CLASS XI PHYSICS CHAPTER 1. UNITS AND MEASUREMENT

SUMMARY

1.A quantity which can be measured is called a physical quantity.

2. The comparison of a physical quantity with a homogeneous quantity of same kind taken as a standard is known as measurement.

3.Unit is a standard quantity with which a physical quantity of same kind is compared.

4. The physical quantities independent of each other are called fundamental quantities and their units are called fundamental units.

5. The physical quantities which are derived from the fundamental quantities are called derived quantities and their units are derived units.

6. There are 7 fundamental units in SI. They are

Physical Quantities	Units	Symbol
Length	Meter	m
Mass	Kilogram	kg
Time	second	s
Temperature	Kelvin	k
Electric Current	Ampere	A
Luminous Intensity	Candela	cd
Amount of substance	Mole	mol

7.Units used to measure large distances

Unit	Abbreviation	Conversion
Astronomical Unit	AU	1 AU = 1.5×10^{11} m
Light Year	lyr	1 ly = 9.46×10^{15} m
Parsec	pc	1pc = 3.08×10^{16} m
		1 pc = 3.26 ly or 1 pc = 206265 AU

8.Dimensions: The powers to which the fundamental quantities are to be raised to represent a physical quantity are known as dimensions of the physical quantity.

9. Dimensional formula: The expression which shows that which of the fundamental quantities and with what powers enter into the derived physical quantity is known as the dimensional formula of the derived quantity. Few simple examples are:

Acceleration	$\frac{\text{velocity}}{\text{time}}$	$\frac{LT^{-1}}{T} = [M^0 L T^{-2}]$
Momentum	Mass x velocity	$M \times LT^{-1} = [M L T^{-1}]$
Force	Mass x acceleration	$M \times LT^{-2} = [M LT^{-2}]$
Pressure	$\frac{\text{Force}}{\text{area}}$	$\frac{MLT^{-2}}{L^2} = [ML^{-1}T^{-2}]$

10. Dimensional equation: The equation obtained by equating the symbol of a physical quantity with its dimensional formula is called dimensional equation.

11.Principle of homogeneity: According to this principle, the dimensions of the fundamental quantities of both the sides of a physical relation must be same.

12. Dimensional analysis: to i) convert one system of unit to another system of unit using the following relation : $n_2 = n_1 [M_1/M_2]^a[L_1/L_2]^b[T_1/T_2]^c$ An example is given below:

$$\therefore \quad n_2 = n_1\left[\frac{M_1}{M_2}\right]^1\left[\frac{L_1}{L_2}\right]^1\left[\frac{T_1}{T_2}\right]^{-3}$$

$$= 60\left[\frac{1\text{ kg}}{100\text{ g}}\right]^1\left[\frac{1\text{ m}}{20\text{ cm}}\right]^1\left[\frac{1\text{ s}}{1\text{ min}}\right]^{-3} = 60\left[\frac{1000\text{ g}}{100\text{ g}}\right]^1\left[\frac{100\text{ cm}}{20\text{ cm}}\right]^2\left[\frac{1\text{ s}}{60\text{ s}}\right]^{-3}$$

$$= 60 \times \frac{1000}{100} \times \frac{100}{20} \times \frac{100}{20} \times 60 \times 60 \times 60$$

$$= 3.24 \times 10^9 \text{ units.}$$

ii) derive relations between various physical quantities and iii) check the correctness in a physical relation. Take the help of following link.
https://www.youtube.com/watch?v=sXp6Ltromsk
13. SIGNIFICANT FIGURES: Significant figures are those digits in a number that are known with certainty plus the first digit that is uncertain.
14. RULES FOR SIGNIFICANT FIGURES
i) all non- zero digits are significant figures.
ii) All zeros occurring between non-zero digits are significant figures.
iii) All zeros to the right of the last non-zero digit are not significant.

iv) All zeros to the right of a decimal point and to the left of a non-zero digit are not significant figures.
v) All zeros to the right of a decimal point and to the right of a non-zero digit are significant figures.
15.**ACCURACY**: The closeness of the measured value to the true value of the physical quantity is known as accuracy.
16. **PRECISION:** It refers to the closeness of different measurements of a physical quantity to each other.
17**. ERROR:** True value – measured value.

Addition $Z = A + B \Rightarrow \Delta Z = \Delta A + \Delta B$

Substraction $Z = A - B \Rightarrow \Delta Z = \Delta A + \Delta B$

Division $Z = \frac{A}{B} \Rightarrow \frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$

Multiplication $Z = A \bullet B \Rightarrow \frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$

Power $Z = A^n \Rightarrow \frac{\Delta Z}{Z} = n\frac{\Delta A}{A}$

WORKSHEET

VERY SHORT ANSWER TYPE QUESTIONS

1. **CHOOSE THE CORRECT OPTION:**

A.i) Parsec is the unit of
a) time b) distance c) frequency d) acceleration
ii) Friction, air resistance, tension and thrust are the forces.SI unit of tension is
a) Joule b) newton c) watt d) henry
iii) Dimensional formula for linear momentum is
a) $[ML^0T^{-1}]$ b) $[M^0LT^{-1}]$ c) $[MLT^{-1}]$ d) $[ML^{-1}T]$
iv)The dimensional formula for pressure gradient is
a) $[M^0LT^{-1}]$ b) $[ML^0T^{-1}]$ c) $[ML^{-2}T^{-2}]$ d) $[M^0L^0T]$
v) The significant figures in the number 20340 are
a) 3 b) 4 c) 5 d) none of these

SHORT ANSWER TYPE QUESTIONS (1 MARK AND 2 MARKS)

2. What do you understand by derived physical quantities? Give examples.
3. How many astronomical units (A.U.) make 1 Parsec?
4. Express 1 parsec in terms of light years.
5. Which is a bigger unit- light year or parsec?
6. If $x = at + bt^2$, where x is in metres and t in seconds, what are the units of a and b?
7. Write down the dimensional formula for Gravitational constant.
8. What is the dimensional formula for i) Pressure ii) Power iii) Density iv) Angle?
9. Give an example of a physical quantity which has neither unit nor dimension.
10. State the number of significant figures in i) 125 ii) 0.20 iii) 3750 iv) 8.27×10^{-11}
11. Round off to 3 significant figures: i) 20.46 m ii) 30.68 m iii) 30.55m.

LONG ANSWER TYPE QUESTIONS (FOR 3 MARKS AND 5 MARKS)

12. What are the main characteristics of SI?

13. Obtain the dimensional formula for torque, coefficient of viscosity, surface tension, angular momentum.

14. Convert 10 erg into joule using dimensional analysis.

15. Check the correctness of the relation $T = \sqrt{l/g}$, where T is the time period, l is the effective length and g is the acceleration due to gravity.
