CHAPTER 2: UNITS AND MEASUREMENTS

1. What is measurement?

Ans: The comparison of any physical quantity with its standard unit is called measurement.

2. What are physical quantities?

Ans: All the quantities which can be measured directly or indirectly or needs measurement is called Physical quantities.

3. State the types of physical quantities?

Ans: Physical quantities are of two types. They are fundamental and derived quantities.

4. What are fundamental quantities? Give example.

Ans: Those quantities which are independent of others. Example- Length, mass, Time, thermodynamic temperature etc.

5. What are derived quantities? Give example.

Ans: Those quantities which are derived from fundamental quantities. Example-Work, energy, Speed, torque, momentum etc.

6. What are physical units?

Ans: It is the standard amount of physical quantity chosen to measure the quantity of the same kind.

7. What are the system of units?

Ans: A complete set of both the fundamental unit and derived unit is known as system of units.

They are FPS, CGS, MKS, SI system of units.

8. What is SI system?

Ans: It is known as international system of units. This system contains seven fundamental and two supplementary quantities (plane angle & solid angle).

9. Write down the name of fundamental and supplementary quantities and their units?

Ans: Refer to NCERT textbook page 17 table 2.1 for this.

10. What are the advantages of choosing SI system?

Ans: Advantages of choosing SI system are…

  I.   One unit needed for particular physical quantity.

  II.   IT can be expressed as a power of 10.

  III. It is a standard unit for measurement.

  IV.   Derived units are obtained by multiplication and division.

11. What do you mean by dimensions of physical quantity?

Ans: The powers to which fundamental quantities must be raised in order to express the given physical quantity are called its dimension.

12. Write down the important dimensions of complete physics?

Ans: Refer to NCERT textbook page 218 for this.

13. Write down the applications of dimensional analysis?

Ans: The important application of dimensional analysis are---

  I.   To find the unit of a physical quantity in a given system of units.

  II.   To find the dimension of physical constant or coefficient.

  III. To convert a physical quantity from one system to another.

  IV.   To derive new relations.

14. Write down the limitations of dimensional analysis?

Ans: Few limitations of dimensional analysis are –

  I.   If dimensions are given, physical quantity may not be unique.

II. Numerical constant having no dimensions cannot be deduced by this method.

III. The method of dimension cannot be used to derive the relations other than product of power function.

15. What is significant figure?

Ans: In the measured value of a physical quantity, the number of digits about the correctness of which we are sure plus the next doubtful digit, are called the significant figure.

16. What is homogeneity principle?

Ans: If the dimensions of left hand side of an equation are equal to the dimensions of right hand side of the equation, then the equation is dimensionally correct. This is known as homogeneity principle.

Mathematically, [LHS] = [RHS].

17. What is Error?

Ans: The lack in accuracy in the measurement due to the limit of accuracy of the instrument or due to any other cause is called an error.

18. Write down the different types of error?

Ans: 1.**Absolute Error:**

The difference between the true value and the measured value of a quantity is called absolute error.

If a_1 , a_2, a_3 ,…, a_n are the measured values of any quantity a in an experiment performed n times, then the arithmetic mean of these values is called the true value (a_m) of the quantity.

$$a_m = \frac{a_1 + a_2 + a_3 + \ldots + a_n}{n}$$

The absolute error in measured values is given by

$\Delta a_1 = a_m - a_1$

$\Delta a_2 = a_m - a_1$

…………

$\Delta a_m = \Delta a_m - \Delta a_n$

2. Mean Absolute Error:

The arithmetic mean of the magnitude of absolute errors in all the measurement is called mean absolute error.

$$\overline{\Delta a} = \frac{|\Delta a_1| + |\Delta a_2| + \ldots + |\Delta a_n|}{n}$$

3. Relative Error:

The ratio of mean absolute error to the true value is called relative error.

$$\text{Relative error} = \frac{\text{Mean absolute error}}{\text{True value}} = \frac{\overline{\Delta a}}{a_m}$$

4. Percentage Error:

The relative error expressed in percentage is called percentage error.

$$\text{Percentage error} = \frac{\overline{\Delta a}}{a_m} \times 100\%$$

19. What is parallax method?

Ans: It is the method of measuring large distance such as the distance of a planet or a star from the earth which cannot be measured directly with a metre scale.

The units used to measure such distance are as follows-

1 astronomical unit = 1.496×10^{11} m (average distance between sun and earth).
1 light year = 9.46×10^{15} m (the distance light travels in one year).
1 parsec = 3.08×10^{16} m = 3.26 light year (the distance associated with one arcsec of parallax).