

Physics topic 5a: Forces

1. Forces keywords

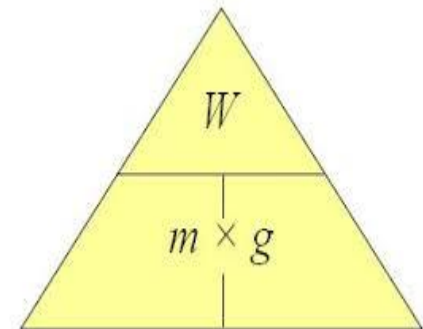
Force	Something that makes a change happen
Magnitude	The value of a force in newtons
Scalar	Things that have magnitude but not direction
Vector	Things that have a magnitude and a direction. Forces are always vectors
Contact force	Can only act when two things touch
Non-contact force	Can act on things not touching
Balanced (forces)	When forces are equal and opposite each other also called equilibrium
Unbalanced (forces)	When opposing forces are not equal to each other
Resultant (force)	The overall force once all the forces are considered
Force arrows	Show direction and size of a force
Newton	Unit force is measured in
Newtonmeter	A spring calibrated so it has a scale to measure force
Centre of mass	A point in the middle of an object where all its mass acts
Elastic	A material that returns to its original shape after being deformed
Plastic	A material that does NOT return to its original shape after being deformed

2. Types of force

Force	Between	Contact or non-contact	Example
Friction	Two moving surfaces	Contact	Brakes
Upthrust	An object and water	Contact	Boat
Reaction	Two stationary objects	Contact	Book on shelf
Air resistance	A moving object and air	Contact	Plane
Gravity	Two masses	Non-contact	You and the earth
Tension	Two ends of an elastic material	Contact	Spring
Magnetic	Magnets and magnetic materials	Non-contact	Magnet picking up a nail

3. Calculating weight

Symbol	Name	Calculated by..
W	Weight (N)	= Mass x Gravity
m	Mass (Kg)	= Weight ÷ Gravity
g	Gravitational field strength	= Weight ÷ mass
On earth $g = 10 \text{ N/kg}$		



4. Calculating work

Symbol	Name	Calculated by..
W	Work (J)	= Force x Distance
F	Force (N)	= Work ÷ Distance
s	Distance (m)	= Work ÷ Force
$W = Fs$		

5. Hooke's law

Symbol	Name	Calculated by..
F	Force (N)	= Spring constant x Extension
k	Spring constant (N/m)	= Force ÷ Extension
e	Extension (m)	= Force ÷ Spring constant
$F = ke$		

6. Energy stored in a spring

Symbol	Name	Calculated by..
Ep	Elastic potential energy stored (J)	$Ep = \frac{1}{2}ke^2$
$\frac{1}{2}$	Half (0.5)	N/A
k	Spring constant (N/m)	$k = \frac{2Ep}{e^2}$
e	Extension (m)	$e = \sqrt{\frac{2Ep}{k}}$
$Ep = \frac{1}{2}ke^2$		
To calculate extension: <ol style="list-style-type: none"> 1. Measure the original length of the object 2. Measure the stretched length of the object 3. Extension = stretched length – original length 		

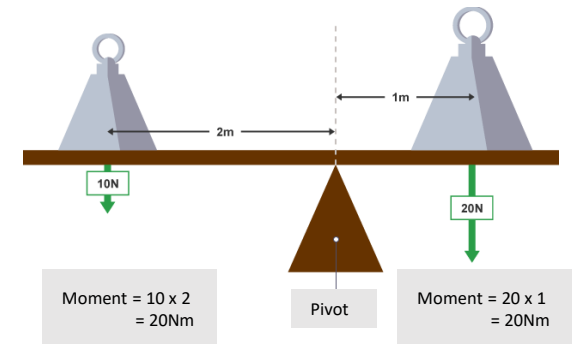
7. Moments:

1. To calculate a moment you need to know:
 - How much force is being applied (Newtons, N)
 - The distance from the pivot that the force is being applied (Meters, m)

$$\text{Moment} = \text{force} \times \text{distance}$$

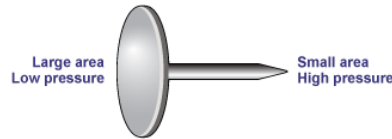
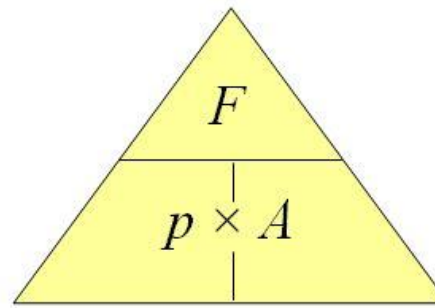
2. The unit for moment is newton metre (Nm)

3. A small force over a large distance can generate the same moment as a large force over a small distance.



8. Calculating pressure

Symbol	Name	Calculated by..
F	Force (N)	= pressure x area
p	Pressure (Pa = n/m ²)	= force ÷ area
A	Area (m ²)	= force ÷ pressure



9. Calculating pressure in column of liquid (HT ONLY)

Symbol	Name	Calculated by..
g	Gravitational field strength (10 N/Kg)	$g = \frac{p}{h\rho}$
p	Pressure (Pa = n/m ²)	$p = h\rho g$
h	Height (m)	$h = \frac{p}{g\rho}$
ρ	Density (kg/m ³)	$\rho = \frac{p}{gh}$

$$p = h\rho g$$