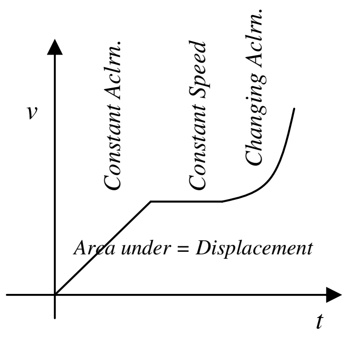
Mechanics 1 Revision

Vector Notation

- Vector quantities have both magnitude and direction, as opposed to scalars which have only magnitude.
- $\underline{\mathbf{a}} = x\underline{\mathbf{i}} + y\underline{\mathbf{j}}$
- $|\underline{\mathbf{a}}| = magnitude = \sqrt{x^2 + y^2}$
- $\hat{\underline{\mathbf{a}}} = unit\ vector = \frac{\underline{\mathbf{a}}}{|\underline{\mathbf{a}}|}$
- $\underline{\mathbf{r}_\mathbf{a}}$ = position vector notation
- $\underline{\mathbf{r}_{\mathbf{a}\text{ relative to }\mathbf{b}}} = \underline{{}_\mathbf{a}\mathbf{r}_\mathbf{b}} = \underline{\mathbf{r}_\mathbf{a}} - \underline{\mathbf{r}_\mathbf{b}}$
- $\theta = \tan^{-1}\left(\frac{y}{x}\right)$

Kinematics

- For use with a constant acceleration
- $v = u + at$
- $s = \left(\frac{u+v}{2}\right)t$
- $s = ut + \frac{1}{2}at^2$
- $v^2 = u^2 + 2as$



- Under gravity $a = g = 9.8$

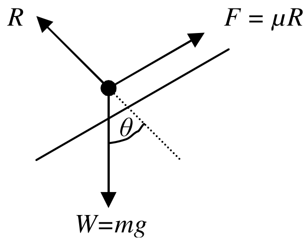
Statics

- Forces acting on a single point
- Forces must be in equilibrium
- In equilibrium $\sum F = 0$

Friction

- $Friction, F \leq \mu R$
- $F_{\max} = \mu R$

Force Diagrams



Dynamics

- Using Newton; $F = ma$
- Now for coplanar forces $\sum F = ma$
- Connected Particles: a is the same on each body, resolve each body individually then add the equations to eliminate T

Momentum & Impulse

- $P = mv$ in Ns
- Principle of Conservation of Momentum, $P_{before} = P_{after}$
- Impulse is ΔP
- Impulse is also $= Ft$
- $\therefore Ft = mv - mu$ in Ns

Moments

- Magnitude, Direction *and* point of application.
- Moment = $|F| \times d$ in Nm
- In equilibrium $\sum M = 0$
- Need a *sense* (clockwise or anti)
- A uniform rod's weight will act at its centre of mass.