PHYSICS:

"is the branch of science that involves the study of the physical world in specific and physical universe in general: energy, matter & their relationship"

SYSTEM INTERNATIONAL (SI)

"The international system of units is a scientific method of expressing the magnitudes or quantities of important natural phenomena."

System of units: "A complete set of units for all physical quantities is called system of units."

- MKS system - SI system (meter, kilogram, second)
- CGS system - Guassian system (centimeter, gram, second)
- FPS system - British system (Foot, pound, second).

⇒ In 1960 an international committee agreed on a single system of units for whole world, the system's official name is the Système International or SI, meaning International System. We can use other systems and its units (Farenheit, pounds, and miles) for our convenience but in science we must always use SI.

A. BASE UNITS:-

In SI SEVEN physical quantities chosen arbitrarily as base and their corresponding units are defined and standardized and are called base units.

SI BASE QUANTITIES AND BASE UNITS

Base Quantity		SI Base Unit	
Name	Symbol	Name	Symbol
Length	l, x, r e.t.c	meter	m
Mass	m	kilogram	kg
Time	t	second	s
Electric current	I	ampere	A
Thermodynamic Temprature	T	kelvin	K
Amount of substance	n	mole	mol
Luminous intensity	I_v	candela	cd

B. DERIVED UNITS:

A quantity and its unit obtained and developed from base quantities and their respective units without giving and consideration to the directional properties are called derived quantities and its units.

SI DERIVED QUANTITIES AND DERIVED UNITS

Derived quantity		SI coherent derived unit	
Name	Symbol	Name	Base terms
Area	A	square meter	m^2
Volume	V	cubic meter	m^3
Speed, velocity	$v, \vec{v}$	meter per second	ms^{-1}
Acceleration	a	meter per second squared	ms^{-2}

etc.

C. SUPPLEMENTARY UNITS:-

i Radian

- **Definition:** One radian (1 rad) is the angle subtended at the centre of a circle by an arc with a length equal to the radius of the circle.
- **Mathematical form:**

$$\text{Number of radians}(\theta) = \frac{\text{Arc length}}{\text{Radius of same circle}} = \frac{S}{r}$$

- **Relation radian measurement and degree measurement:-**

In one complete rotation there are 360°

Number of degrees in one rotation = 360° —①

Whereas no. of rad in one revolution is = $\frac{\text{Circumference of circle}}{\text{Radius of same circle}}$

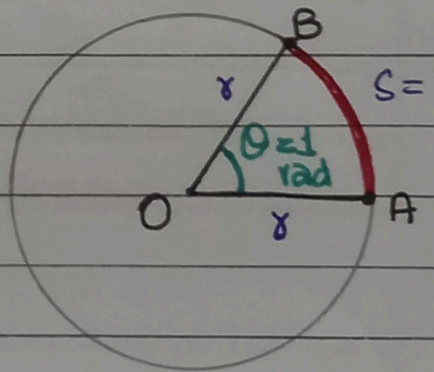
No of radians in 1 revolution = $\frac{2\pi r}{r} = 2\pi$ rad —②

as no. of degrees in one revolution = number of radians in one revolution

Therefore 2π rad = 360°

$$1 \text{ rad} = \frac{360^\circ}{2\pi} = \frac{360^\circ}{2 \times 3.14} = 57.3^\circ$$

Figure



The angle θ here is approx. 1 rad.

- **Conclusion:**

An angle of approx. 57° corresponds to 1 radian. There are a little more than 6 radians in a full rotation.

ii Steradian:

- **Definition:** Steradian is defined as the solid angle subtended at the centre of sphere by an area of its surface equal to the square of its radius of that sphere.
- **Mathematical form:**

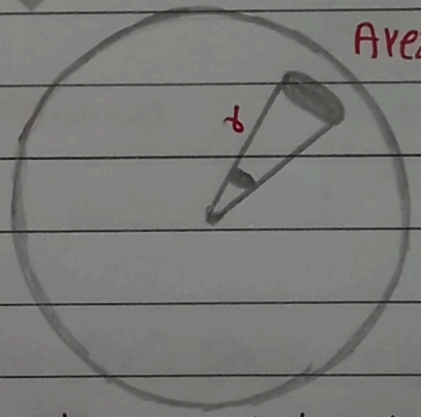
No. of steradians in sphere $= \frac{\text{Area of sphere}}{r^2}$

" $= \frac{4\pi r^2}{r^2}$

- **Conclusion:**

Sphere or for that matter any closed surface subtends 4π (12.56) steradian at an of its interior point.

Figure



Angle subtended at the centre = 1 steradian.

SCIENTIFIC NOTATION

- **Definition:** Scientific notation is an easy way of writing numbers that are too big or too small to be written in decimal form.
- **Mathematically:**

Number in scientific notation = mantissa $\times 10^{\text{exponent}}$.

1-10 no. is mantissa

- **Example**

• 7,000,000,000. = 7×10^{9} ← exponent

mantissa

• 0.000000007 = 7×10^{-9} exponent.

mantissa

Tip:
exponent will be +ive when you'll move decimal point from right to left Ei -ve when you'll move decimal point from left to right.

- **Multiplying two numbers:**

When you multiply two numbers, their powers/exponents add up.

- **Example:**

$(6 \times 10^{3}) \times (2 \times 10^{2}) = 12 \times 10^{3+2} = 12 \times 10^{5}$

- **Dividing two numbers:-**

When two numbers are divided, their powers are substracted.

- **Example:**

$$\frac{6 \times 10^{3}}{2 \times 10^{2}} = 3 \times 10^{3-2} = 12 \times 10^{1}$$

PREFIXES TO THE POWER OF TEN:

Definition:

A mechanism through which a term in scientific notation is expressed by giving a proper name to the power of ten is called prefixes to the power of ten.

Table

Prefix	Decimal Multiplier	Symbol
Deca	10^{1}	da
deci	10^{-1}	d
centi	10^{-2}	c
milli	10^{-3}	m
micro	10^{-6}	μ

etc.

EXTRA INFO

A. Lightyear (Ly)
$= 9.4607 \times 10^{15}$ m

B. Angstorm (A°)
$= 1 \times 10^{-10}$ meters

C. Micron (μ)
$= 1 \times 10^{-6}$ meters.

Non SI units.

ERRORS:

Error is the doubt that exists about any measurement's result. For every measurement, there's always a margin of doubt called error.

A. SYSTEMATIC ERRORS:

- Definition:-

The systematic errors are those that tend to be in one direction, either positive or negative

Sources are

(i) instrumental error; Arise due to imperfect design or calibration of the measuring system i.e least count.

(ii) Personal error; arise due to an individual's bias.

B. RANDOM ERRORS:

- Definition:-

The random errors are those errors, which occur irregularly and hence are random with respect to sign and size.

UNCERTAINTIES

The quantification or magnitude of error or doubt in measurement is called uncertainty. Uncertainty estimates how small or large the error is.

TYPES OF UNCERTAINTIES:-

Representation:
(Δ)

i) Absolute Uncertainty:
(least count).

Representation =
(ε)

ii) Relative uncertainty:

$\varepsilon = \frac{\text{Absolute} \cdot u}{\text{measurement}}$

iii) Percentage uncertainty:

$\frac{\text{Absolute} \cdot u}{\text{measurment}} \times 100$