PHYSICS I

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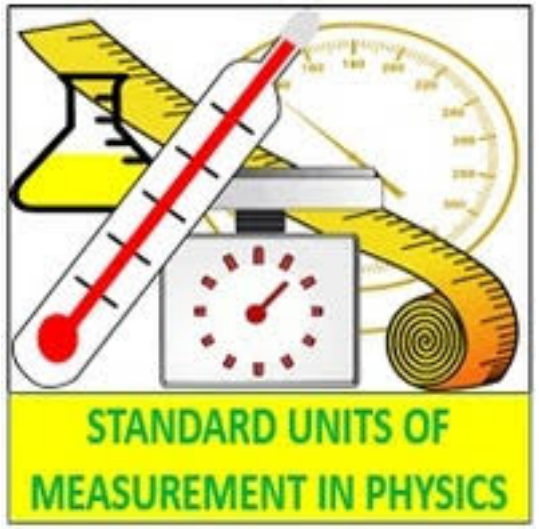
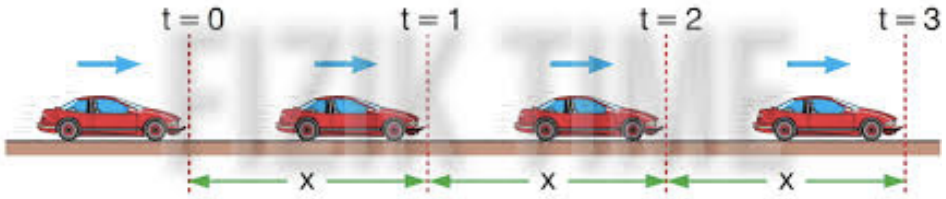
Physics and Measurements



Introduction and Chapter 1

Physics: Fundamental Science

- Concerned with the fundamental principles of the Universe
- Foundation of other physical sciences
- Has simplicity of fundamental concepts



"YOU CAN'T STAY INDIFFERENT TO PHYSICS."

Physics is divided into six major areas:

- Classical Mechanics
- Relativity
- Thermodynamics
- Electromagnetism
- Optics
- Quantum Mechanics

Classical Physics

Mechanics and electromagnetism are basic to all other branches of classical and modern physics.

Classical physics

♣ Developed before 1900

♣ First part of text deals with Classical Mechanics

> Also called Newtonian Mechanics or Mechanics

Modern physics

♣ From about 1900 → to the present

Objectives of Physics

To find the limited number of fundamental laws that govern natural phenomena;

To use these laws to develop theories that can predict the results of future experiments;

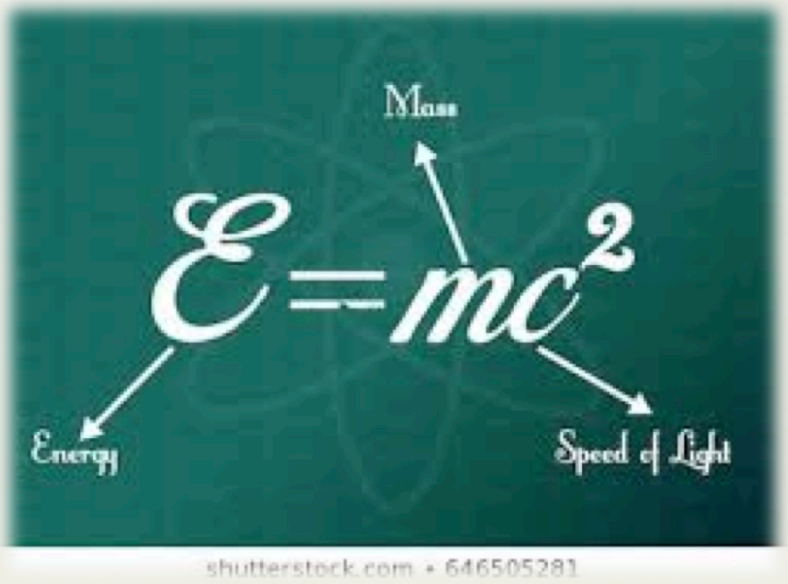
Express the laws in the language of mathematics
- Mathematics provides the bridge between theory and experiment.

Modern Physics

- Began near the end of the 19th century
- Phenomena that could not be explained by classical physics
- Includes theories of “relativity” and “quantum mechanics”

Special Relativity

- Correctly describes motion of objects moving near the speed of light
- Modifies the traditional concepts of space, time, and energy
- Shows the speed of light is the upper limit for the speed of an object
- Shows mass and energy are related

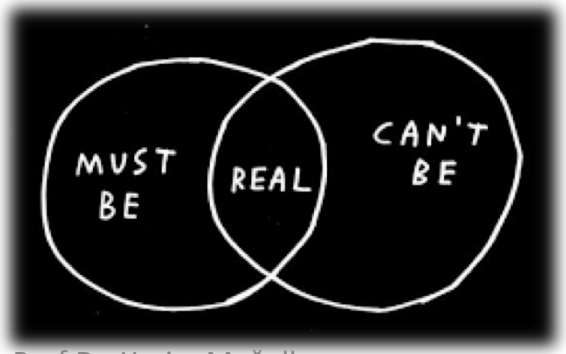


Quantum Mechanics

What does quantum physics actually do?

- Formulated to describe physical phenomena at the atomic level

- Led to the development of many practical devices



Measurements

Used to describe natural phenomena
Each measurement is associated with a physical quantity
Need defined standards
Characteristics of standards for measurements

- Readily accessible
- Possess some property that can be measured reliably
- Must yield the same results when used by anyone anywhere
- Cannot change with time

Standards of Fundamental Quantities

Standardized systems

- Agreed upon by some authority, usually a governmental body **SI – Systéme International**
- Agreed to in 1960 by an international committee
- Main system used in this text

Fundamental Quantities and Their Units

Quantity	SI Unit
Length	meter
Mass	kilogram
Time	second
Temperature	Kelvin
Electric Current	Ampere
Luminous Intensity	Candela
Amount of Substance	mole

Quantities Used in Mechanics

In mechanics, three fundamental quantities are used:

- Length (L)
- Mass (M)
- Time (T)

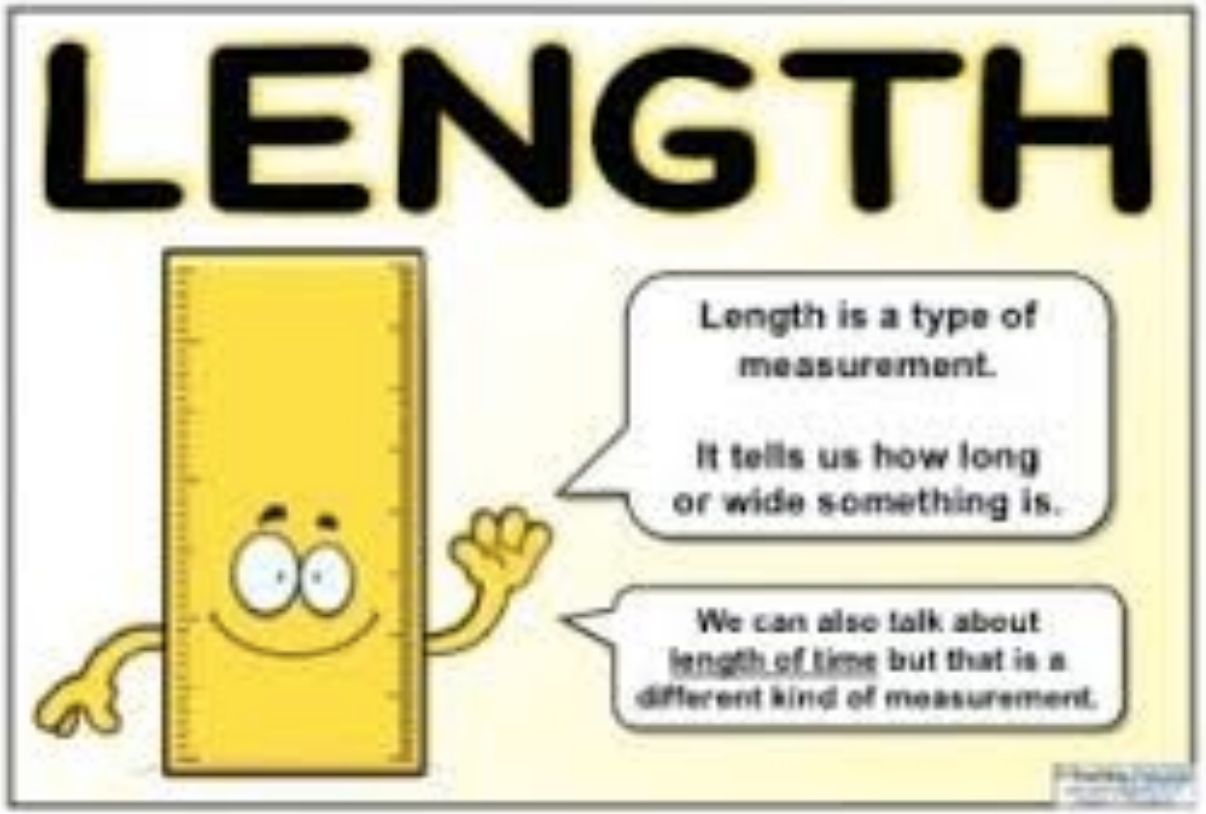
All other quantities in mechanics can be expressed in terms of the three fundamental quantities.

Length

Length is the distance between two points in space.

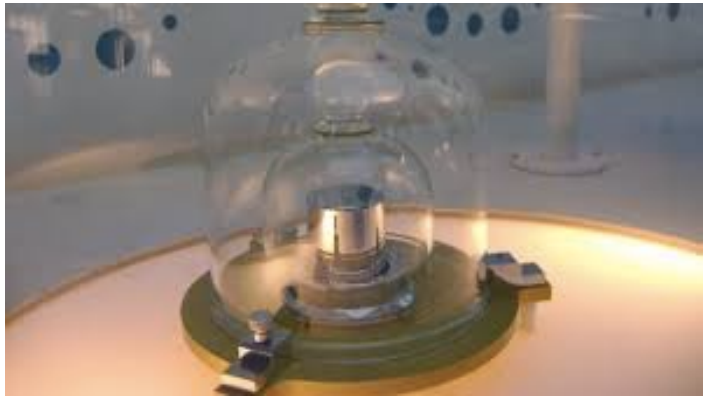
Units

- SI – meter, m



Defined in terms of a meter – the distance traveled by light in a vacuum during a given time

Mass



Units

- SI – kilogram, kg

Defined in terms of a kilogram, based on a specific cylinder kept at the International Bureau of Weights and Measurements (BIPM)

The biggest change is to the kilogram, which was set by a 143-year-old **platinum alloy cylinder**, dubbed "Le Grand K" housed in the International Bureau of Weights and Measures (BIPM) in Paris.

The kilogram is now defined in terms of the Planck constant, h, which has been measured with extraordinary precision in recent years. Its agreed value will be set as $6.62607015 \times 10^{-34}$ kg m^2 s^{-1}, with researchers able to make precise mass measurement using equipment such as the Kibble balance.

Time

Units

- seconds, s

Defined in terms of the oscillation of radiation from a cesium atom

What do you think about time?

Un/Countable ?!