

EMSAT physics

Lesson 1:- Units

Objective:

identify, convert, and use various units of measurement in physics effectively.

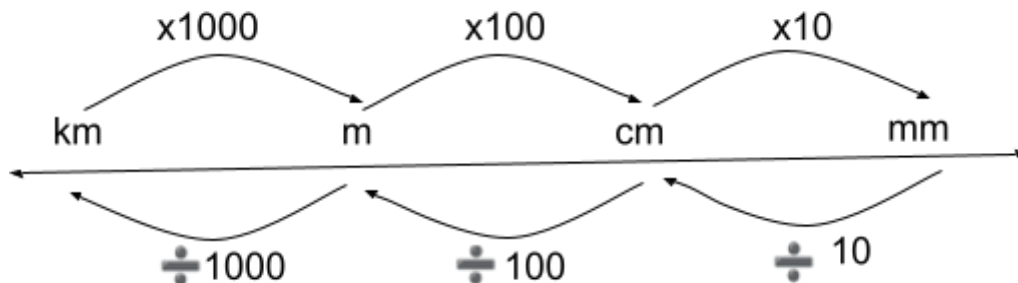
Description:

In this lesson, we will dive into the fundamental role that units play in the field of physics. Units are essential for quantifying physical quantities and making sense of the world around us. We will explore different types of units, including:

1. Base Units: Understand the seven fundamental units in the International System of Units (SI) — meter (m) for length, kilogram (kg) for mass, second (s) for time, ampere (A) for electric current, kelvin (K) for temperature, mole (mol) for the amount of substance, and candela (cd) for luminous intensity.

2. Derived Units: Learn how these base units combine to form derived units like Newtons (N) for force, Joules (J) for energy, and Pascals (Pa) for pressure.

3. Unit Conversion: Master the techniques for converting between different units, such as meters to kilometers, grams to kilograms, or Celsius to Kelvin. We will cover dimensional analysis and the use of conversion factors to ensure accuracy in measurements.










Units

In physics, units are fundamental for expressing quantities and measurements. They provide a standardized way to describe physical properties and ensure that communication and calculations are consistent and understandable. Here's a broad overview of how units are used in physics:

The International System of Units (SI):-

The SI system, also known as the metric system, is the most widely used system of measurement in science and engineering. It is based on seven fundamental units:

1. **Meter (m):-**  The unit of length. One meter is the distance traveled by light in a vacuum in $1/299,792,458$ seconds.
2. **Kilogram (kg):**  The unit of mass. One kilogram is the mass of the international prototype of the kilogram, a platinum-iridium cylinder kept at the International Bureau of Weights and Measures.
3. **Second (s):-**  The unit of time. One second is defined based on the vibrations of cesium atoms (specifically, 9,192,631,770 vibrations of the cesium-133 atom).
4. **Ampere (A):-**  The unit of electric current. One ampere is defined based on the force between two parallel conductors carrying current.
5. **Kelvin (K):**  The unit of temperature. The Kelvin scale starts at absolute zero, the theoretical point where atomic motion ceases.

6. **Mole (mol):**  The unit of amount of substance. One mole contains exactly 6.022×10^{23} entities (such as atoms or molecules), known as Avogadro's number.
7. **Candela (cd):**  The unit of luminous intensity. One candela is the intensity of a source emitting monochromatic radiation of frequency 540×10^{12} Hz and radiant intensity $1/683$ watt per steradian.

Derived Units:-

In addition to the seven base units, many derived units are combinations of these base units. Some common examples include:

- **Newton (N):** The unit of force. One newton is defined as the force needed to accelerate a one-kilogram mass by one meter per second squared ($\text{kg}\cdot\text{m}/\text{s}^2$).

- **Joule (J):** The unit of energy. One joule is the energy transferred when the force of one newton moves an object one meter ($\text{N}\cdot\text{m}$).

- **Watt (W):** The unit of power. One watt is one joule per second (J/s).

- **Pascal (Pa):** The unit of pressure. One pascal is one newton per square meter (N/m^2).

- **Coulomb (C):** The unit of electric charge. One coulomb is the amount of charge transported by a current of one ampere in one second ($\text{A}\cdot\text{s}$).