SUVAT

S: Displacement (m)

U: Initial Velocity (ms^{-1})

V: Final Velocity (ms^{-1})

A: Acceleration (ms^{-2})

T: Time (s)

$$v = u + at$$

$$v^2 = u^2 + 2\text{as}$$

$$s = ut + \frac{1}{2}at^2$$

$$s = vt - \frac{1}{2}at^2$$

$$s = \frac{1}{2}(u+v)t$$

Under gravity $a = g\,(-9.8\text{ms}^{-1})$

On a speed time graph:

Area is distance travelled

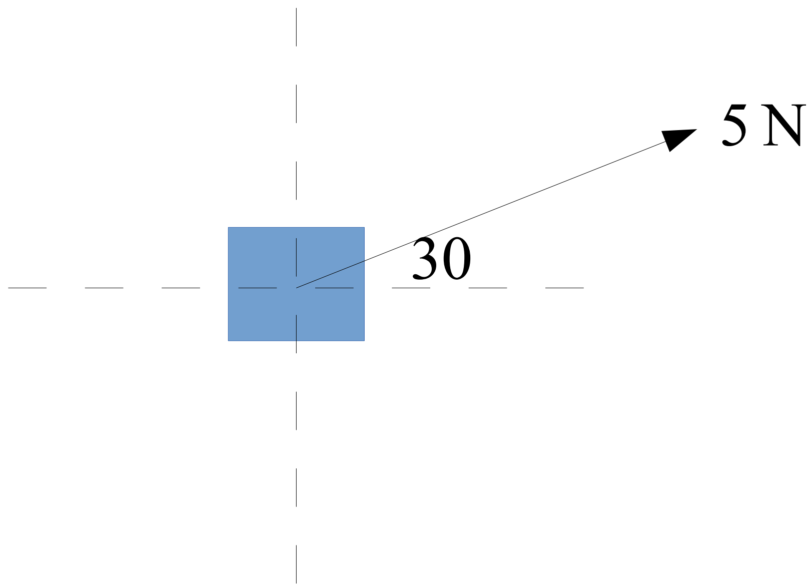
Gradient is acceleration

Dynamics

F = ma

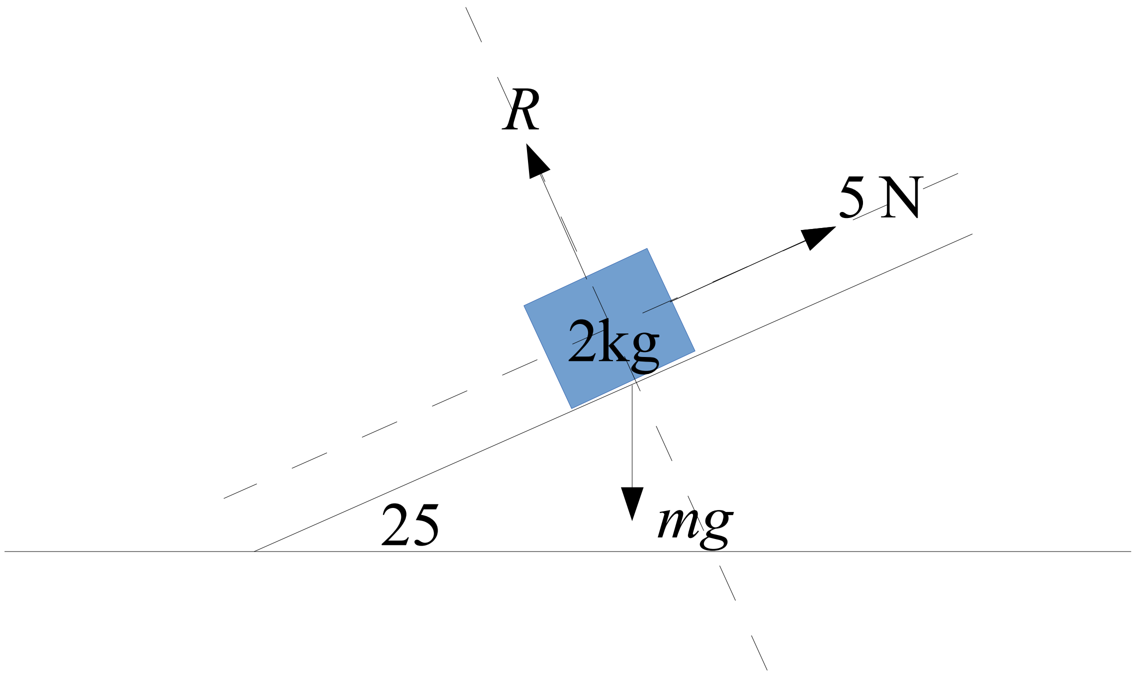
The resultant force is equal to mass times acceleration

We often need to split a force into horizontal and vertical components:



$$\text{Force acting horizontally} = 5\cos(30)$$
$$\text{Force acting vertically} = 5\sin(30)$$

Dynamics



Perpendicular to the Plane:

$$R = 2g\cos(25)$$

$$R = 17.76\,\text{N}\,(2\text{dp})$$

Parallel to the Plane: T_2

$$F = ma$$

$$2g\sin(25) - 5 = 2a$$

$$a = 1.64\,ms^{-1}\,(2\text{dp})$$

$$Friction_{MAX} = \mu R$$

μ is the coefficient of friction

$$0 < \mu < 1$$

Dynamics

Momentum

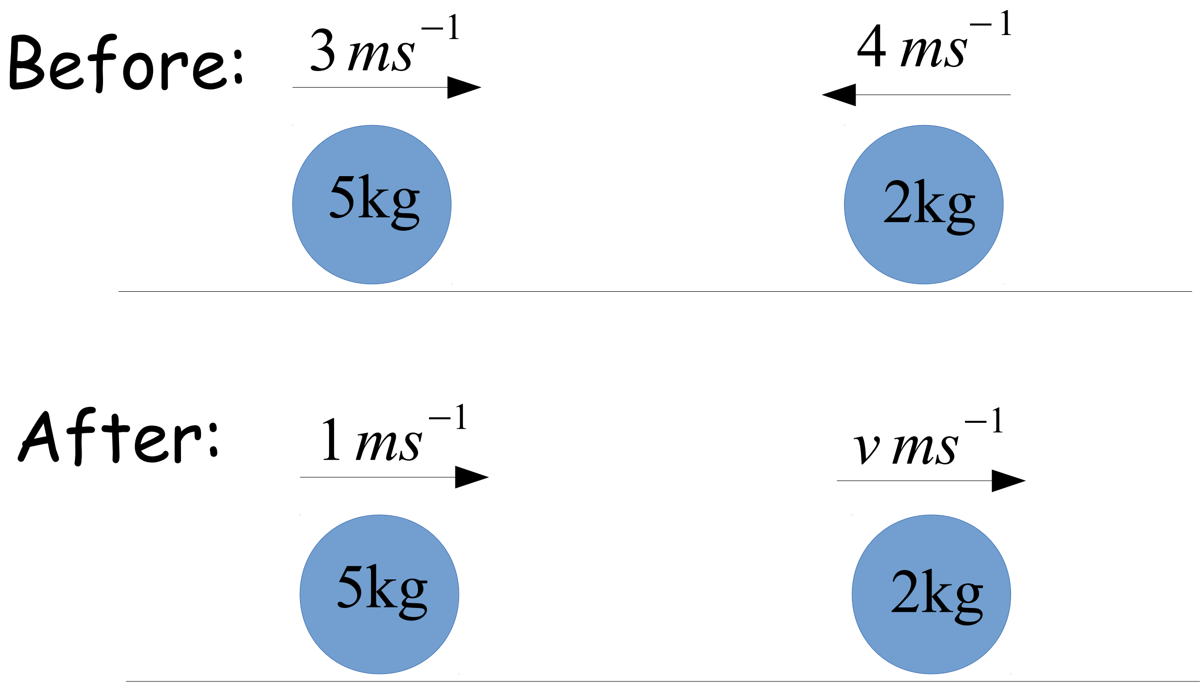
$$Momentum = mv$$

Impulse = change in momentum

$$I = mv - mu$$

Conservation of Momentum

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

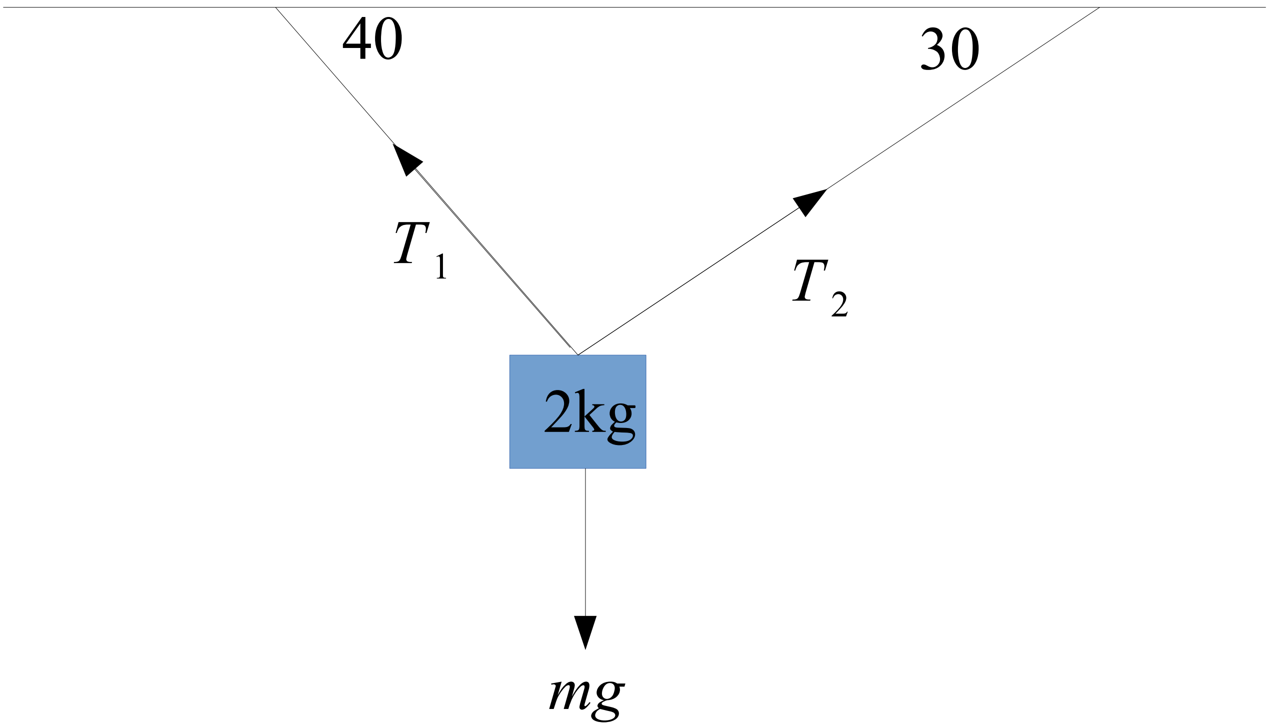


$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$
$$5(3) + 2(-4) = 5(1) + 2(v)$$
$$2 = 2(v)$$
$$v = 1\ ms^{-1}$$

Statics

If an object is in equilibrium all forces in all directions must be equal

Forces up = Forces down
Forces Left = Forces right



Forces left = Forces right

$$T_1 \cos(40) = T_2 \cos(30)$$

Forces up = Forces down

$$T_1 \sin(40) + T_2 \sin(30) = 2g$$

(We can find T_1 and T_2 by solving the simultaneous equations)

Moments

$$\text{Moment} = F \times d$$

A moment is a turning force

d is the distance from the pivot

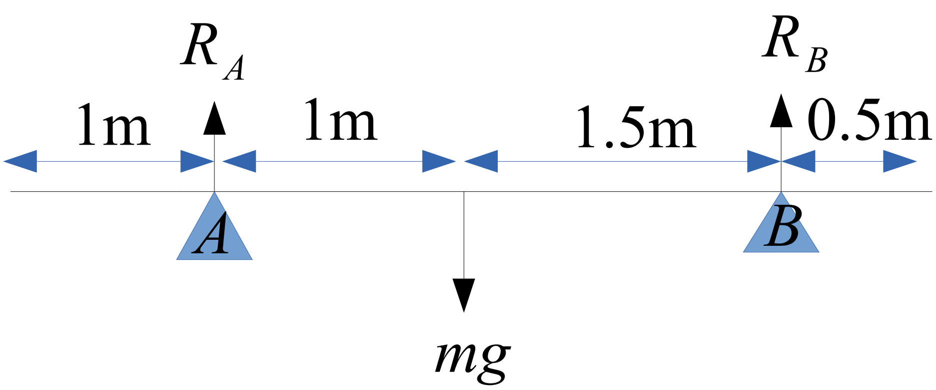
If a plank is uniform the weight acts from the centre

In equilibrium

$$Clockwise\ Moments = Anticlockwise\ Moments$$

$$Forces\ up = Forces\ down$$

In Equilibrium: uniform plank of mass 10kg



$$Taking\ moments\ about\ A$$

$$1 \times 10\text{g} = 2.5 \times R_B$$

$$R_B = 4\text{g}$$

$$Forces\ up = Forces\ down$$

$$R_A + R_B = 10\text{g}$$

$$R_A = 6\text{g}$$

Vectors

Vectors have a magnitude and direction

The i direction is along the positive x axis,
j direction is along the positive y axis

$$R = R_0 + vt$$

The position of a vector is the starting point + velocity times time

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We use Pythagoras to find:
The length of a line
The magnitude of a force
The speed

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the direction of $\overrightarrow{AB}$ is the position of B minus the position of A