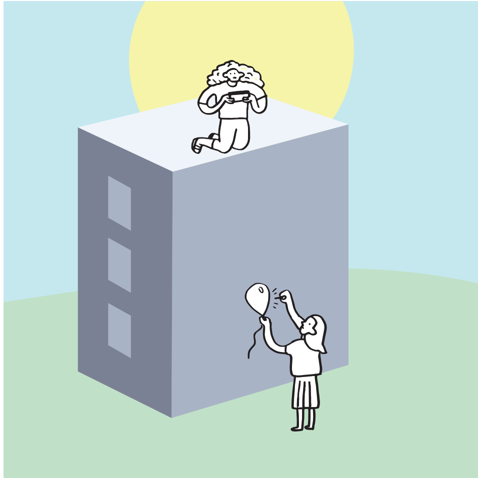
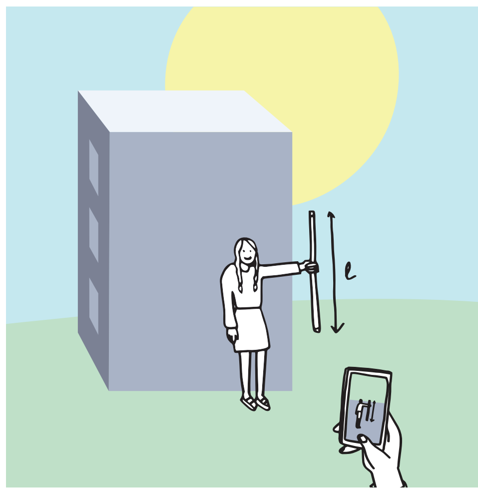


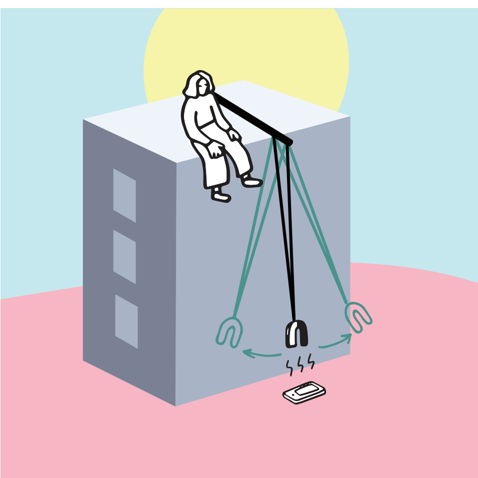


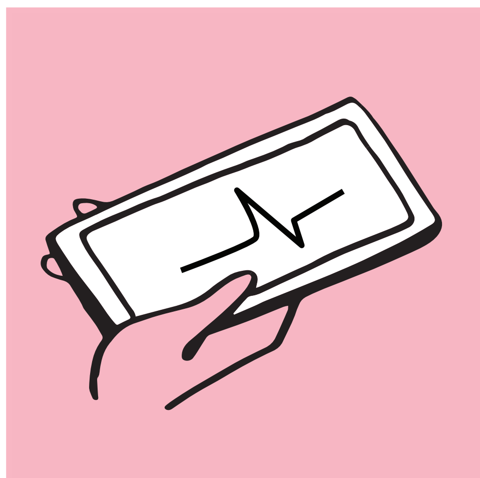
Theme:

NOT WORKING

Methods that should work in theory, but that are best left unused.







Discover The Smartphone Physics Challenge at VULGARISATION.FR

«Physics Reimagined» team (Paris-Saclay University)

№38. GPS

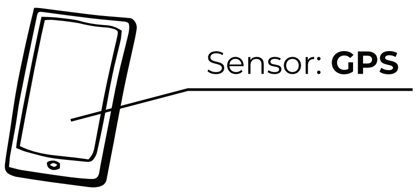
Precision: minimum

Difficulty: minimum

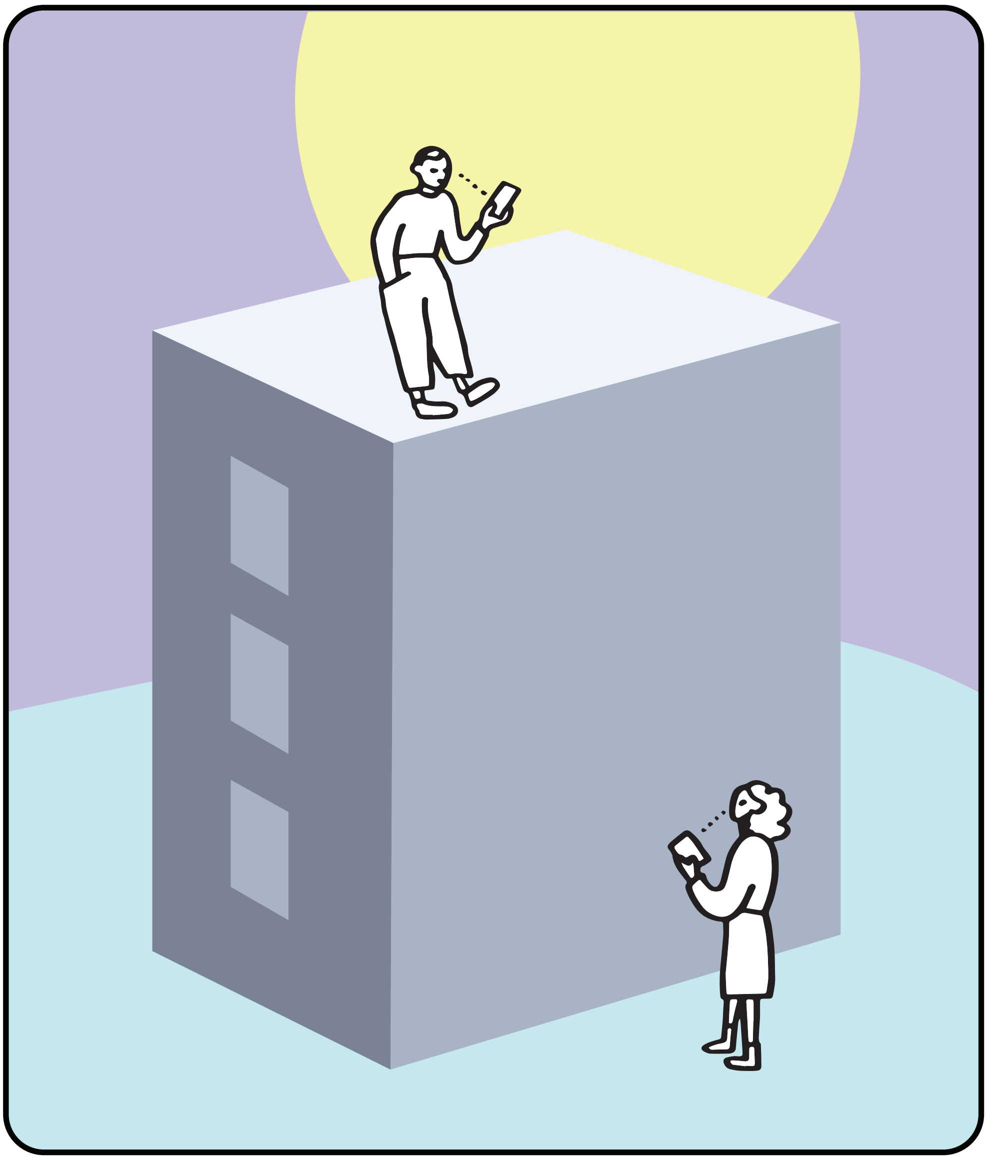
Formula

$$H = h_2 - h_1$$

Material

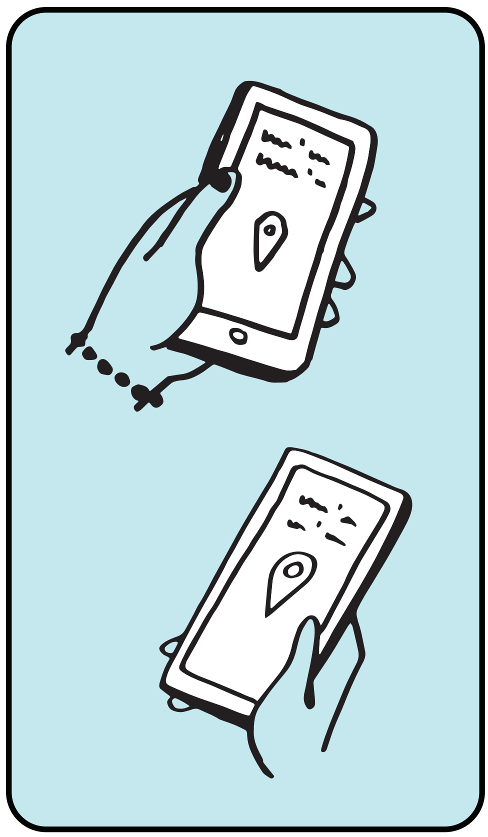


1 smartphone



Use the GPS data to determine the altitude at the bottom and at the top of the building.

h_2 = altitude at the top of the building, h_1 = altitude at the bottom



The altitude function of the GPS is really not accurate.

Precision: minimum

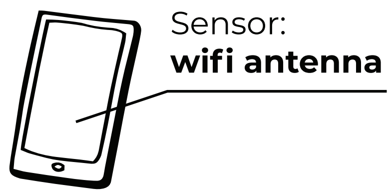
Difficulty: low

№51. Wifi Intensity

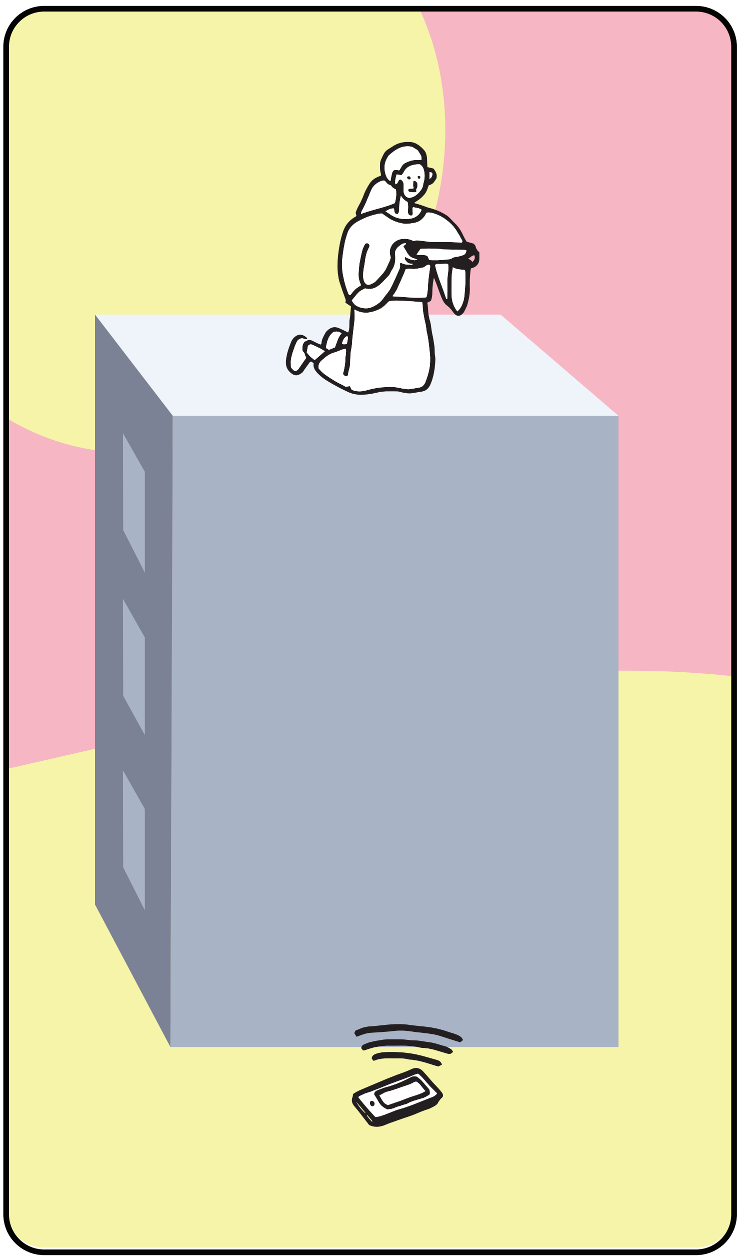
Formula

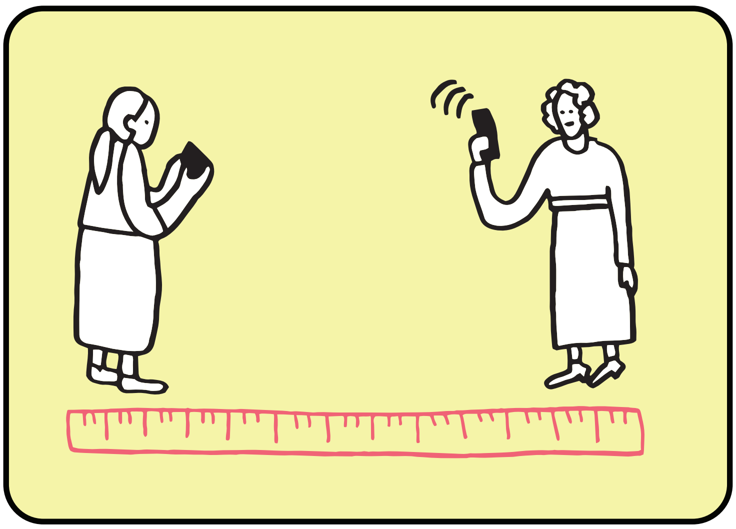
$$H \propto \frac{1}{\sqrt{I}}$$

Material



2 smartphones





I = wifi intensity

Turn the hotspot on for the smartphone at the bottom of the building, and measure the wifi intensity at the top of the building. When no perturbation is present, the intensity of a propagating electromagnetic wave varies in $1 / R^2$, and must be calibrated before.

Precision: high

Difficulty: impossible

№53. Radioactivity

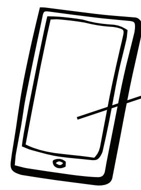
Formula

$$H \propto \frac{1}{\sqrt{I}}$$

Material

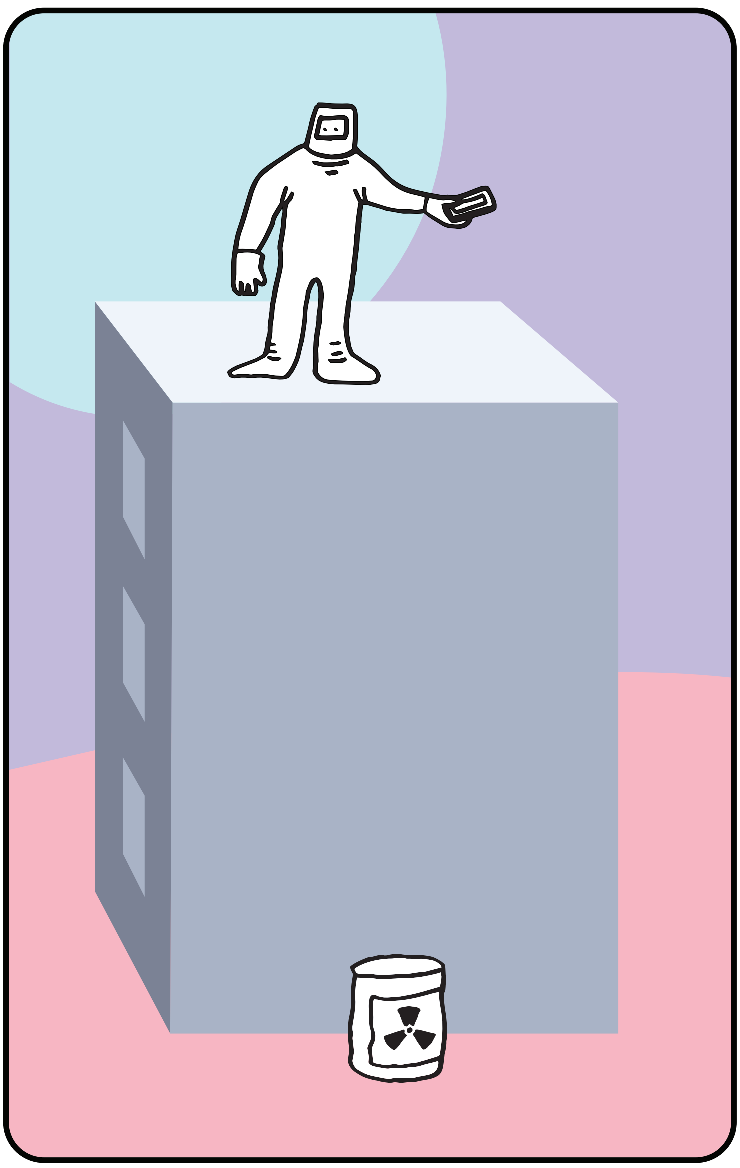
1kg of plutonium

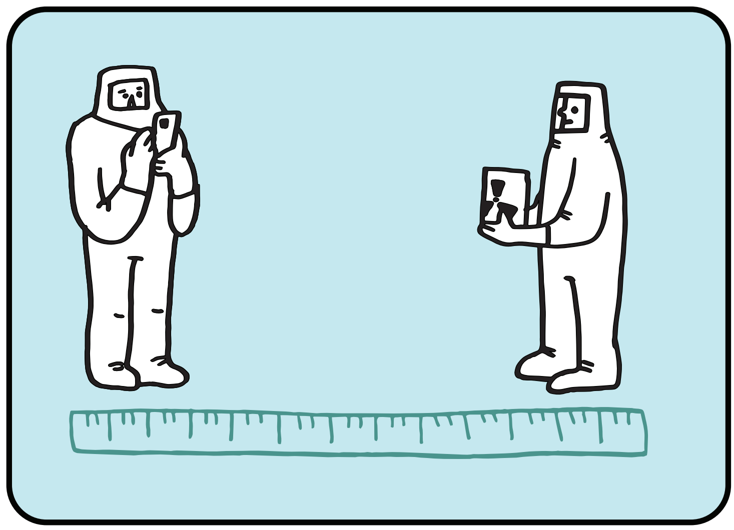
black tape



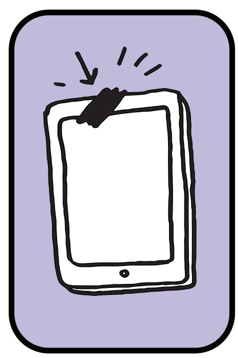
Sensor: **CCD sensor**

1 smartphone





Turn your smartphone into a Geiger counter with black tape. Install the plutonium at the bottom of the building, and measure the radio-activity at the top. The radioactive intensity varies in $1 / R^2$, and must be calibrated before.



I = radioactive intensity

This method works in theory, but is too dangerous to be conducted for real.

Precision: awfully bad

Difficulty: low

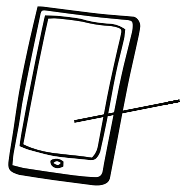
№57. Small Pendulum

Formula

$$H = \frac{T_2 - T_1}{2\pi}\sqrt{\frac{GM}{l}}$$

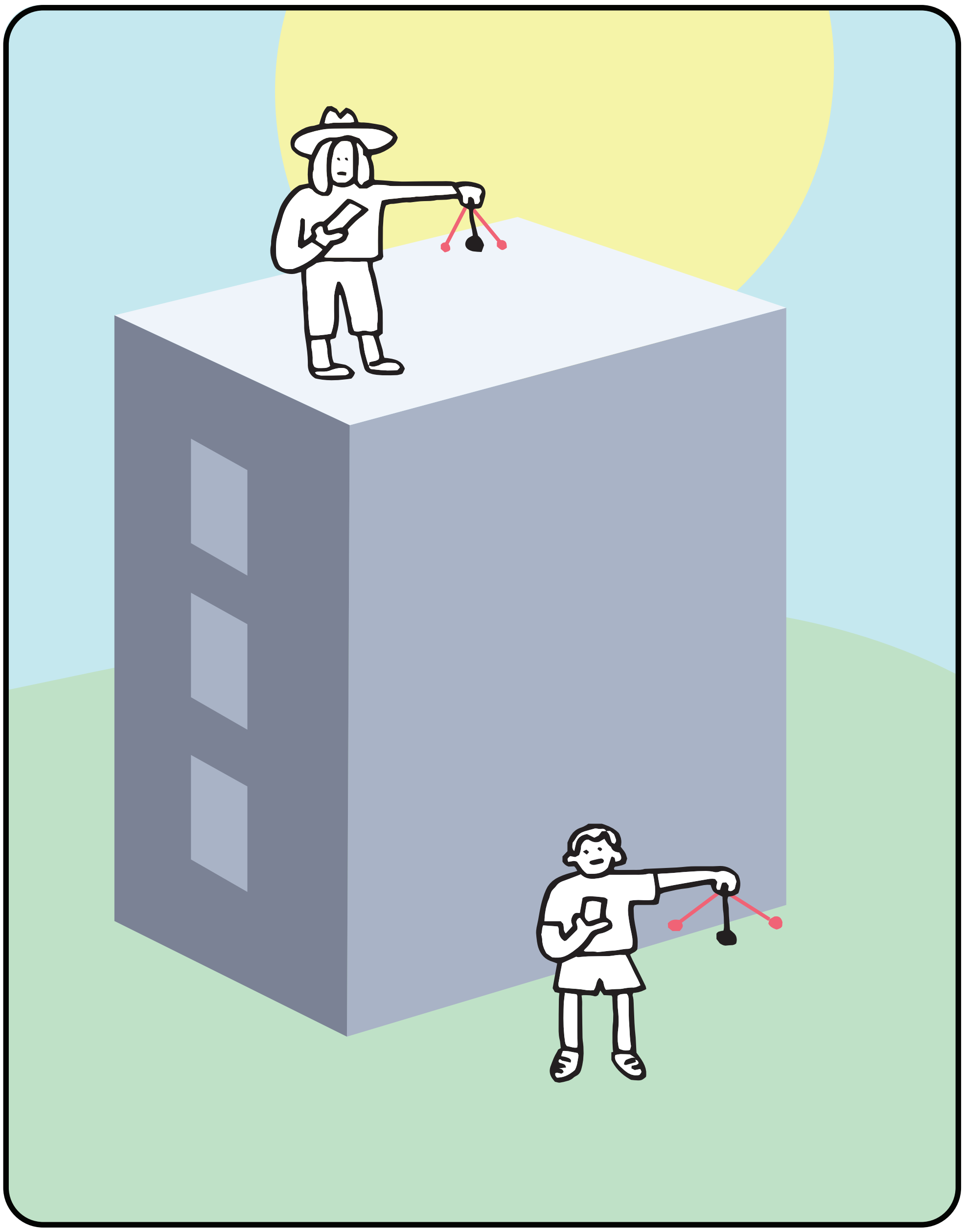
Material

1 rope



1 smartphone

Sensors:
stopwatch, camera, accelerometer, gyroscope, magnetometer, light sensor, proximity sensor, microphone



Make a pendulum with your smartphone, and measure its period when it is at the bottom then at the top of the building, using the sensor of your choice. The difference of the periods makes it possible to determine the height if the measure is sufficiently precise.

T_2 and T_1 = periods of the pendulum at the bottom and at the top, l = length of the pendulum, G = universal constant of gravitation, M = mass of the Earth

Precision: awfully bad

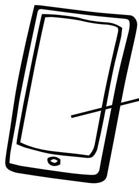
Difficulty: minimum

№58. Gravity Variation

Formula

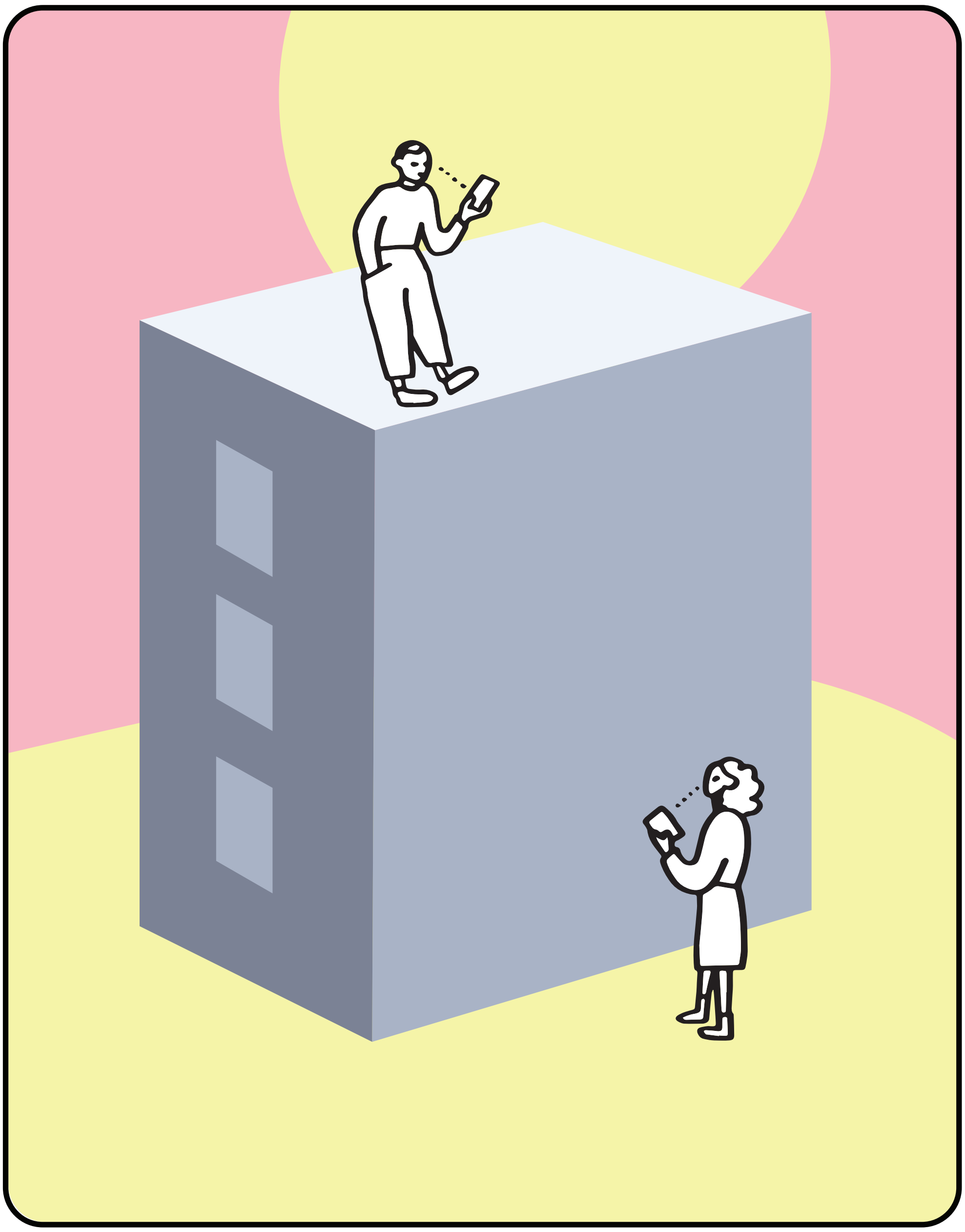
$$H = \frac{R}{2} \frac{g_2 - g_1}{g_2}$$

Material

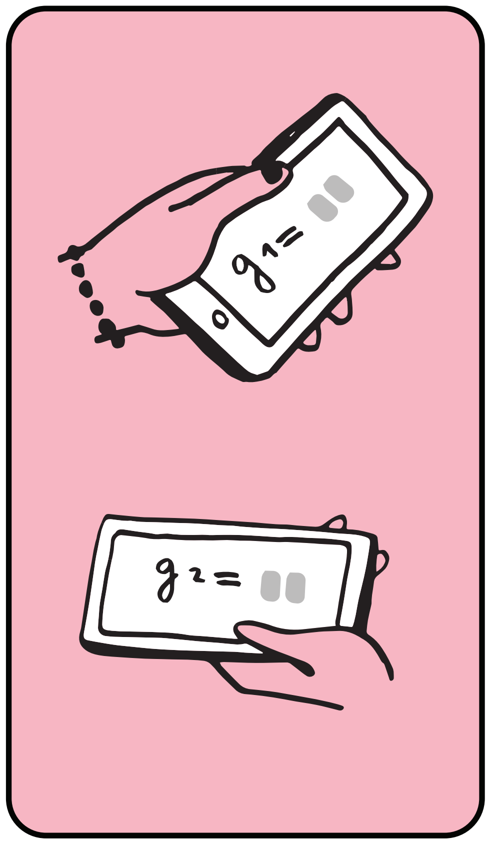


Sensor: **accelerometer**

1 smartphone



Measure gravity at the top and at the bottom of the building with the accelerometer.



R = radius of the Earth, g_1 and g_2 = gravity at the top and bottom of the building

Precision: awfully bad

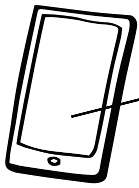
Difficulty: minimum

№59. Earth Magnetism

Formula

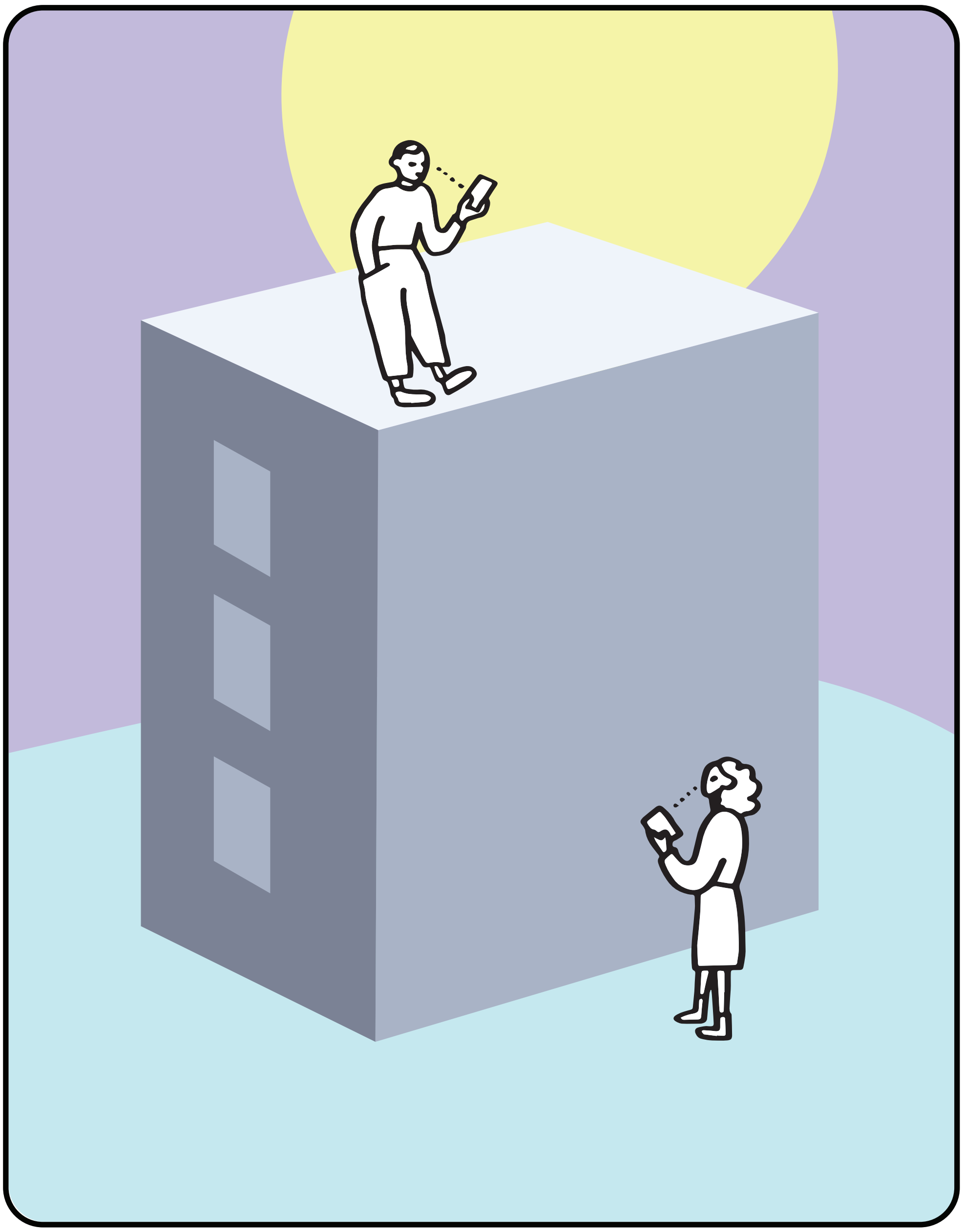
$$H = \frac{R}{3} \frac{B_2 - B_1}{B_2}$$

Material

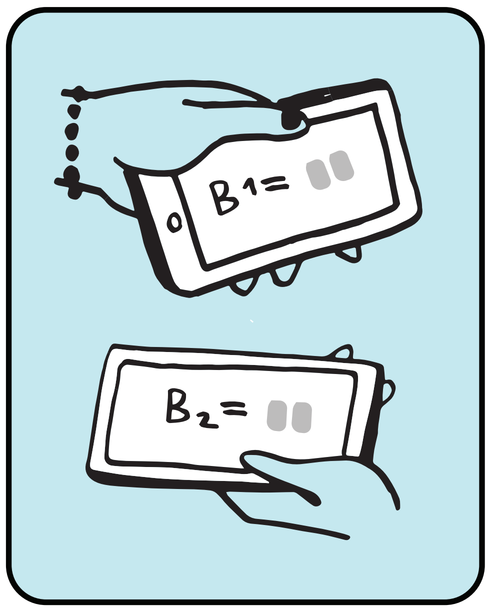


Sensor: **magnetometer**

1 smartphone



Measure the magnetic field at the top and bottom of the building. Assuming that the magnetic field of the Earth is that of a dipole and that the building does not produce nor contain any magnetic field, the height can be determined.



R = Earth's radius, B_1 and B_2 = Earth's magnetic field at the bottom and top of the building.

Precision: awfully bad

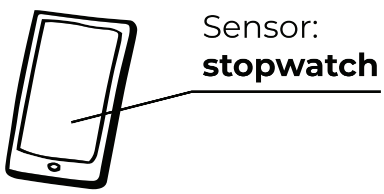
Difficulty: minimum

№60. General Relativity

Formula

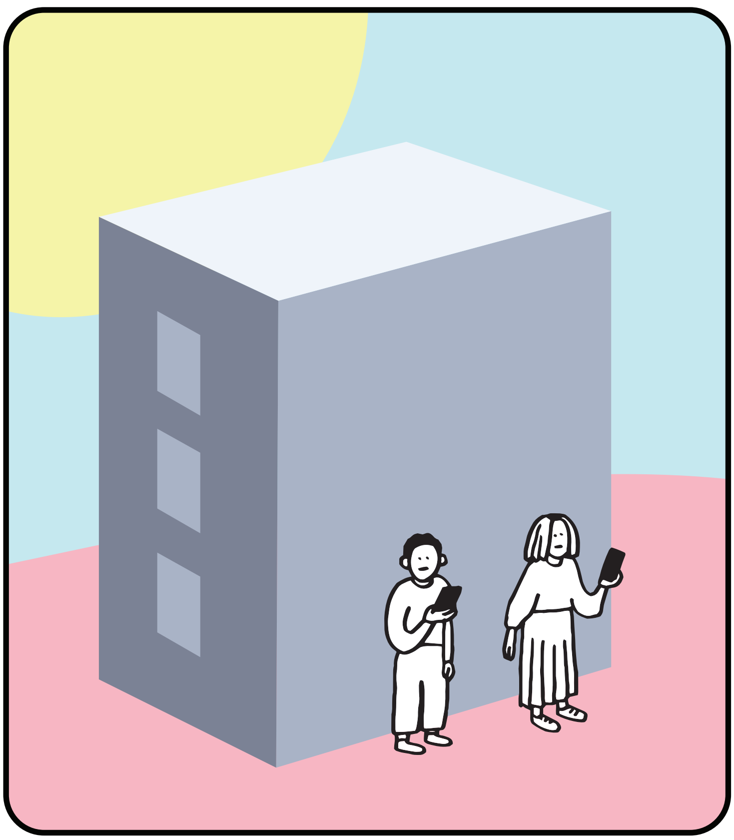
$$H = \frac{c^2}{g}\frac{\delta t}{t}$$

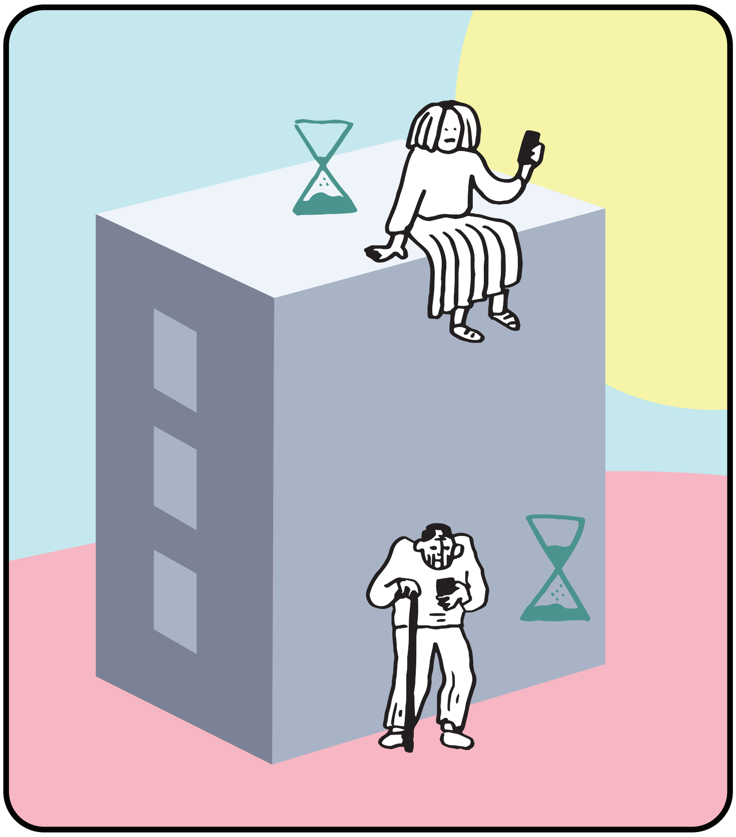
Material



2 smartphones

At the bottom of the building, start both chronometers, then go to the top of the building with one of the smart-phones. Wait for a while, then go down again. Measure the delay (due to general relativity) between the two chronometers.





c = speed of light, g = gravity, δt = difference between the two chronometers, t = duration of the experiment

The effect of velocity (twin paradox) is negligible in front of the effect of altitude in this situation.

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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