PHY 170
GENERAL PHYSICS

Instructor: Dr. Eric. K. K Abavare
Department of Physics, Frontier Science group
(KNUST)

Background

- Physics is a quantitative science that uses experimentation and measurement to advance our understanding of the world around us.
- Many people are afraid of physics because it relies heavily on mathematics, but don't let this deter you.
- Most physics concepts are expressed equally well in plain English and in equations.

Background cont’

- In fact, mathematics is simply an alternative shorthand language that allows us to easily describe and predict the behavior of the natural world.
- Much of this course involves learning how to translate from English to equations and back again and to use those equations to develop new information

Background

- This course lets you know a bit of Physics but master of no specialized area. Your understanding about our world and univers would be explored never before you have thought through imagination and experimentation.
- Your mind would be stretched to appreciate the progress of science and the weakness of mankind.
- Relax and enjoy the lectures.

Cause outline

- Review of Measurement
- Optics and Waves
- Nuclear physics
- Atomic Physics
- Magnetic properties
- Relativistic mechanics

Assessment

- The course would be assessed based on the following
- Exercise and Home Work 15%
- Mid semester examination 20%
- Final Examination 60%
- Class attendance 5%
- (If students attends lectures less 90% of total lectures, he does not get this score)

Text books

- RECOMMENDED TEXTBOOKS
- FUNDAMENTALS OF PHYSICS – HALIDAY AND RESNICK
- PHYSICS FOR SCIENTISTS AND ENGINEERS WITH MODERN PHYSICS (4 TH EDITION) – GIANCOLI
- PHYSICS FOR SCIENTISTS AND ENGINEERS WITH MODERN PHYSICS EXTENDED VERSION) – TIPLER AND MOSCA
- ANY GENERAL PHYSICS MATERIALS FROM THE WEB WOULD BE HELPFUL

- **Rules for the Class**
- No one will be allowed to join the class 15 min. after commencement.
- Attendant sheet will be taken each time after the class with students' signatures. Attending less than 50% lectures during the entire semester automatically disqualifies you from taking the exams, according to the University rules and regulations
- Mobile calls are not allowed during the lectures except the Lecturer.
- Make sure you understand at least 60% of lectures

MEASUREMENT & UNITS

Measurement & Units

- Physics is based on quantity and measurements
- You may ask questions such as:

a. what is the time interval between two clicks of a clock?

b. what is the wavelength of light from a laser?

c. what is the temperature of a liquid in a vessel?

d. what is the electric current in this wire?

e. What is the height of your friend?

f. What is your weight?

Measurement & Unit

- We measure physical quantities based on which laws of Physics are expressed.
- Some physical quantities include:

a. mass
b. length
c. time
d. Temperature
e. Electrical resistance

Do you know something we measure?

Measurement & Units (Cont'd)

- Use of everyday words and Physics

- ex. "I will go to any *length* to help you as long as you don't *pressure* me".
- In Physics, *length* and *pressure* have precise meanings from their everyday meanings.
- A physical quantity is defined by setting up a standard and a unit to that quantity.
- Free to define the standard in any way:

-Scientists around the world will agree

-that our definition is both sensible and practical.

Measurement & Units (Cont'd)

- Once we set up a standard, for example, a standard for *length, we must lay out procedures so that any length whatsoever can be expressed in this standard* .
- There are some many physical quantities and that are all not independent. Example is *Speed* which is a ratio of *length to time*

-Derive units.

Measurement & Units (Cont'd)

- define *all other physical quantities* in terms of these base *standards.*
- Base standards must be both *accessible* and *invariable*.

For example, defining *length as the distance between your nose and your outstretched finger*

- *Surely you have an accessible standard but its not very invariable.*

Measurement & Units (Cont'd)

- We look for *invariability of physical quantities* *and then make Derived and other auxiliary standards accessible to those who need them.*
- This enable us to collaborate with anyone

The *International System of Units* (SI Units)

- In 1971, the 14th General Conference on Weights and Measures picked seven quantities as *base units* forming the basis of the *International System of Units*.

SI Base Quantities and Units

Quantity	**Unit**	**Symbol**
Length	Meter	m
Time	second	s
Mass	kilogram	kg
Electric Current	Ampere	A
Thermodynanic temperature	Kelvin	K
Amount of Substance	mole	mol
Luminous Intensity	candela	cd

Definitions of Some Base *Units*

- Second: *It is the time occupied by 9,192,631,770 vibrations of light (of a specified wavelength) emitted by a Cesium atom.*
- This is based on hyperfine structure transition frequency of cesium-133 atoms.
- The accuracy of hyperfine structure transition-are used as a basis to define the second

Definitions of Some Base *Units*

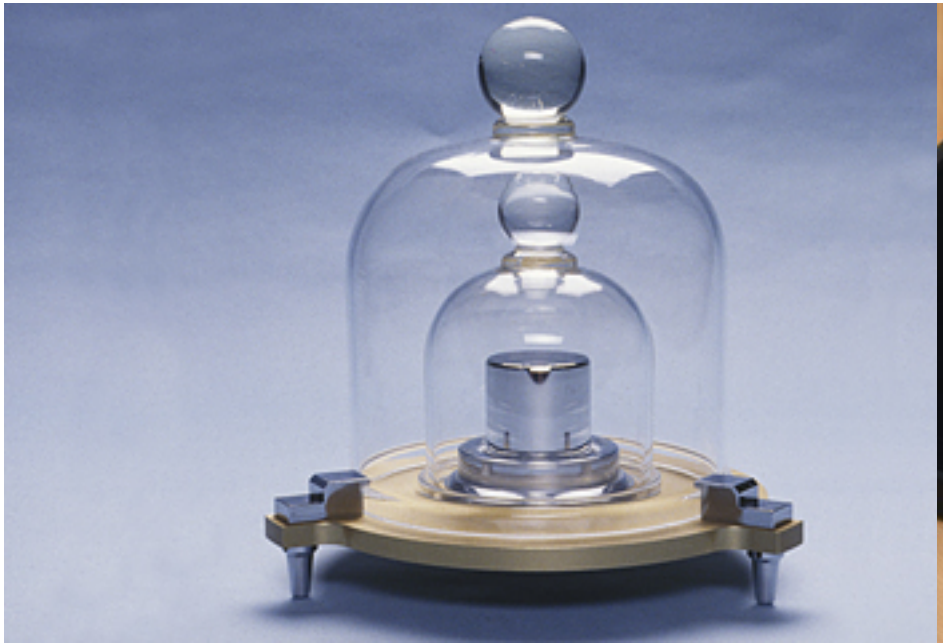
- Meter: *It is the length of the path traveled by light in vacuum during a time interval of 1/299,792,458 of a second.*
- This is equivalent to saying that the speed of light is exactly, c=*299,792,458 m/s*

Alternatively:

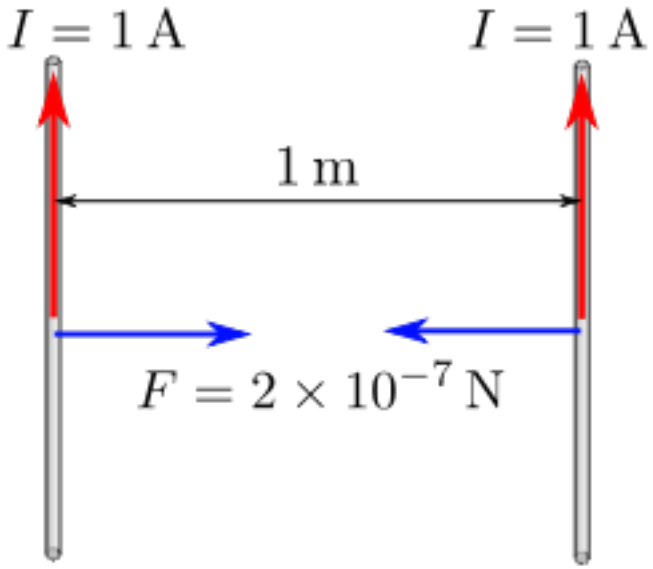
- *The meter is the length of the path travelled by light in vacuum during a time interval of 30.663189884984 caesium-133 hyperfine transition cycles.*

The kilogram:

defined as the mass of an object called the *international prototype kilogram* referred to IPK made of a platinum 90% platinium and 10% iridium by mass machined into a right circular cylinder (height=diameter) of 39.17mm



- Ampere: …that constant current, which if maintained in two straight parallel conductors of infinite length, of negligible circular cross section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per meter of length



- Kelvin:

…The fraction 1/273.16 of the thermodynamic temperature of triple point of water.

-theoretically lowest temperature where all thermal motion ceases in the classical description of thermodynamics

- The mole:

…the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kg of carbon or defined as the amount of any substance that contains as many elementary entities as the Avogadro number:

- Candela: …The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian (star radian, SI unit for solid angle)
- candela means candle in Latin and other langs.
- A common candle emits light with roughly 1 cd luminous intensity.
- Prior to 1948, various standards for luminous intensity were in use in a number of countries.
- These were typically based on the brightness of the flame from a "standard candle" of defined composition, or the brightness of an incandescent filament of specific design.
- One of the best-known of these was the English standard of candlepower
- weighing one sixth of a pound and burning at a rate of 120 grains per hour.

Derived units

- Many SI derived units are defined in terms of these base units. For example, the SI unit for power, called the *watt* (abbr. W), is defined in terms of the base units for mass, length and time. Thus;
- 1 watt= $1W=1kgm^2/s^3$
- Try some examples:

Accuracy vs. Precision

- Precision - how well can I repeat a measurement with a given apparatus?
- Accuracy - how close is my measurement result to the actual value?
- Uncertainty includes both accuracy and precision

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- How would you criticize this statement: “Once you have picked a standard, by the very meaning of “standard”, it is invariable.

- Why are there no SI base units for area and Volume?
- Suggest ways to measure the radius of the earth, radius of the sun and distance between the sun and earth.

Try

- (a) Describe how you would device a system of measurement such that you can collaborate scientifically with other scientist and engineers without having to speak the same language? [3 mark]

(b) List seven (7) base units and their symbols that you know. [3.5 marks]