**CBSE GUESS - 2015**
**Class – XI**
**Subject - Physics**

# Unit Dimension And Error

1. What is physical quantity?

A: A quantity which can be measured directly or indirectly is called a physical quantity .

2. What is unit?

A: Unit is a standard quantity of the same kind with which a physical quantity is compared for measuring it .
For the measurement of a physical quantity say x, two things are required .
(i) The unit (u) in which the physical quantity is expressed .
(ii) The number (n) of times the given unit is contained in the physical quantity.
i.e. Physical quantity =number X unit.
Or , X= nu .

3. Show that smaller the unit of a physical quantity , larger will be the numerical value of the physical quantity and vice-versa.

A: Let $n_1$ =numerical value of the physical quantity X having unit $u_1$
$\therefore$ X=$n_1\ u_1$ .............................. (1)
If $n_2$ =numerical value of the same physical quantity X having unit $u_2$ ,
Then X= $n_2\ u_2$ ........................... (2)
From eqn. (1) and (2) , $n_1u_1 = n_2u_2$
Or , nu=constant

$$\therefore \quad n = \frac{const.}{u}$$

Or , $n \propto \frac{1}{u}$

This shows that , smaller the unit of a physical quantity , larger will be the numerical value of the physical quantity and vice-versa.

4. What do you mean by mean solar day and mean solar second ?

A: Mean solar day is the time interval between two successive passage of the sun across the meridian .

One mean solar second is equal to $\frac{1}{24\times60\times60}$ th part of a mean solar day.

5. What is Fundamental physical quantity and unit?

A: There are three physical quantities namely mass, length and time, these are called fundamental physical quantities.

The units of fundamental physical quantities are called fundamental units.

6. What do you mean by derived physical quantities and units?

A: Any physical quantities which can be derived form the fundamental physical quantities by multiplying or dividing them is called derived physical quantities .

The units of derived physical quantities are called derived units.

Ex: Speed or Velocity = $\frac{Distance}{time} = \frac{length}{time}$

7. What are the characteristics of a standard unit?

A: (i) It should be well defined.

(ii)It should be proper size.

(iii)It should be easily accessible.

(iv)It should be reproducible at all places without any difficulty.

(v) It should not change with time , place and physical conditions such as pressure, temp. etc

(vi)It should be widely acceptable.

8. Name the t5ypes of system of units.

A: 1. CGS system 2. FPS system 3. MKS system 4. SI system

In SI system of unit there are seven fundamental and two supplementary units.

Fundamental units are:

| | | |
|---|---|---|
| 1. | Mass | kg |
| 2. | Length | m |
| 3. | Time | s |
| 4. | Temperature | K |
| 5. | Electric Current | A |
| 6. | Luminuous Intensity | cd |
| 7. | Quantity of Matter | mol |

Supplementary Units are:

1. Plane Angle rad
2. Solid Angle Sr

9.)What is the definition of radian and Steradian?

A: Radian : One radian is an angle subtended at the centre of a circle by an arc of length equal to the radius of the circle .

$$d\theta = \left(\frac{ds}{r}\right) radian$$

Steradian :One steradian is the solid angle subtended at the centre of a sphere by its surface whose area is equal to the square of the radius of the sphere.

$$d\Omega = \frac{area}{(radius)^2}$$

Or, $d\Omega = \frac{dA}{(r)^2} steradian$

10.)Give example of three large units of length?

A: 1. <u>Astronomical Unit (A.U.):</u> The average distance between sun and earth is called Astronomical Unit.

1 A.U.= $1.5\times10^{11} m$

2.<u>Light Year</u> : The distance traveled by light in vacuum in one year is called light year.

1 Light Year= $9.46\times10^{15} m$

3.Parsec : It is the distance at which an arc of length equal bto one astronomical unit subtends an angle of one second.

1 parsec= $3.1\times10^{16} m$.

11.)What is Dimension?

A: The dimensions of a physical quantity are the powers to which the fundamental quantities are to be raised to represent this quantity.

12.What is dimensional formula ?

A: The expression by the powers of the fundamental quantities to represent a physical quantity is called dimensional formula.

Ex: Dimensional formula of volume= $[M^0L^3T^0]$

13. What is the Principle of Homogeneity?

A: The dimensions of the fundamental quantities of two sides of a physical relation must be same.

i.e. ,If $[M^aL^bT^c]=[M^xL^yT^z]$

according to principle, a=x, b=y, c=z.

14. What are different types of variables and constants? Give examples.
A: 1. Dimensional variables: The physical quantities which posses dimensions and have variable values are called dimensional variables.
Ex: Area, Volume, Velocity, etc.
2.Dimensionless variables: The physical quantities which have no dimensions but have variable values are called dimensionless variables.
Ex: Angle, Strain, Specific gravity, etc.
3.Dimensional constant: The physical quantities which posses dimensions and have constant values are called dimensional variables.
Ex: Gravitational constant, Plank's constant, etc.
4.Dimensionless constant: The quantities which do not have dimensions but have a constant value are called dimensionless constant.
Ex: $\pi$, e, numerical constant like 1,2,3,………..etc.

15.Convert 10 joule into erg using dimensional analysis?
A: Use formula: $n_2 = n_1 \left(\frac{M_1}{M_2}\right)^a \left(\frac{L_1}{L_2}\right)^b \left(\frac{T^1}{T^2}\right)^c$

16.Check the dimensional consistency in case of following equation.
$$S = ut + \frac{1}{2}at^2 .$$
17.Frequency of vibration ($\nu$) of a string mass depends upon length (l) of the string , tension(T) in the string and mass per unit length(m)of the string . Using method of dimensions establish the formula for frequency.
A: Do your self.

18.What do you mea by significant figures?
A: Significant figures are the number of digits upto which we are sure about their accuracy.

19.What are the rules for Significant figures?
A: 1. All non zero digits are significant figures.
2.All zeros occurring between nonzero digits are significant.
3.All zeros to the right of the last non zero digit are not significant.
4.All zeros to the right of a decimal point and to the left of a nonzero digit are not significant.
5.All zeros to the right of a decimal point and to the right of a non zero digit are significant figures.

20.What do you mean by accuracy and precision of measurement?
A: Accuracy: The closeness of measured value to the true value of the physical quantity is known as the accuracy of the measurement.

Precision: Precision is a measure of extent to which successive measurements of a physical quantity differ from one another.

21. What do you mean by true value, absolute error, mean absolute error, relative error, percentage error?

A: True value: Let $x_1, x_2, x_3, ......, x_n$ be observed values.

$$\therefore \ \bar{x} = x_{mean} = \frac{x_1 + x_2 + ... + x_n}{n}$$

$$\text{Or, } \ \bar{x} = \frac{\sum x_i}{n}$$

$\bar{x}$ is the true value.

Absolute error: $\Delta x_i = |\bar{x} - x_i|$

Mean absolute error: $\Delta \bar{x} = \frac{|\Delta x_1| + |\Delta x_2| + ... + |\Delta x_n|}{n} = \frac{1}{n}\sum_{i=1}^{n}|\Delta x_i|$

Relative error: $\delta x = \frac{\Delta \bar{x}}{\bar{x}}$

Percentage error: percentage error=relative error X 100%= $\frac{\Delta \bar{x}}{\bar{x}}$ X100%.

22. Write the formula of combination of errors?

A: (i) Addition: Z=A+B, $\therefore \ \Delta Z = \Delta A + \Delta B$

(ii)Subtraction: Z=A-B $\therefore \ \Delta Z = \Delta A + \Delta B$

(iii)Multiplication: Z=AB $\therefore \ \frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$

(iv)Division: Z= $\frac{A}{B}$ $\therefore \ \frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$.

(v)IF Z= $A^n$ $\therefore \ \frac{\Delta Z}{Z} = n\frac{\Delta A}{A}$.

23. A physical quantity Z is given by $Z = \frac{a^2 b^3}{c^4}$ ,percentage errors in measurement of a,b,c are respectively 1%, 4% ,2%. Calculate the relative error and percentage error of Z.

A: Do your self.

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