1. Measurement in Science and Technology

- Measurement is a process of comparing a physical quantity with a standard quantity.

- The standard quantity used to compare a physical quantity for its measurement is called unit.

- The internationally accepted modern system of units used in science is known as SI units.

- If a physical quantity P is "n" times the standard quantity (unit) u, then

$$P = nu$$

- In SI units there are 7 basic units. These are metre for length, kilogram for mass, second for time, Kelvin for temperature, ampere for electric current, candela for luminous intensity and mole for amount of substances.

- The units obtained in terms of basic units are called derived units.

- In international system of units known as SI the basic units are defined as under:

   (i) **Kilogram:** One kilogram is the mass of a particular cylinder made of Platinum Iridium alloy kept at the International Bureau of Weight and Measures in France.

   (ii) **Metre:** one metre is the distnace travelled by light in vacuum in a time interval of 1/299792458 second.

   (iii) **Second:** One second is the time required for cesium-133 atom to undergo 9192631770 vibrations.

   (iv) **Kelvin:** One kelvin is equal to 1/273.15 of the thermodynamic temperature of tiple point of water.

   (v) **Ampere:** One ampere is the current that when flowing through two long parallel wires, each of length equal to one metre, separated by one metre in free space, results in a force of 2×10^7 N between the two wires.

   (vi) **Candela:** One candela is the luminous intensity, in a given direction of a source that emits monochromatic radiation of frequency 540×10^{12} Hz and that has a radiant intensity of 1/683 watt per steradian in that direction.

   (vii) **Mole:** One mole is the amount of any substance, which contains, as may elementary units, as there are atoms in exactly 0.012 kg of C-12 isotops of carbon.

Build Your Understanding

- Classify the followings as basic units and derived units newton, kilogram, ms^{-2}, joule, kelvin, watt, kilo watt hour, second, metre.

- Which can be taken as standard; hand span, pace, light year, ton, dhanurmusti, maund.

- Express the following in basic units (i) newton (ii) joule (iii) pascal

- How will you measure the density of a solid block?

- Arrange the following in increasing order of their values. seer, ratti, chhantak, masha.

- Write the numeral value of the following SI prefixs: yotta, mega, micro, femto, yoco.

- Cite one example which shows that the power to which a unit with a prefix is raised applies to the whole unit, including the prefix.

Measurement and distribution

A milkman has only threee containers of capacity 8L, 5L and 3L. He has 8L of milk. Now he decides to divide the milk into two equal halves. How will he do it?

Let 8L milk be taken in the container of 8L capacity. Now he has to poure the milk as the process given below:
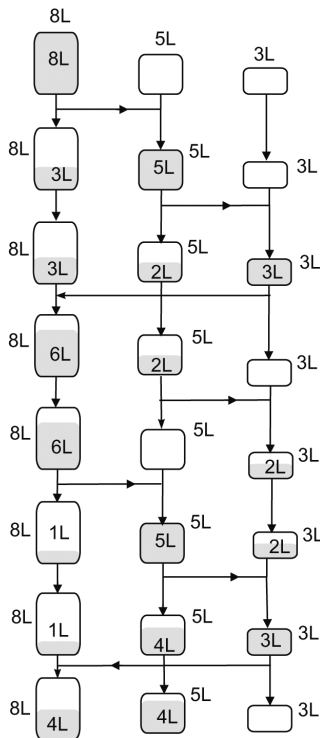
✔ Maximise Your Marks

- "Measurement is an essential part of our day to day activities" justify.
- In the ancient times parts of 'human body' were used for measurement. Give some examples of the same.
- Why were the ancient measurements replaced by SI units?
- Write three charactristics of Unit.
- In the statement p = nu, what do the symbols stand for?
- For measurement of which quantities are the followings units used:
  (i) Gaz (ii) Prahar (iii) quantal (iv) KVAH

★ Stretch Yourself

1. Rules while using SI prefixes

(i) No space is required between the prefix and the symbol of the unit.
(ii) The prefixes are used only with the units and not alone.
(iii) Use only one prefix at a time.
(iv) SI prefix is not used with the unit °C.

2. Rules for Representing SI units

(i) While writing the value of physical quantity, the number and the unit are separated by a space.
(ii) No space is given between number and °C, degree, minute and second of plane angle.
(iii) The symbols of the unit are not changed while writing them in plural.
(iv) The symbols of the units are not followed by a full stop except at the end of a sentence.
(v) In writing the SI unit obtained as a combination of unit a space is given between the symbols.
(vi) When using powers with a unit name the modifier is used after the unit name.

? Test Yourself

1. Convert the followings into respective SI units
   (i) metric tone (ii) light year (iii) year
2. In what unit the following are measured (i) potatoes (ii) milk (iii) silk-ribbon (iv) land area.
3. Can a weighing machine with each division at 5 kg weigh 2 kilo mango?
4. Represent the following measurements by using suitable SI prefixes.
   (i) 2×10^{-8} s (ii) 1.54×10^{-10} m (iii) 1.98×10^{-6} mol
5. Convert the following into SI unit.
   (i) 1 litre (ii) 10000 cm^2 (iii) 100 decigram (iv) 760 cm of Hg coloumn