

**Al- Mustaqbal University College**

**Medical Physics Department**



# **General Physics/Lecture 1**

**First Stage**

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# Lecture 1

## What is Physics?

Physics is the most fundamental of the sciences. Its goal is to learn how the Universe works at the most fundamental level and to discover the basic laws by which it operates. There are many fields in the physics: theoretical physics, applied physics, medical physics.

This variety is what makes physics one of the most interesting of the sciences and it makes people with physics training very versatile in their ability to do work in many different technical fields.

## The major fields of physics are:

- Classical mechanics
- Electricity and magnetism
- Quantum mechanics
- Optics
- Acoustics
- Plasma physics
- Medical physics
- Solid-state physics
- Atomic, nuclear, and particle physics

## Measurement units

Every measurement has two parts. **The first is a number (n) and the next is a unit (u).  $Q = nu$ .** For Example, the length of an object = 40 cm.

كل قياس يتكون من جزأين الأول هو القيمة العددية اي الرقم والجزء الثاني هو الوحدة

The quantities that are independent of other quantities are called **fundamental quantities**. The units that are used to measure these fundamental quantities are called **fundamental units**. There are four systems of units namely **C.G.S, M.K.S, F.P.S,** and **SI**.

الكميات المستقلة عن الكميات الأخرى تسمى الكميات الأساسية. تسمى الوحدات المستخدمة لقياس هذه الكميات الأساسية بالوحدات الأساسية. هناك أربعة أنظمة للوحدات وهي CGS و M.K.S و FPS و SI.

The quantities that are derived using the fundamental quantities are called **derived quantities**. The units that are used to measure these derived quantities are called **derived units**.

الكميات المشتقة باستخدام الكميات الأساسية تسمى الكميات المشتقة. تسمى الوحدات المستخدمة لقياس هذه الكميات المشتقة بالوحدات المشتقة.

## Measurement system

- 1- **C.G.S: Centimeter, Gram, Second.**
- 2- **M.K.S: Meter, Kilogram, Second.**
- 3- **F.P.S: Foot, Pound, Second.**
- 4- **SI: International System.**

Table 1. System of measurement units.

Fundamental Quantity	System of measurement units		
	C.G.S.	M.K.S.	F.P.S.
Length	Centimeter	Meter	Foot
Mass	Gram	Kilogram	Pound
Time	Second	Second	Second

Table 2. SI unit

Physical quantity	Unit	Symbol
Length	Meter	M
Mass	Kilogram	Kg
Time	Second	S
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Intensity of light	candela	Cd
Quantity of substance	mole	Mol

## How to write Units of Physical Quantities

1. Full names of the units, even when they are named after a scientist should not be written with a capital letter. Eg: newton, watt, ampere, meter.
2. The unit should be written either in full or in agreed symbols only.
3. Units do not take the plural form. Eg: 10 kg but not 10 kgs, 20 w but not 20 ws.
4. No full stop or punctuation mark should be used within or at the end of symbols for units. Eg: 10 W but not 10 W.

## **Dimensions**

### **What are Dimensions?**

Dimensions of a physical quantity are the powers to which the fundamental units are raised to obtain one unit of that quantity.

### **Dimensional Analysis**

Dimensional analysis is the practice of checking relations between physical quantities by identifying the dimensions of the physical quantities. These dimensions are independent of the numerical multiples and constants and all the quantities in the world can be expressed as a function of the fundamental dimensions.

### **Dimensional Formula**

The expression showing the powers to which the fundamental units are to be raised to obtain one unit of a derived quantity is called the dimensional formula of that quantity.

If  $Q$  is the unit of a derived quantity represented by  $Q = M^a L^b T^c$ , then  $M^a L^b T^c$  is called dimensional formula and the exponents  $a$ ,  $b$  and,  $c$  are called the dimensions.

## What are Dimensional Constants?

The physical quantities which have dimensions and have a fixed value are called dimensional constants. e.g.: Gravitational constant (G), Planck's constant (h), Universal gas constant (R), Velocity of light in a vacuum (C), etc.

## What are the Dimensionless quantities?

Dimensionless quantities are those which do not have dimensions but have a fixed value.

- 1. Dimensionless quantities without units:** Pure numbers,  $\pi$ , e,  $\sin \theta$ ,  $\cos \theta$ ,  $\tan \theta$  etc.
- 2. Dimensionless quantities with units:** Angular displacement – radian, Joule's constant – joule/calorie, etc.