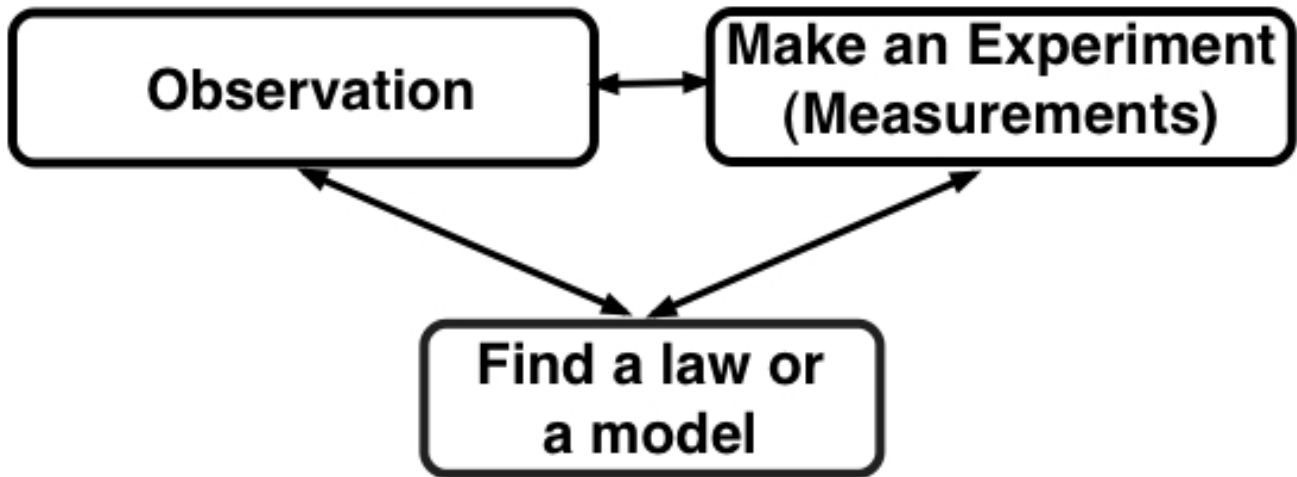


Laboratory: Fundamental Terms and Measurements

1. Basic physical principals, basic units



Experiments are mainly based on observations and measurements. To measure means to compare the dimension, which has to be investigated with a given unit.

$$\text{Physical Quantity} = \text{Numerical Data} \cdot \text{Unit}$$

Examples: 12 m means twelve meters
4.5 kg means four point five kilograms
-10°C means minus ten degree Celsius

All units in physics and technology can be deduced from only 7 **basic units**.

In mechanics we use the following basic units:

Kilogram (kg)
Meter (m)
Second (s)

Deduced units are e.g.: km/h, m/s, m³,

Larger and smaller measurements can expressed with so called prefixes:
kilo, deci, centi, mili

Kilometres:	km	1 km = 1000 m	= 10 ³ m
Decimetre:	dm	1 dm = 0.1 m	= 10 ⁻¹ m
Centimetre:	cm	1 cm = 0.01 m	= 10 ⁻² m
Milimetre:	mm	1 mm = 0.001 m	= 10 ⁻³ m
Megametre	Mm	1 Mm = 1'000'000 m	= 10 ⁶ m
Milligram	mg	1 mg = 0.001 g	= 10 ⁻³ g = 10 ⁻⁶ kg
Milisecond	ms	1 ms = 0.001 s	= 10 ⁻³ s
Kilogram	kg	1 kg = 1000 g	= 1 kg

Exercise: Convert the following measures into basic units:

12.5 cm =

5 dm =

230.54 km =

3.7. Mm =

0.1 ms =

2000 g =

2. Body, Matter

- Attribute of matter:
1. It takes space --> Volume
 2. It has a mass (-> Energie $E = mc^2$)
 3. It consists of atoms and molecules (Model representation)

Definition: **Mass** is the quantity of inertia possessed by an object or
Mass is a quantity of matter

Unit: Kilogram (kg)

Exercise: Measure length, width and height and calculate the volume:

a) A book (solution in cm^3)

b) The classroom (solution in m^3)

Measure the weight of

a) a book:

b) a stone:

3. Density (See book p 58)

Definition: **Density** is the mass of a certain volume of a substance

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Or as formula with abbreviations by letters: $d = \frac{m}{V}$

The unit of density is: $\frac{\text{g}}{\text{cm}^3}$ or $\frac{\text{kg}}{\text{m}^3}$

For the conversion: $\frac{\text{kg}}{\text{m}^3} = 1000 \frac{\text{g}}{\text{cm}^3}$

Density is a way of comparing the masses of equal volumes of materials

Exercise: Measure the volume and mass of

a) a book (solution in cm^3)

b) a piece of wood (solution in cm^3)

c) an apple (solution in cm^3)

Calculate the density (solution in g/cm^3) of the

a) book

b) piece of wood

c) apple