

Ch.1 Estimation
Ch.2 Measurement
Ch 3. Experimentation

Physics

Fundamentals for revision for
competitive examinations

- 1 Physics deals with measurement of quantities, that vary in magnitude from very tiny (atom) to extremely large (Universe , speed of light) . The power of ten (10^n) is called the order of magnitude of the physical quantity, and M is called its numerical value.
- 2 The order of magnitude of a physical quantity is its magnitude in powers of ten, when that physical quantity is expressed in powers of ten with one digit to the left of the decimal.
- 3 A quantity of magnitude greater than 10 is expressed in positive powers of ten, while a quantity of magnitude less than 1 is expressed in negative power of ten
- 4 A physical quantity with magnitude having a large number of digits is expressed in powers in ten with one digit to the left of decimal. Physical quantity = $M \times 10^n$
- 5 If M is greater than 1 but less than 10, and n is a positive or negative integer. $0.0,000,000,001 = 1 \times 10$ to the power of -10.
- 6 If M is less than 3.2, it is written as under root 10 or 10 to the power of 0.5 , rounded to 1 = 10 to the power of 1.
- 7 S. I. Unit is abbreviation for “Systeme Internationale d’Units”, recommended in 1960.
- 8 A metre is defined in terms of speed of light as “the distance travelled by light in $1/ 299, 792, 458$ of a second, in air or vacuum
- 9 Smaller units are centimetre, millimetre, micron, nanometre and the bigger non-metric units are astronomical unit (A.U.) which is the mean distance between earth and the sun; light year is the distance travelled by light in vacuum, in one year; and PARSEC is 3.26 times light year. It is an abbreviation of PARallactic SECond.

2. Measurement

Least count of an instrument is the smallest measurement that can be taken accurately with it.

Instruments for measurement of solids:

- 1) Main Scale division
- 2) Vernier Scale Division
- 3) Vernier Callipers
- 4) Screw Gauge

Correct reading = Observed reading minus (-) zero error .

For measuring liquids , the instruments are (a) Burette (b) Measuring Flask (c) Measuring Cylinder, and (d) Pipette.

Principle of Vernier : The Vernier Constant or the Least Count is obtained simply by dividing the value of one division of main scale by the total number of divisions on the vernier scale.

Pitch of a screw is the distance moved by the screw along its axis in one complete rotation of its head. Back lash error is due to wear and tear of threads on a screw. It occurs when the tip of the screw does not start moving in the opposite direction at once after rotation pressure is applied , but remains stationary for a part of the rotation.

Measurement of Volume: One litre is equal to the volume of 1 kg of pure water at 4 degree Centigrade and one millilitre is the volume of 1 gram of pure water at 4 degree C.

For measuring volume of regular and symmetric shaped objects, first step is to measure the dimensions of the shape using either a metre scale, or a vernier scale or vernier callipers, or screw gauge. Next use the formula for the prescribed shape of cube, sphere, cylinder, cone, cuboid, to obtain the volume

For measuring irregular solids heavier than water the method of displacement of water is used. Water is filled in a Measuring cylinder and its lower meniscus is noted. The irregular solid piece is tied to a string and slowly immersed into the water without splashing it. The risen level of water in the cylinder is noted. The difference between the two levels gives the measurement.

Measurement of time and mass

Instruments for measuring time are the Stop watch indicating 60 equal divisions of 1 second or a stop clock. Both use the periodic oscillations of a balance wheel.

A pendulum is a heavy point mass suspended from a rigid support by a inextensible string. Terms used in the context of a Pendulum include: Oscillation, Period of oscillation, Frequency of oscillation, Amplitude.

The pendulum of a clock is a seconds ' pendulum. It has a time period of oscillation equal to two seconds.

A mass of a body is the quantity of matter it contains.

For measurement of Mass, an instrument called the Beam Balance is used. It works on the principle of moments according to which in equilibrium , the anti – clockwise moment due to the weight of an object on left pan of the beam is equal to the clockwise movement due to the standard weights on the right pan of the beam.

3. Experimentation

This Chapter details how data on laboratory experiments is to be presented in tabular and graphic forms. Scalar quantities are those that have magnitude but no direction. (Mass, distance, time speed, temperature, density , pressure) Vector quantities have magnitude + direction (displacement, velocity, force, momentum)

- Separate tables are to be used for measurement of different quantities.

Table is of two kinds : (a) Headed columns and numbered rows

- (b) Headed rows and numbered columns.
- Choice of table depends on convenience

Graph should be given a title and is to be labelled clearly.

- Its four quadrants , given anti-clockwise in the book, are to be labelled as Q1, Q2, Q3, and Q4.
- More than half the portion of the graph paper must be used.

Thank you