All Physics Equations

Equations of Motion

For constant acceleration we define

$a = (v - u) / t$

and we rearrange to get

1) $v = u + a\,t$ (no ***s*** term)

From the concept that distance is average speed x time we get

2) $s = \frac{1}{2}(u + v)\,t$ (no ***a*** term)

Putting in ***v*** from 1) into 2) we get

3) $s = u\,t + \frac{1}{2}\,a\,t^2$ (no ***v*** term)

Putting in ***u*** from 1) into 2) we get

4) $s = v\,t - \frac{1}{2}\,a\,t^2$ (no ***u*** term)

Putting ***t*** from 1) into 2) we get

5) $v^2 = u^2 + 2\,a\,s$ (no ***t*** term)

Thus we work with five equations, each equation inter-relating 4 terms from "***s u v a t***" and leaving out the 5th. It is recommended the student carries out each of these substitutions to gain familiarity.

nb

Differentiating 1) acceleration.

Differentiating 3) gives 1).

Force, Work, Energy

force = mass × acceleration

$F = m\,a$ *(newton)*

work = force × distance

$W = F\,s$ *(joule)*

Energy is the potential to do work so has the same units

power = rate of doing work

$P = F\,s/t$ *(watt)*

momentum = mass × velocity

$p = m\,v$ *(newton-sec)*

impulse = force × time (duration)

$I = F \times \Delta t$

hence impulse = change in momentum

$I = mv - mu$

the units are thus either kg-m/s or N-s

In collisions,

momentum after = momentum before

so

$m_1u_1 + m_2\,u_2 = m_1v_1 + m_2\,v_2$

rg

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