

Class 9 Physics

Chapter 1: Measurement and Experimentation

Instructions:

1. Study the content provided and Answer related Questions
2. Write all Questions and their answers in your notebook

Assignment 1.1

- Measurement is a process of comparison of the given physical quantity with the known standard quantity of same nature.
- The standard quantity used to measure and express the given physical quantity is called the unit.
- Different quantities need different units.
- Measurement of quantity involves two parameters:
 - **Unit** in which quantity is being measured
 - **Numerical Value** which express multiple of selected unit.
- Magnitude of physical quantity = numerical value X unit;
Example: 5 kg (5 is numerical value and kg is unit)
- Units chosen should have the following properties:
 - The unit should be of **convenient size**.
 - It should be defined **clearly** without any confusion.
 - It should be **reproducible** and **independent of space and time**.
- There are different systems of unit
 - **C.G.S. System** (or French System)
C.G.S. stands for Centimeter (C), Gram(G), and Second(S).
 - **F.P.S. System** (or British System)
F.P.S. stands for Foot(F), Pound(P) and Second(S).

- **M.K.S. System** (or Metric System)
M.K.S. stands for Metre(M), Kilogram(K) and Second(S).

All the above are no longer used by scientific community because none of the above was accepted globally, So a new system was introduced in 1960 called **S.I.** (*Systeme Internationale d' Unites* or International system of units), it is based on M.K.S. system.

- Units can be classified in to 2 types:
 - **Fundamental or Basic:** which is independent of any other unit, it does not depend on any other fundamental unit.
 - **Derived:** which depends on fundamental units, it requires fundamental unit to be expressed.
- There are **7 fundamental Quantities** and **two complementary** quantities:

Quantity	Unit	Symbol
Length	metre	M
Mass	kilogram	Kg
Time	second	S
Temperature	kelvin	K
Luminous intensity	candela	Cd
Electric current	ampere	A
Amount of substance	mole	Mol
<u>Complementary Quantities</u>		
Angle	radian	rd
Solid angle	steradian	st-rd

- Some Examples of Derived Quantities:

Quantity	Unit	Symbol
Area	metre X metre	m ²
Volume	metre X metre X meter	m ³
Density	Mass/ volume	kg m ⁻³
Force	kilogram (metre/second ²) Or newton	Kg m s ⁻² N
pressure	newton/ metre X metre	N/m ²

➤ Unit of Length

❖ SI unit of length is **metre(m)**

❖ **Sub units** of metre are used for measurement of smaller length:

- **centimetre (cm):** $1\text{cm} = 1/100\text{ m} = 10^{-2}\text{ m}$
- **millimetre (mm) :** $1\text{mm} = 1/1000\text{ m} = 10^{-3}\text{m}$
- **micrometre or micron (μm) :**
 $1\mu\text{m} = 1/10,00,000\text{ m} = 10^{-6}\text{ m} = 10^{-4}\text{ cm} = 10^{-3}\text{ mm}$
- **nanometre (nm):** $1\text{nm} = 10^{-9}\text{ m}$

❖ **Multiple units** of metre:

- **kilometre (km):** $1\text{ km} = 1000\text{ m}$

❖ **Non-metric unit of length** for measurement of distance between **heavenly body**:

- **Astronomical Unit (A.U.):** One astronomical unit is equal to mean distance between earth and sun. $1\text{ A.U.} = 1.496 \times 10^{11}\text{ metre.}$
- **Light Year (ly):** A light year is the distance travelled by light in vacuum in one year. $1\text{ly} = 9.46 \times 10^{15}\text{ m.}$
- **Parsec:** one parsec is the distance from where the semimajor axis of orbit of earth (1 A.U.) subtends an angle of one second.
 $1\text{parsec} \times 1'' = 1\text{ A.U.} = 3.26\text{ ly}$

❖ **Non- metric units of length** used for measurement of **atomic length**:

- **Angstrom (\AA):** $1\text{\AA} = 10^{-10}\text{ m}$ (used for measurement of wavelength of light)
- **Fermi (f):** $1\text{f} = 10^{-15}\text{m}$

➤ Unit of Mass

❖ SI unit of mass is **kilogram (kg).**

❖ **Sub units** of kilogram are used for measurement of smaller mass:

- **gram (g):** $1\text{g} = 1/1000\text{ kg}$
- **milligram (mg):** $1\text{mg} = 1/10,00,000\text{ kg} = 10^{-6}\text{ kg} = 10^{-3}\text{ g}$

❖ **Multiple units** of kilogram are used for measurement of larger mass:

- **quintal:** 1 quintal = 100 kg
- **metric tonne:** 1 metric tonne = 1000 kg = 10 quintal

❖ **Non metric unit** of mass:

- **atomic mass unit (amu)** used to measure mass of subatomic particles like proton, neutron and electron. **1 amu = 1.66×10^{-27} kg**
- **solar mass** is used to measure mass of large heavenly bodies.
1 solar mass = 2×10^{30} kg

➤ Units of Time

❖ SI unit of time is **second (s)**.

❖ Smaller units of time:

- **1ms** = 10^{-3} s ; **1 μ s** = 10^{-6} s ; **1shake** = 10^{-8} s ; **1ns** = 10^{-9} s

❖ Bigger units of time:

- **1 minute** = 60 s ; **1hour** = 60 min = 60 X 60 s = 3600 s ;
1day = 24 hr = 24 X 60 min = 1440 min = 1440 X 60 s = 86400 s
- **Lunar month:**
1 lunar month is the time of one lunar (moon) cycle = 29.5 days (approx.)
- **month: 1month = 30 days** (although there are different number of days in different months like 30,31, 29 or 28 but for scientific calculation one month is of 30 days.)
- **year (yr): 1 year = 365 days = 3.1536×10^7 s**
- **leap year:**
year in which the month of February is of 29 days, **1leap year = 366 days.**
- **Decade:** a decade is of 10 years, **1 Decade = 10 year = 3.1536×10^8 s**
- **Century:** a century is of 100 years, **1 Century = 3.16×10^9 s.**
- **Millennium:** a millennium is of 1000 years, **1 Millennium = 3.16×10^{10} s.**

Answer the following Questions:

Que 1. What is meant by measurement?

Que 2. What do you understand by the Term Unit?

Que 3. What are the three requirements for selecting a unit of a physical quantity?

Que 4. Name the three fundamentals quantities.

Que 5. Name the three systems of units and state the various fundamentals units in them.

Que 6. Define a fundamental unit.

Que 7. What are the fundamental unit in S.I system? Name them along with their symbols.

Que 8. Explain the meaning of derived unit with the help of example?

Que 9. Name two units of length which are bigger than a metre. How are they related of the metre?

Que 10. Write the names of two units of length smaller than a metre. Express their relationship with metre.

Que 11. How is nanometer related to Angstrom?

Que 12. Name the three convenient units used to measure length ranging from very short to very long value. How are they related to the S.I unit?

Que 13. Complete the following: -

1 light year =.....m

1 m =.....Å

1 m =..... μ

1 micron =.....Å

1 fermi = m

Que 14. State two units of mass bigger than smaller than a kilogram. How are they related to the kilogram?

Que 15. State two units of mass bigger than a kilogram. Give their relationship with the kilogram?

Que 16. Complete the following: -

1 g =kg

1 mg =kg

1 quintal =kg

1 a.m.u (or u) =kg

Que 17. Name two units of time bigger than a second. How are they related to the second?

Que 18. What is a leap year?

Que 19. 'The year 2020 will have February of 29 days'. Is this statement true?

Que 20. What is a lunar month?

Que 21. Complete the following: -

1 nano second = s.

1 μ s = s.

1 year = s.