

Exercise (Chap 1): Dimensional analysis

Exercise

In order to find the equations giving the position of a freely falling body, the students have giving different equations:

$$\text{Eq. 1:} \quad x = v_0 t + \frac{1}{2} g t^2$$

$$\text{Eq. 2:} \quad x = v_0 t^2 + \frac{1}{2} g t$$

Choose the correct equation by using dimensional analysis.

Answer

If we analyze the first equation dimensionally, we have:

$$[L] = \frac{[L]}{[T]} [T] + \frac{[L]}{[T]^2} [T]^2$$

$$[L] = [L] + [L]$$

$$[L] = [L]$$

Eq. 1 is correct with respect to dimensional analysis.

If we analyze the first equation dimensionally, we have:

$$[L] = \frac{[L]}{[T]} [T]^2 + \frac{[L]}{[T]^2} [T]$$

$$[L] = \frac{[L]}{[T]} [T][T] + \frac{[L]}{[T][T]} [T]$$

$$[L] = [L][T] + \frac{[L]}{[T]}$$

~~$$[L] = [L][T] + \frac{[L]}{[T]}$$~~

Eq. 2 is meaningless and incorrect with respect to dimensional analysis.