Introduction to Students

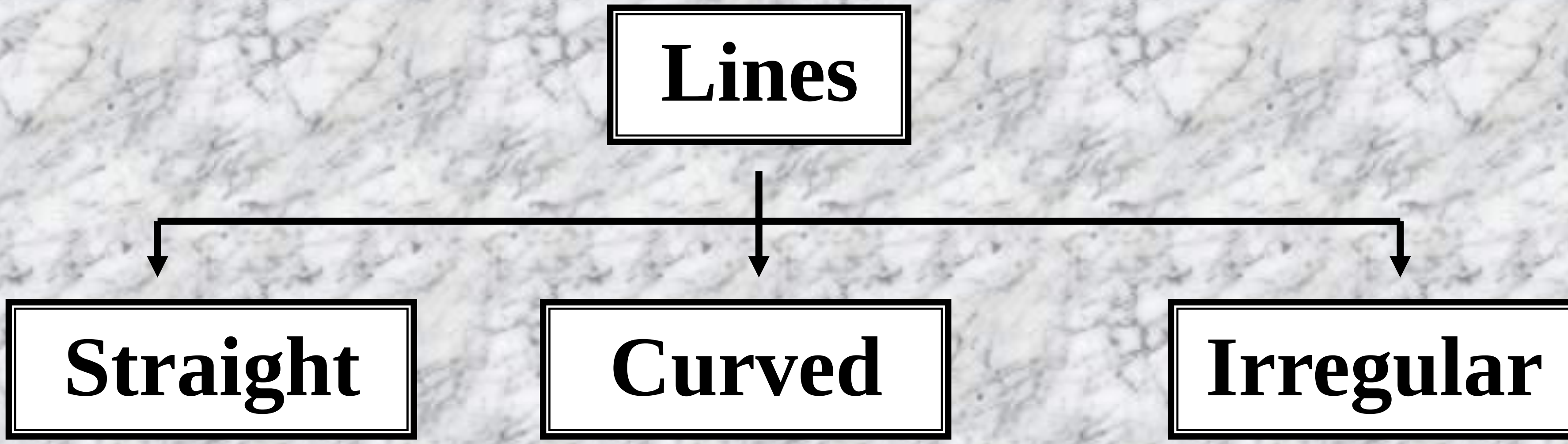
Practical work in physics is intended to teach the student how to select and set up apparatus skillfully and well, to make careful observations and precise measurements while at the same time realising the limitations of the measuring instruments employed, and to use the experimental results obtained to the best advantage.

Graphs

The majority of experiments in physics require the drawing of a graph, for not only does a graph give an immediate visual picture of results and information (e.g. how one variable quantity varies with another) but it also usually provides the most convenient way of obtaining the average of a set of readings.

It is better to draw a graph of the different values as ordinates (Y-axis) against the corresponding values as abscissae (X-axis).

Types of Lines in Graphs



- **Straight Lines**

The straight lines occur when there is an increase or a decrease in both X-values and Y-values.

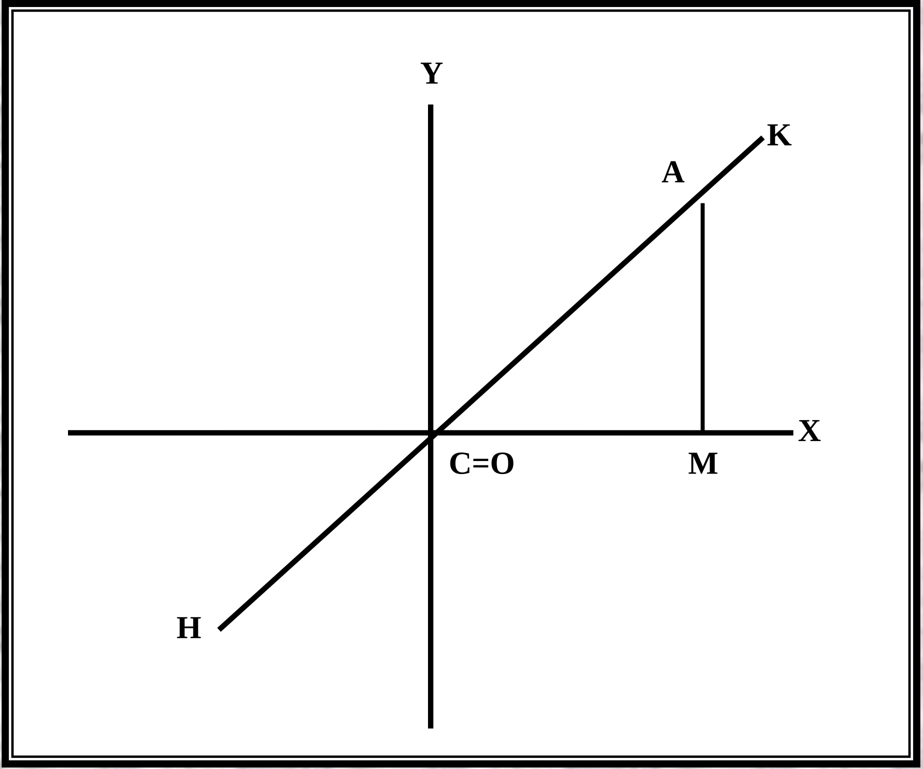
The general equation of this line is: -

$$Y = mX \pm C$$

The straight lines can be found in three forms

1. Intersection through the original point (0.0).

When the line intercepts the original point (0.0) as represent in the following graph: -



The equation of this line is: -

$$Y = mX$$

<u>Because of: -</u>

In ΔAMC, tan $A\hat{C}M = AM/CM$

But $A\hat{C}M = \theta$

$$AM = Y$$

$$CM = X$$

Hence $\tan\theta = Y/X$

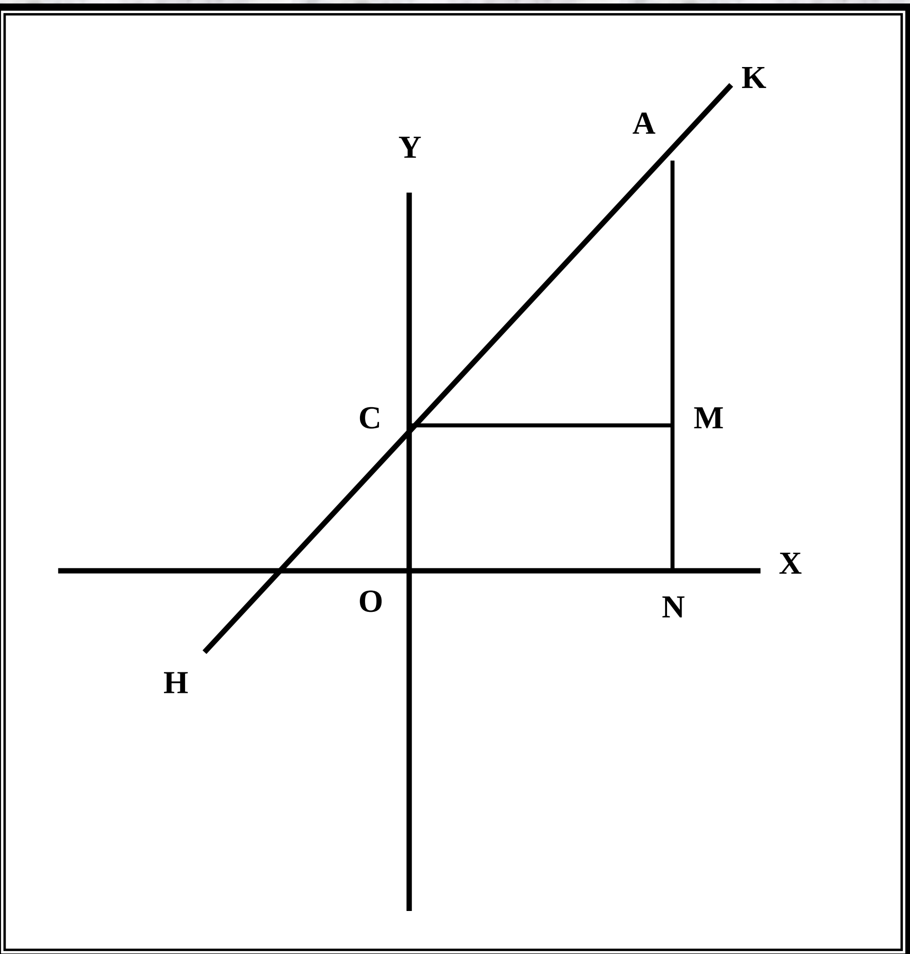
$$Y = X\tan\theta$$

Writing m for $\tan\theta$,

$$Y = mX$$

2. Intersection through the Y^+ axis.

When the line intercepts the Y^+ axis as represent in the following graph: -



The equation of this line is: -

$$Y = mX + C$$

Because of: -

In ΔAMC, $\tan A\hat{C}M = AM/CM$

But $A\hat{C}M = \theta$

$AM = AN - MN$

$AM = AN - OC$

$AM = Y - C$

$CM = ON$

$CM = X$

Hence $\tan\theta = (Y-C)/X$

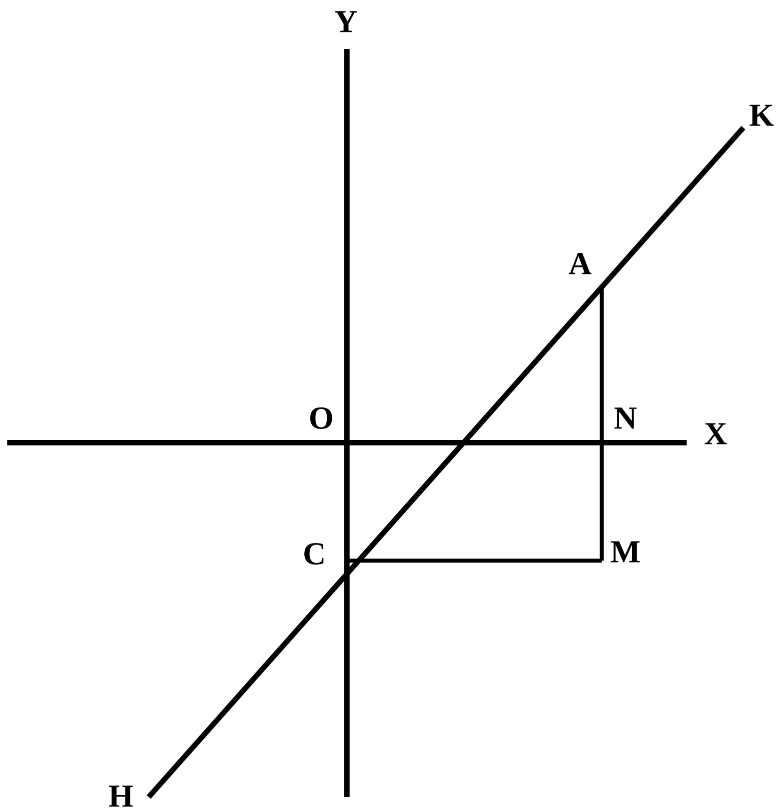
$Y = X\tan\theta + C$

Writing m for $\tan\theta$,

$Y = mX + C$

3. Intersection through the Y^- axis.

When the line intercepts the Y^- axis as represent in the following graph: -



The equation of this line is: -

$$Y = mX - C$$

<u>Because of: -</u>

In ΔAMC, tan $A\hat{C}M$=AM/CM

But $A\hat{C}M=\theta$

AM=AN+MN

AM=AN+OC

AM=Y+C

CM=ON

CM=X

Hence $\tan\theta=(Y+C)/X$

$Y=X\tan\theta-C$

Writing m for $\tan\theta$,

$Y=mX-C$

- **Curved Lines**

The curved lines occur when there is an increase in X-values with a decrease in Y-values or a decrease in X-values with an increase in Y-values.

So the curved lines indicate that the relations between the data are inversely proportional.

- **Irregular Lines**

The irregular lines occur when there is an increase or a decrease in X-values and Y-values randomly.

The SI System of Units

The **Systeme Internationale d'Unites**, abbreviated to the **SI** system of units, was approved in 1960 by the **General Conference of Weights and Measures**, an international organization, and is coming into increasing use throughout the world because of its many advantages over the multitudinous national systems it is now superseding. Apart from its own intrinsic merits, it has the great advantage over all other systems of units in that it is ***international***-the one system that is common to all countries. So, once everyone uses the system, gone will be the need to convert laboriously from one system of units to another, involving time and energy that can be more profitably spent.

Table (1): - The International System (SI)

Physical Quantity	Unit	Symbol
Length	Meter	m
Mass	Kilogram	kg
Time	Second	sec
Electric Current	Ampere	A
Temperature	Degree Kelvin	K
Luminous Intensity	Candela	cd
Amount of Substance	Mole	mol

All other units are derived from these units. The more important derivative units, which all have special names, are as follows: -

Table (2): - Derived Units.

Physical Quantity	Unit	Abbreviation	Dimensions
Force	Newton	N	$kg\ m / sec^2$
Pressure	Pascal	Pa , N/m^2	$kg / m\ sec^2$
Energy	Joule	J , Nm	$kg\ m^2 / sec^2$
Power	Watt	W , J/sec	$kg\ m^2 / sec^3$
Torque	Meter-Newton	τ , mN	$kg\ m^2 / sec^2$
Electric charge	Coulomb	C	A sec
Electric potential	Volt	V , J/C	$kg\ m^2 / sec^3\ A$
Electrical resistance	Ohm	Ω , V/A	$kg\ m^2 / sec^3\ A^2$
Capacitance	Farad	F , C/V , C^2/J	$sec^4\ A^2 / kg\ m^2$
Inductance	Henry	H , J/A^2 , Ωsec	$kg\ m^2 / sec^2\ A^2$
Magnetic flux	Weber	Wb , J/A , Vsec	$kg\ m^2 / sec^2\ A$
Magnetic intensity	Tesla	T, Wb/m^2, $Vsec/m^2$	$kg / sec^2\ A$
Frequency	Hertz	Hz	1 / sec
Luminous flux	Lumen	lm	cd sr
Illumination	Lux	lx	lm / m^2
Disintegration rate	Becquerel	Bq	1 / sec
Absorbed dose	Gray	Gy , J/kg	m^2 / sec^2

Note: -

The abbreviation for steradian, the SI unit of solid angle, is sr.

Table (3): - Non-SI Units.

Physical Quantity	Unit	Symbol
Mass	gram	g
Length	foot centimeter	ft cm
Volume	liter	---
Time	minute	min
Force	dyne $\text{pound}_{\text{force}}$	--- lb_f
Energy	calorie, kilocalorie	cal, kcal
Power	kilocalories/minute	kcal/min
Pressure	pounds/inch^2 millimeter of mercury centimeter of water atmosphere	psi mmHg cmH_2O atm
Temperature	Fahrenheit Celsius	F C