Ngā Whetū Resources

Physics Year 13 (NCEA Level 3)

Summary Linear Motion

Graphing Motion

Drawing displacement / time, Velocity / time, Acceleration / time graphs

Linear graph: $y = mx + b$; Quadratic graph: $y = A + Bx + Cx^2$

Equations of Motion

$$v_f = v_i + at\,;\ \ v_f^2 = v_i^2 + 2ad\,;\ \ d = \frac{(v_i + v_f)^2}{2}\,;\ \ d = v_i t + \frac{1}{2}at^2\,;$$

Which equation to use depends on problem: what has been given? what is asked?
Make up a budget before you decide.

Revise Newton's laws

1. No Force $\rightarrow$ No motion or Uniform motion; i.e. no acceleration
2. $F = ma$ Force is proportional to acceleration; gradient in *F/a* graph is mass *m*
3. A exerts force on B; then B exerts same force but opposite on A (remember: fly exerts same force on windshield as windshield on fly!)

Centre of Mass

A. **DEFINITION** $\rightarrow$ IF FORCE AT THAT POINT, THEN NO TORQUE (NO ROTATION)

Location (see-saw, dumbbell) $m_1 d_1 = m_2 d_2$ or $\frac{d_1}{d_2} = \frac{m_2}{m_1}$

or with $D = d_1 + d_2$ $\rightarrow$ $\boxed{d_1 = \frac{m_2}{m_1 + m_2} D}$ or $\boxed{d_2 = \frac{m_1}{m_1 + m_2} D}$

Velocity $$V_{CoM} = \frac{Total\ Momentum}{Total Mass}$$

Conservation of Momentum: Because Total Momentum doesn't change during collisions, V_{CoM} doesn't change either.

Momentum

$p = mv$; unit is $kgms^{-1}$

Momentum (like velocity) is a **vector**. Therefore determine Total Momentum in 2- (or 3-) dimensional problems from a **vector diagram**.

Impulse

$v_f = v_i + at$ with $F = ma$ gives: $(mv_f - mv_i) = Ft$

change in Momentum equals Impulse

Ft is integral of Force over time (area under the Force curve).

Same impulse: Smaller peak force when t is larger (e.g. airbag in car)

Larger peak force when t is smaller (e.g. hammer on nail).