Use 2

To check the correctness of a physical relation (checking a formula).

- **If a relation obeys the principle of homogeneity, then the relation is dimensionally correct relation.**

Question*: Check the correctness of physical equation $s = u\,t + ½\,at^2$. In the equation, s is the displacement, u is the initial velocity, v is the final velocity, a is the acceleration and t is the time in which change occurs.*

Solution:

According to question, $\text{L.H.S} = s$

and $\text{R.H.S} = u\,t + \frac{1}{2}at^2$

The dimensional formula for the L.H.S can be written as:

$$[\text{L.H.S}] = [M^0L^1T^0] \quad \ldots\ldots\ldots\ldots\ldots \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Simplifying we can write, R.H.S as $[u][t] + [a]\,[t]^2$

Numerical constants do not have dimensions.

The dimensional formula for the R.H.S can be written as:

$$[\text{R.H.S}] = [\,M^0L^1T^{-1}]\,[M^0L^0T^1] + [\,M^0L^1T^{-2}]\,[M^0L^0T^1]^2$$

$$[\text{R.H.S}] = [\,M^0L^1T^0] \quad \ldots\ldots\ldots\ldots\ldots \quad \ldots\ldots\ldots\ldots\ldots (2)$$

From (1) and (2), we have [L.H.S] = [R.H.S]

Hence, by the principle of homogeneity, the given equation is dimensionally correct.

- ✓ *Dimensionally correct equation may not be physically correct.*
- ✓ *Dimensionally incorrect relation is never physically correct.*

Check Yourself:

1. *Check the correctness of the physical equation $v^2 = u^2 + 2as^2$.*
2. *Check the correctness of the formula $T = 2\pi\sqrt{\frac{l}{g}}$. Here, T is time period, l is length and g is acceleration due to gravity*
3. *Check the correctness of the formula $v = \sqrt{\frac{R}{2G}}$ .Where R is radius, M is mass.*
4. *Check the correctness of the formula $F = ma$.*
5. *Check the correctness of the formula $H = \frac{2T\cos}{r\rho\, g}$, where, H is height, T is surface tension ($T = \frac{F}{l}$), r is radius and g is acceleration due to gravity.*

Short question:

1. *Is dimensionally correct relation necessarily physically correct relation? Explain with examples.*