

Tutorial Exercises in Physics 1 / Set 1

Exercise 1:

Provide the dimensions and the units of the various physical quantities listed below:

Force **F**, Surface **S**, Volume **V**, Pressure **P**, Density **ρ** , Energy **E**, Power **W**, Potential **U**, and Resistance **R**.

Exercise 2:

The force (modulus) of gravitation is given by: $\mathbf{F} = \mathbf{G} \frac{Mm}{r^2}$. Using the international units derived from the different quantities

1. Find the equation of dimensions and the unit of the gravitational constant G . With M and m (in kilogram: Kg) and r (in meter: m).

Exercise 3:

The quantity of movement (momentum) is written as $\mathbf{p} = m\mathbf{v}$, with m is mass, and v is velocity

1. Determine the dimensions and the unit of p

The expression of energy E as a function of the quantity of movement p is $E = \frac{m^a p^b}{2}$

2. Determine the constants a and b

Exercise 4:

To measure the thickness of a hollow cylinder, we measure the inner diameter **D₁** and the outer diameter **D₂**, and we find $D_1 = 19.5 \pm 0.1$ mm and $D_2 = 26.7 \pm 0.1$ mm.

1. Give the measurement result and its precision (relative uncertainty).

To measure the area **S** of a circle, we measure the radius **R** of the circle and we obtain **R** = 5.21 ± 0.10 cm

2. Give the precision ($\Delta S/S$ in %) of the obtained result?

Exercise 5:

To calculate the terrestrial acceleration **g** of a pendulum, we measure the length of the pendulum

l as well as the oscillation period **T** we use the law: $T = 2\pi\sqrt{\frac{l}{g}}$

With $l = (1.552 \pm 0.002)\text{m}$ and $T = (2.50 \pm 0.02)\text{s}$

1. Calculate **g** with its relative uncertainty as well as its absolute uncertainty

Exercise 6:

Due to the lack of accuracy of our ammeter, we repeat the measurement of the electric current (in mA) flowing through a resistor **R** five times. The results obtained are:

Test	1	2	3	4	5
I (mA)	101.00	102.30	99.80	100.90	98.50

1. Calculate the average value of the measured electric current I_{avr}
2. Calculate the absolute and relative uncertainty of the result obtained.