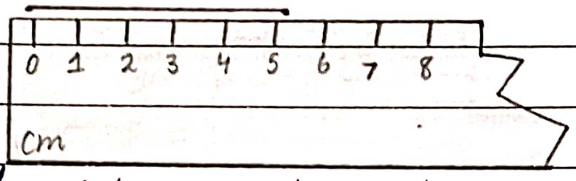
Q. No. 2 (i) **Reason:-** Unit need to be specified because to access the nature of the quantity and to describe the magnitude.

Explanation:- It is meaningless for the number without a unit and a unit does not mean anything without a number.

Figure:-



For example:- Let us consider, a drawing using scale.

- **The measurement given is 5 (meaningless).**

When there is only a number, it will lead to a confusion whether to draw a line for cm or m. Hence, the above-mentioned statement is meaningless.

Since the measurement is 5cm. This is making complete sense.

Q. No. 2 (ii) **Advantages system of units (SI):-**

1. **Base quantities:-** It consists of only seven base units of the base quantities. Most of the derived units are obtained by multiplying and dividing the base units.
2. **Standard unit:-** Each quantity has only one standard unit, so we don't need to specify a quantity with different units.
3. **No less definitions:-** There are no numerical definitions or constant for students to memorize. E.g. The quantity "**power**" is defined as work done per unit time $\left(\text{Power} = \frac{\text{Work}}{\text{Time}}\right)$. Therefore, the SI unit of power "**Watt**" is defined as the unit of work per unit time $\left(\text{Watt} = \frac{\text{Joule}}{\text{Second}}\right)$.
4. **Derivation of SI units:-** SI units are coherently derived as simple algebraic ÷ or x of a few base units, using the same equation as the quantity being measured.
5. **Use of decimals:-** SI uses decimals, for eliminating fractions & mixed numbers.

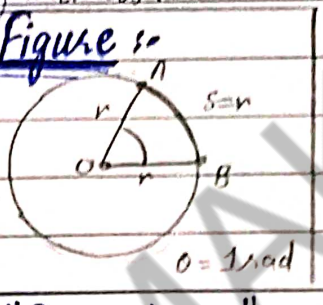
Q. No. 2 (iii) **Radians:-** The circumference of circle is $2\pi r$. Radians that account for circumference of circle can be found as:-

- **Mathematically:-**

No. of radians in 1 revolution = Circumference of ● / Radius of ●

No. of radians in one revolution = $\frac{2\pi r}{r} = 2\pi$ rad

- **Figure:-**



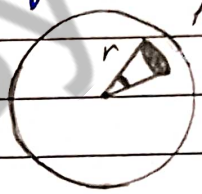
- **Conclusion:-** In 1 revolution there will be "2π radians."

Steradian:- The area of sphere is $4\pi r^2$. Steradians can be found as:-

- **Mathematically:-** No. of steradians = $\frac{\text{Area of sphere}}{\text{Squared radius}}$

No. of steradians in sphere = $\frac{4\pi r^2}{r^2} = 4\pi sr$

- **Figure:-**



- **Conclusion:-** Hence steradians in sphere is "$4\pi sr$."

Q. No. 2 (iv) **Least Count Errors:-** "The smallest value that can be measured by the measuring instrument is called **least count.**"

i) All the readings or measured values are good only up to this value.

ii) For example, a "**vernier callipers**" has the least count as **0.01cm**; a "**spherometer**" has a least count of **0.001cm.**

iii) Least count error belongs to the category of random errors but within a limited size; it occurs both with systematic & random errors.

"Reduction of least count error"

i) We can reduce the least count error by using instrument with high resolution, improving experimental techniques, etc.

ii) By repeating observations and taking the arithmetic mean of the result, the mean value can be closer to the true value of the quantity.

Cutting Line

Q. No. 2 (v) **Reason:-** Including more digits in answers, doesn't make it more accurate but it can make answer more precise.

Explanation:- Accurate answer is the one which is closet to actual or acceptable value.

Example:- "Actual length" of a wire is 10.6cm. If "student A" measures its value as 10.5cm and "student B" measures its value as 10.15cm.

We see that "Student A" measurement is closer to actual value, so his measurement is more correct than "Student B."

Although "Student B" reading has more digits than "A", it is less accurate but more precise.

More digits = More precision but less accuracy

Q. No. 2 (vi) **Precision:-** It means how close the measured values are to each other.

Dependence of precision on least count:- "Precision depends upon the least count of measuring instrument."

* Smaller the least count of the instrument, measurement will be more precise and vice versa.

Example:- Consider length of wire is measured with "Vernier Caliper" is:-

$$L = 10.5 \pm 0.1\,mm$$

This means that its true length lies between 10.4mm – 10.6mm.

The length of some wire is measured with "Screw guage" is:-

$$L = 10.50 \pm 0.01\,mm$$

This means that its true length lies between 10.49mm - 10.51mm.

We see that measurement taken by the screw guage is more precise than that of vernier caliper, because they are closer to eachother.

Q. No. 2 (vii) Yes, we can multiply and divide quantities with different dimensions and after multiplication or division they will give us dimensions of any derived quantity.

For example:-

As, Force = mass × acceleration

Dimension of Force = Dimension of mass × Dimension of acceleration

$[F] = [M][LT^{-2}]$

$[F] = [MLT^{-2}]$

Reason:- i) Only those quantities can be added or subtracted which have same dimensions.

ii) Quantities with different dimensions can't be added or subtracted so we multiply or divide them.

Q. No. 2 (viii) A quantity can be taken as time standard if:-

i) Accessible

ii) Invariable (Constant).

Human Pulse:- Cannot be taken as time standard.

"Reasons"

★ Pulse rate varies as a person rests, walks and run.

★ It also changes with age.

Swinging Pendulum:- Time period of simple pendulum is expressed as: $T = 2\pi\sqrt{l/g}$. It cannot be taken as time standard. All the reasons given below affect the Time period.

"Reasons"

★ Length of pendulum may change due to **change in temperature.**

★ Time period **varies with "g"** and **"g" varies with altitude.**

★ **Frictional force** of air and support may affect the time period.

Q. No. 2 (ix) If an equation is dimensionally correct, then that equation may or may not be a right equation.

Example:-

Consider the equation of Newton's 2nd Law $F = ma$.

- The above equation is a correct equation in any sense. But if we write $F = 2\pi(ma)$.
- The above equation is dimensionally correct but it is not a right equation:-

Reason:- In the equation 2π is a dimensionless constant, so by applying principle of homogenity, dimensions on L.H.S and R.H.S will be same, it will be **dimensionally consistent** but it is not **correct equation.**

Q. No. 2 (x)