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# MATHEMATICAL TOOLS

**Physical Quantities**
The quantities which can be measured by an instrument and follow laws of physics are called physical quantities.
**Example:** mass, length, time, velocity, acceleration, force, pressure, density, etc.

**Physical quantities are two types:**
(i) Fundamental or Basic quantities
(ii) Derived Quantities

**i. Fundamental quantities :**
The physical quantities that are independent of one another are called fundamental quantities. The units of these fundamental quantities are called fundamental units.
For Example: mass, length, time, temperature

**ii. Derived quantities :**
The physical quantities, which can be expressed in terms of fundamental quantities, are called derived quantities. The units of derived quantities are called derived units.
For Example: Speed of a particle can be written as distance travelled by it in unit time.

$$\textbf{Speed} = \frac{\text{distance}}{\text{time}} \text{ or } \frac{\text{length}}{\text{time}}$$

**Measurement and Systems of Units**
Measurement plays an important role in our daily life. Measurement is the comparison of an unknown quantity with a known standard quantity of the same kind. The standard quantity used for comparison is called the unit. To express the measurement the following things are essential:

**(i) Unit :** A unit of measurement is a definite magnitude of a quantity, defined and adopted by convention or by law and used as standard for measurement of the same quantity.
**(ii) Numerical value:** It expresses the magnitude of quantity i.e. how many times the amount is in the quantity.
So, the measure of a physical quantity can be expressed as :

**Measure of a physical quantity (M) = Numerical value (N) × Unit (U)**

**Example:** If the mass of certain quantity of rice is 8 kilograms, it means the unit of mass is kilogram (kg) and the magnitude of the given quantity of rice is eight times this unit.

**Systems of units:**
**(i) F.P.S. System:** In this system the unit of length, mass and time are foot, pound and second, respectively.
**(ii) C.G.S. System:** In this system the unit of length, mass and time are centimetre, gram and second, respectively.
**(iii) M.K.S. System:** In this system the unit of length, mass and time are metre, kilogram and second, respectively.
**(iv) S.I. System:** In 1960, International Bureau of weights and measurements set up a new system which is the extension of M. K. S. system and units of all physical units can be expressed in these terms. The new system is called 'International system of units or S.I. units'. Seven fundamental units and two supplementary units were decided, which are shown in the following table:

| Basic Quantity | S.I Unit | |
|---|---|---|
| z | Name | Symbol |
| Length | metre | m |
| Mass | kilogram | kg |
| Time | second | s |
| Electric Current | ampere | A |
| Temperature | kelvin | K |
| Amount of Substance | mole | mol |
| Luminous Intensity | candela | Cd |

**Derived units of some physical quantities:**

| Derived Physical Quantity | Formula or Relation with other Physical Quantities | Derived unit | symbol |
|---|---|---|---|
| Area | Length × Breadth | m × m | $m^2$ |
| volume | Length × Breadth × Height | m × m × m | $m^3$ |
| Frequency | $\frac{1}{\text{Time period}}$ | $\frac{1}{\text{second}}$ | Hz |
| Density | $\frac{\text{Mass}}{\text{Volume}}$ | $\frac{kg}{m^3}$ | kg $m^{-3}$ |
| Speed | $\frac{\text{Distance}}{\text{Time}}$ | $\frac{m}{s}$ | $ms^{-1}$ |
| Velocity | $\frac{\text{Displacement}}{\text{Time}}$ Time | $\frac{m}{s}$ | $ms^{-1}$ |
| Acceleration | $\frac{\text{Change in velocity}}{\text{Time}}$ | $\frac{m/s}{s}$ | $ms^{-2}$ |
| Force | Mass × Acceleration | kg × $m/s^2$ = kg.m.$s^{-2}$ | newton = N |
| Pressure | $\frac{\text{Force}}{\text{Area}}$ | newton/$m^2$ | pascal=Pa |

## S.I. Prefixes

The magnitude of physical quantities varies over a wide range. So in order to express the very large magnitude as well as very small magnitude more compactly, "CGPM" (General conference on weight and measures) recommended some standard prefixes for certain power of 10.

| Power of 10 | Prefix | Symbol |
|---|---|---|
| $10^{18}$ | exa | E |
| $10^{15}$ | peta | P |
| $10^{12}$ | tera | T |
| $10^{9}$ | giga | G |
| $10^{6}$ | mega | M |
| $10^{3}$ | kilo | k |
| $10^{2}$ | hecto | h |
| $10^{1}$ | deca | da |
| $10^{-1}$ | deci | d |
| $10^{-2}$ | centi | c |
| $10^{-3}$ | milli | m |
| $10^{-6}$ | micro | μ |
| $10^{-9}$ | nano | n |
| $10^{-12}$ | pico | p |
| $10^{-15}$ | femto | f |
| $10^{-18}$ | atto | a |

## Some special units:

**(i) For length**

**(A) Micron (μ)**

It is one millionth part ($10^{-6}$) of a metre and is denoted by the symbol μ. It is also called micrometre.

1 micron = $10^{-6}$ metre

= $10^{-4}$ cm = $10^{-3}$ mm

**(B) Angstrom (Å)**

It is ($10^{-10}$) times of a metre. It is denoted by the symbol Å.

1 Å = $10^{-10}$ m = $10^{-8}$ cm

**(C) Light year**

A light year is the distance travelled by light in vacuum in one year.

1 light year = $9.46 \times 10^{15}$ m

**(D) Parsec**

1 parsec = 3.26 light year

**(ii) For mass**

**(A) Quintal :** One quintal is equal to hundred kg.

1 quintal = 100 kg = $10^2$ kg

**(B) Metric tonne :** One metric tonne is equal to thousand kg.

1 metric tonne = 1000 kg = $10^3$ kg

**(iii) For time**

**(A) Year :** The time taken by the earth to complete one revolution round the sun.

$$1 \text{ year} = 365\frac{1}{4} \text{ days}$$

**(B) Lunar month :** One lunar month is the time in which the moon completes one revolution around the earth.

1 Lunar month = 27.3 days

**(C) Millennium :** A millennium is of 1000 years.

**(D) Solar day :** The time taken by the earth to complete one rotation on its own is called solar day.

1 solar day = 86400 sec

**(E) Shake:** 1 shake = $10^{-8}$ second

**(iv) The smallest and the biggest units**

The smallest practical unit of distance is Fermi.

1 fermi = $10^{-15}$ m

The biggest unit of distance is parsec.

1 parsec = 3.26 light year

The smallest unit of time is shake.

1 shake = $10^{-8}$ second

The largest unit of time is Millennium.

1 millennium = 1000 year

**Example:**

(i) 1 μm = 1 micrometre = $10^{-6}$ m

(ii) 1 mm = 1 millimetre = $10^{-3}$ m

(iii) 1 nm = 1 nanometre = $10^{-9}$ m

(iv) 1 MHz = 1 megahertz = $10^{6}$ Hz

(v) 1 km = 1 kilometre = $10^{3}$ m

(vi) 1 GHz = 1 gigahertz = $10^{9}$ Hz

**Example 1:**

A football field is 0.5 km long. How many meters long is the football field?

**Solution:** 1000 m = 1 km

$\therefore$ 0.5 km = 0.5 × $10^3$ m = 500 m

**Example 2:**

Sunita bought 700 grams of sugar to make a cake. How many kg of sugar did she buy?

**Solution:** 1000 grams = 1 kg

$$700 \text{ g} = \frac{700}{1000} \text{ kg} = 0.7 \text{ kg}$$

**Example 3:**

Convert 64 km/h into m/s.

**Solution:** $64\ \frac{\text{km}}{\text{h}} = \frac{64\times 1000\text{m}}{60\times 60\text{s}} = \frac{160}{9}\ \frac{\text{m}}{\text{s}}$

**Example 4:**

Convert 36 g/cm$^3$ into kg/m$^3$.

**Solution:** 36 g/cm$^3$

$$36\times\frac{1}{1000}\text{kg}\times\frac{1}{(100)^{-3}\text{ m}^3} = 36 \times 10^3 \text{ kg/m}^3$$

**Note :** To convert $\frac{\text{km}}{\text{hour}}$ into $\frac{\text{m}}{\text{sec}}$, multiply it by $\frac{5}{18}$

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**FUNDAMENTAL UNLOCKED- (FU#1)**

**Q.1** Convert the following in metre :
(i) 5 μm. (ii) 3 km (iii) 20 mm
(iv) 73 picometer (v) 7.5 nm

**Q.2** Convert 5 metric tonne into gram.

**Q.3** Convert 1560 gram in kilogram.

**Q.4** Density of mercury is 13.6gcm$^{-3}$, then its value in MKS system will be?

**Q.5** How many metres are there in 1 light year?

**Q.6** The volume of a cube of side 1 cm is equal to.....m$^3$.

**Q.7** A vehicle moving with a speed of 18 km h$^{-1}$ covers....m in 1 s.

## Types of Physical Quantities

Physical quantities classified into two more categories **based on their directional properties**:

(a) Scalar (b) Vector

**(a) Scalar :**

The physical quantities which have magnitude only and no direction are called scalar quantities.

**Example:** Mass, time, temperature, distance, etc.

**i.** A scalar has magnitude only and no direction is associated with it.

**ii.** Scalar can be added, subtracted, multiplied or divided by using the rules of ordinary algebra.

**Example:** Adding 20 kg mass to 10 kg mass gives 30 kg mass.

**(b) Vector :**

The physical quantities which have magnitude as well as direction and also follow the laws of vector algebra are called vector quantities.

**Eg.:** Displacement, velocity, acceleration, force, etc.

**i.** The direction of a vector is as important as its magnitude.

When we say that the displacement of a particle is 5m, the description is incomplete because direction of the displacement is not given. However, the statement that the displacement of a particle is 5m towards east is correct and meaningful. Thus the description of a vector must be associated with magnitude as well as direction.

**ii.** The vector are added, subtracted or multiplied by the rules of vector algebra. However, division of a vector by another vector is not an operation in vector algebra.

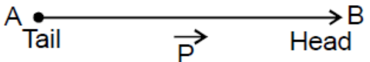
**(c) Representation of a Vector:**

A vector has two things:

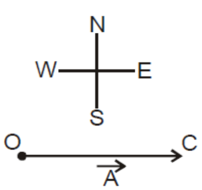
(i) Magnitude (ii) Direction

A vector is represented by a line with arrow head. Length of line shows its magnitude and arrow head shows its direction. Figure represents a vector $\vec{P} = \overrightarrow{AB}$. Point A is called tail and point B is called head of the vector $\vec{P} = \overrightarrow{AB}$.

Sometimes, a vector $\vec{P}$ is represented by bold faced letter **P**. The magnitude of vector $\vec{P}$ can be written as $|\vec{P}|$, modulus of $\vec{P}$ or simply P.




**Graphical representation of a vector**




**Example:**

A car travels 30 km due east. In order to represent this vector (displacement), we select a convenient scale say 1 cm = 10 km. Then we draw a straight line 3 cm with an arrow head on it towards east.

The vector $\overrightarrow{OC} = \vec{A}$ represents a displacement of 30 km towards east.

**Example 5:**

Represent two forces one of 50 N due south and the other of 25 N due east, acting simultaneously on a particle.

**Solution:** Here we have to represent two forces of 50 N and 25 N. Let our scale be:

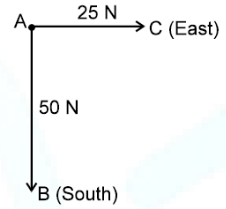
1 cm represents 10 N.

Now since 10 N = 1 cm

$\therefore$ 50 N = (1/10) × 50 cm = 5 cm

Again, 10 N = 1 cm

$\therefore$ 25 N = (1/10) × 25 cm = 2.5 cm




Thus in order to represent 50N force due south we draw a 5 cm long straight line AB from north to south with the arrow head pointing towards south. Now $\overrightarrow{AB}$ represents a force of 50 N due south (on a scale of 1 cm = 10 N). In order to represent the other force of 25 N, we draw a 2.5 cm long straight line AC pointing towards east. So $\overrightarrow{AC}$ represents a force of 25 N due east (on scale 1 cm = 10 N).

**Example 6:**

Draw vector corresponding to the following displacement :

(i) 6 m, 60° north-east

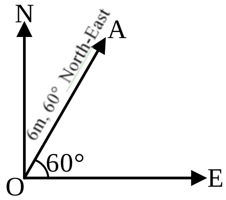
(ii) 6 m, west (iii) 25 m, 30° south-east

**Solution. (i)** We will first draw a vector representing a displacement of 6 m, at 60° in the north-east direction. Let our scale be 1 cm represents 1 m.

Now, 1 m = 1 cm

$\therefore$ 6 m = 6 cm

Then we draw a 6 cm long straight line OA making an angle of 60° with east direction (towards north). We also put an arrowhead at point A. Now, vector OA represents a displacement of 6m, 60° north-east (on a scale: 1 cm = 1 m).

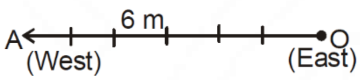



**(ii)** Let 1 cm = 1 m

or, 1 m = 1 cm

$\therefore$ 6 m = 6 cm

In this case displacement is towards the 'West' direction. So, from the origin O we draw a 6 cm long straight line OA pointing towards west. So, the $\overrightarrow{OA}$ given below represents a displacement of 6 m towards west.

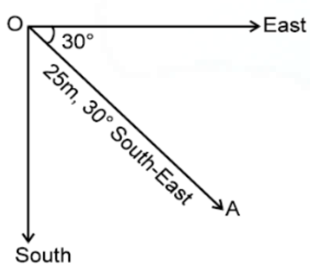



**(iii)** 1 cm represents 5 m.

or, 5 m = 1 cm

$\therefore$ 25 m = (1/5) × 25 = 5 cm

Thus, a displacement of 25 m can be represented by a 5 cm long straight line. Here, the displacement is 30º towards south of east, so first of all we draw south and east direction. We now draw a 5 cm long straight line OA making an angle of 30º with east direction (towards South). So the $\overrightarrow{OA}$ shown in the figure below represents a displacement of 25 m, 30º south - east (on a scale 1 cm = 5m).




**FUNDAMENTAL UNLOCKED- (FU#2)**

**Q.1** Mark the following as scalar or vector :

| | |
|---|---|
| (i) Distance | (ii) Displacement |
| (iii) Speed | (iv) Velocity |
| (v) Acceleration | (vi) Force |

**Q.2** Which of the following is not a vector?

| | |
|---|---|
| (A) Mass | (B) Weight |
| (C) Velocity | (D) Force |

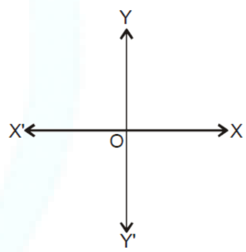
## Introduction to Graphs

In our daily routine, we all use newspapers, TV channels and ratio etc. in order to get information in the form of data and these data's can be represented graphically, i.e., on the bar graph, pie chart, histograms etc. But before proceeding, we will discuss how one can locate the positions of a point and the plotting of point in the plane.

**(a) Co-ordinate System**

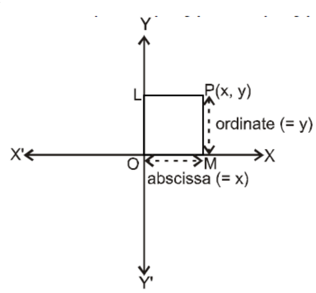
In Cartesian co-ordinate system, we represent any point by ordered pair (x, y), where x and y are called X and Y co-ordinate of that point respectively.

Take two perpendicular lines X'OX and Y'OY intersecting at the point O. X'OX and Y'OY are called the co-ordinate axes. X'OX is called the X-axis, Y'OY is called the Y-axis and O is called the origin. Lines X'OX and Y'OY are sometimes also called rectangular axes.




**(b) Co-ordinates of a point**

Let P be any point as shown in figure. Draw PL and PM perpendiculars on Y- axis and X- axis, respectively. The length LP (or OM) is called the x - coordinate or the abscissa of point P and MP is called the y-coordinate or the ordinate of point P. A point whose abscissa is x and ordinate is y named as the point (x, y) or P (x, y). The numbers on the left and above the origin are positive. The numbers on the right and below the origin are negative.



The two lines X'OX and Y'OY divide the plane into four parts called quadrants. XOY, YOX', X'OY' and Y'OX are, respectively, called the first, second, third and fourth quadrants. The following table shows the signs of the coordinates of points situated in different quadrants:

| Quadrant | X - coordinate | Y - coordinate | Point |
|---|---|---|---|
| First quadrant | + | + | (+, +) |
| Second quadrant | – | + | (–, +) |
| Third quadrant | – | – | (–, –) |
| Fourth quadrant | + | – | (+, –) |

**Note :**

i. Abscissa is the perpendicular distance of a point from y-axis.
(i.e., positive to the right of y-axis and negative to the left of y-axis)

ii. Ordinate is positive above x-axis and negative below x-axis.

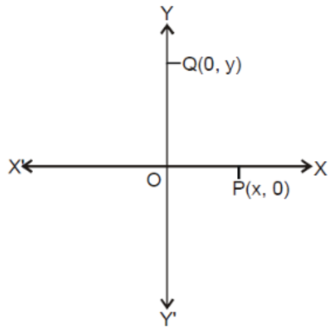
iii. Abscissa of any point on y-axis is zero.

iv. Ordinate of any point on x-axis is zero.

v. Co-ordinates of the origin are (0, 0).

**(c) Points which lies on Axes**

If point P lies on X-axis then clearly its distance from X-axis will be zero, therefore we can say that its Y-coordinate will be zero. Similarly if any point Q lies on Y-axis, then its distance from Y-axis will be zero therefore we can say its X-coordinate will be zero.




**(d) Plotting the Points**

In order to plot the points in a plane, we may use the following steps :

**Step I :** Draw two mutually perpendicular lines on the graph paper, one horizontal and other vertical.

**Step II :** Mark their intersection point as O (origin).

**Step III :** Choose a suitable scale on X-axis and Y-axis and mark the points on both the axis.

**Step IV :** Obtain the coordinates of the point which is to be plotted. Let the point be P(a,b). To plot this point, start from the origin and move 'a' units along OX, OX' according as 'a' is positive or negative respectively. Suppose we arrive at point M. From point M move vertically upward or downward 'b' units according as 'b' is positive or negative. The point where we arrive finally is the required point P (a, b).

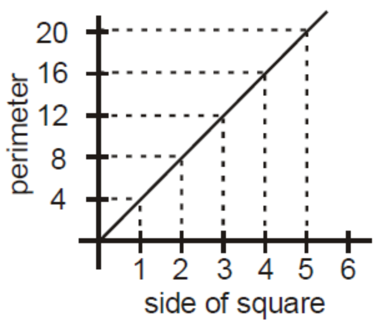
**(e) Plotting of Graphs**

**i. Perimeter vs. side of a square**

Let us find the perimeter of squares having sides 1 cm, 2 cm, 3 cm, 4 cm, 5 cm, 6 cm and tabulate the result.

| Side of square (cm) | Perimeter of the square (4xside)cm | (Side, perimeter) |
|---|---|---|
| 1 | 4 | (1,4) |
| 2 | 8 | (2,8) |
| 3 | 12 | (3,12) |
| 4 | 16 | (4,16) |
| 5 | 20 | (5,20) |
| 6 | 24 | (6,24) |

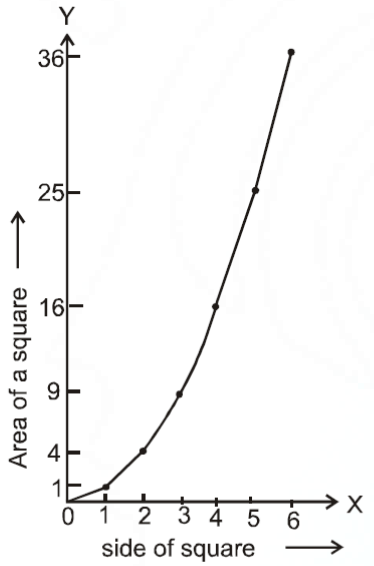
Draw coordinate axes. Take side of the square along x-axis and perimeter of square along y-axis. Then plot the points and join them successively to obtain the required graph given below.



**ii. Area vs. side of a square :** Let us find the area of squares having sides 1 cm, 2 cm, 3 cm, 4 cm, 5 cm, 6 cm and tabulate the result.

| Side of square (cm) | Area of square (side × side) $cm^2$ | (Side, area) |
|---|---|---|
| 1 | 1 | (1, 1) |
| 2 | 4 | (2, 4) |
| 3 | 9 | (3, 9) |
| 4 | 16 | (4, 16) |
| 5 | 25 | (5, 25) |
| 6 | 36 | (6, 36) |

Draw coordinate axis. Take side of the square along x-axis and perimeter of square along y-axis. Then, plot the points and join them successively to obtain the required graph given below.




**(f) Reading of graphs**

So far we have been plotting the points. We have also seen that when these points are joined sometimes we get a line and sometimes we do not get a line. If the points when joined together lie on a straight line, we get a graph called linear graph. In this section, we shall learn in general the reading of linear graphs and then reading of distance vs. time graphs.

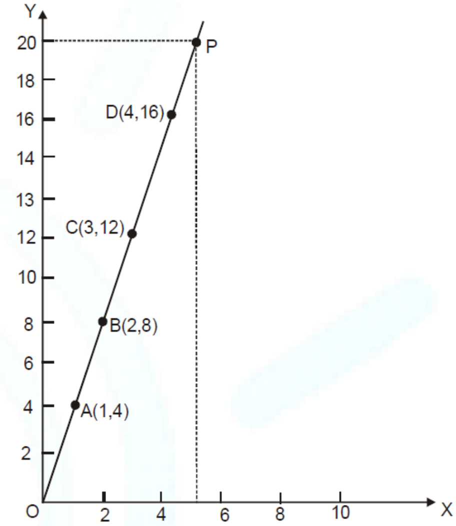
**i. Let us plot the following points for the multiples of 4 and join them.**

| X | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Y | 4 | 8 | 12 | 16 |

We plot the points (1, 4), (2, 8), (3, 12), (4, 16) and then join them.

Now from the graph we can find 4 × 5.

For that we locate number 5 on the x-axis and from there draw a perpendicular (go parallel to y-axis) which touches the graph at P. From P, we draw a line parallel to x-axis which meets y-axis at the point marked 20. Thus, 4 × 5 = 20.




**FUNDAMENTAL UNLOCKED- (FU#3)**

**Q.1** Draw vector corresponding to the following displacement:

(i) 10 m, 30° south-east

(ii) 50 m, north

(iii) 20 m, 30° north-west

**Q.2** Which of the following are vector quantities?

(A) The velocity of Frisbee

(B) The width of carter made by an asteroid

(C) The speed of car oh highway

(D) The displacement of a billiard ball after it is struck by a cue ball

**Add to Your Knowledge**

**Scientific Definitions:**

**Metre:**

The metre is the length of the path travelled by light in vacuum during a time interval of 1/ 299,792,458 of a second. (1983)

**Kilogram:**

The kilogram is equal to the mass of the international prototype of the kilogram (a platinum iridium alloy cylinder) kept at international Bureau of Weights and Measures, at Sevres, near Paris, France. (1889)

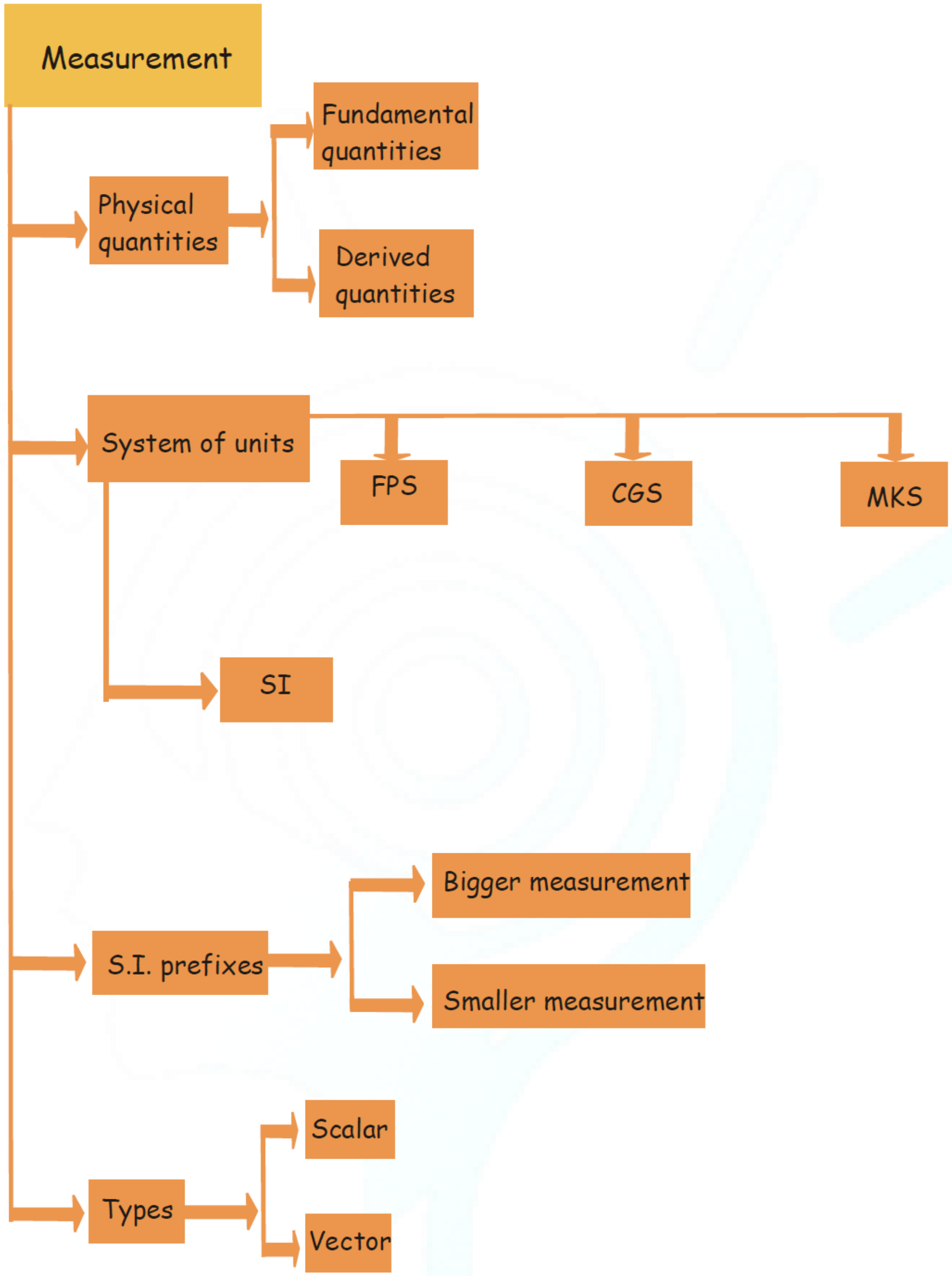
**Second:**

The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom. (1967)

**Summary / What We Learned So Far?**

- **Physical quantities :** The quantities which can be measured by an instrument are called physical quantities.
- Physical quantities are of two types :
  (a) Fundamental quantities
  (b) Derived quantities
- Measurement is the comparison of an unknown quantity with a known standard quantity of the same kind.
- **Unit :** A unit of measurement is a definite magnitude of a quantity.
- **Numerical value :** It expresses the magnitude of quantity.
- Measure of a physical quantity(M)
  = Numerical value(N) × Unit(U)
- There are following system of units:
  (a) F.P.S. System (b) C.G.S. System
  (c) M.K.S. System (d) S.I. System
- **Scalar:** The physical quantities which have magnitude only and no direction are called scalar quantities.
- **Vector:** The physical quantities which have magnitude as well as direction and also follow laws of vector algebra are called vector quantities.
- To locate the position of an object or a point in a plane, we required two perpendicular lines.
  One of them is horizontal, and the other is vertical.
- The plane is called the cartesian, or coordinate plane and the lines are called the coordinate axes.
- The horizontal line is called the x-axis, and the vertical line is called the y-axis.
- The coordinate axes divides the plane into four parts called quadrants.
- The point of intersection of the axes is called the origin.
- The distance of a point from the y-axis is called its x-coordinate, or abscissa, and the distance of the point from the x-axis is called its y-coordinate, or ordinate.
- If the abscissa of a point is x and the ordinate is y, then (x, y) are called the coordinates of the point.
- The coordinates of a point on the x-axis are of the form (x, 0) and that of the point on the y-axis are (0, y).
- The coordinates of the origin are (0, 0).
- The coordinates of a point are of the form (+, +) in the first quadrant, (–, +) in the second quadrant, (–, –) in the third quadrant and (+, –) in the fourth quadrant, where + denotes a positive real number and – denotes a negative real number.

Concept Map


Measurement
Physical quantities
Fundamental quantities
Derived quantities
System of units
FPS
CGS
MKS
SI
S.I. prefixes
Bigger measurement
Smaller measurement
Types
Scalar
Vector

## EXERCISE - I

### SINGLE CORRECT TYPE QUESTIONS

**1.** Density of a cuboid of mass 200 g with dimension length 2 cm, breadth 4 cm and height 5 cm is
(A) 1000 kg $m^{-3}$ (B) 3000 kg $m^{-3}$
(C) 5000 kg $m^{-3}$ (D) 2000 kg $m^{-3}$

**2.** The total mass of two objects of masses 1050 kg and 12 tonnes is:
(A) 130.5 quintals (B) 225 tonnes
(C) 11.2 quintals (D) 12 tonnes

**3.** $10^4$ $cm^3$ is equal to
(A) $\frac{1}{1000}$ $m^3$ (B) $\frac{1}{100}$ $m^3$
(C) 10 $m^3$ (D) 100 $m^3$

**4.** Express a speed of 360 cm $h^{-1}$ in km $s^{-1}$.
(A) $10^{-6}$ (B) $10^{-5}$
(C) $36\times10^{-6}$ (D) $360\times10^{-6}$

**5.** What does the abscissa of a point on the plane called?
(A) x-coordinate (B) y-coordinate
(C) origin (D) Quadrant

**6.** On converting 2 kg $m^2$ $s^{-2}$ to g $cm^2$ $s^{-2}$ we get
(A) $1 \times 10^7$ g $cm^2$ $s^{-2}$ (B) $2 \times 10^7$ g $cm^2$ $s^{-2}$
(C) $3 \times 10^7$ g $cm^2$ $s^{-2}$ (D) $4 \times 10^7$ g $cm^2$ $s^{-2}$

**7.** What is the SI unit of pressure?
(A) mm of Hg (B) pascal
(C) bar (D) dyne/$cm^2$

**8.** The unit of time is
(A) light year (B) angstrom
(C) leap year (D) newton

**9.** In the SI system, the unit of temperature is
(A) degree Celsius (B) degree Centigrade
(C) degree Fahrenheit (D) Kelvin

**10.** One light year distance is equal to
(A) $9.46 \times 10^{12}$ km (B) $9.46 \times 10^{14}$ km
(C) $9.46 \times 10^{12}$ m (D) $9.46 \times 10^{15}$ km

**11.** Which of the following is not a vector quantity?
(A) Force (B) Acceleration
(C) Time (D) velocity

**12.** What is the ordinate of a point P on the plane?
(A) x-coordinate (B) y-coordinate
(C) origin (D) Quadrant

**13.** Scalars have only
(A) Magnitude (B) direction
(C) both (A) and (B) (D) None of these

**14.** Time is
(A) scalar (B) vector
(C) tensors (D) none of these

**15.** Electric current has magnitude as well as direction then it will be
(A) scalar (B) vector
(C) Both (A) and (B) (D) none of these

### FILL IN THE BLANKS

**1.** The unit of speed is centimeter/second in _____ System of unit.

**2.** The weight of a body 60 kg.m.$sec^{-2}$ is equal to _______ Newton (N).

**3.** One micrometer is equal to _________ meter.

**4.** Light year is unit of __________.

**5.** C.G.S unit of time is _____________.

**6.** Quantity of matter contained in a body is called as _________.

**7.** Physical quantity, velocity is ___________quantity.

**8.** Physical quantity, distance is ___________ quantity.

**9.** Temperature is a ___________quantity.

**10.** Vector can be added, subtracted, multiplied by using _______________algebra.

**TRUE / FALSE**

1. The unit of length is light year
2. 1km/h is equal to 5/18 m/s.
3. The time taken by the earth to complete one rotation on its own is called solar day.
4. Light year is unit of speed.
5. Force is scalar quantity.
6. Displacement is vector quantity.
7. Vectors can be added using simple rules of algebra.

## EXERCISE - II

### VERY SHORT ANSWER TYPE QUESTIONS

**1.** Convert $1m^2$ into $cm^2$.

**2.** Convert 0.25 kg $m/s^2$ into g $cm/s^2$.

**3.** Convert 16 m/s into km/h.

**4.** Convert 1 km/h into m/s.

**5.** What is light year?

**6.** What is relation between parsec & light year?

**7.** How do we represent vectors?

### SHORT ANSWER TYPE QUESTIONS

**8.** A satellite was orbiting the earth at an altitude of 300 km. What is the altitude in millimeters?

**9.** Name the different systems of units.

**10.** What are the basic Quantities?

**11.** Define the system of unit.

**12.** Write down the formula of following physical quantities.

(i) Acceleration (ii) Force (iii) Pressure

**13.** How many basic physical quantities are there? Define them with examples.

**14.** What are the coordinates of a point? Give example.

### LONG ANSWER TYPE QUESTIONS

**15.** Calculate seconds in 1 lunar month.

**16.** What are vector quantities? Explain with the help of examples.

**17.** What are scalar quantities? Explain with the help of examples.

**18.** What are the quadrants? Explain their signs with example. Plot these points on graphs.

(i) (2,1) (ii) (–2, 3) (iii) (3, –2) (iv) (–1, 3)

# ANSWER KEY

## EXERCISE-I

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | C | A | B | A | A | B | B | C | D | A | C | B | A | A | A |

### FILL IN THE BLANKS

**1.** C.G.S **2.** 60 Newton(N). **3.** $10^{-6}$ meter. **4.** Distance **5.** Second

**6.** Mass **7.** Vector **8.** Scalar **9.** Scalar **10.** Vector

### TRUE / FALSE

**1.** True **2.** True **3.** True **4.** False **5.** False

**6.** True **7.** False

## EXERCISE-II

### VERY SHORT ANSWER TYPE QUESTIONS

**1.** $10^4$ $cm^2$ **2.** $25 \times 10^3$ **3.** 57.6 km/h **4.** 5/18 m/s

**5.** $9.46 \times 10^{12}$ km **6.** 1 parsec = 3.26 light year