Year 11 Physics 5: Forces and Motion Knowledge Organiser

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 direct
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

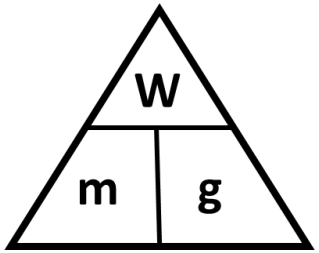
2. Types of force

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
W	Weight (N)
m	Mass (Kg)
g	Gravitational field strength

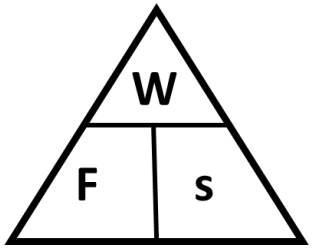
On earth g = 10 N/kg



4. Calculating work

Symbol	Name
W	Work (J)
F	Force (N)
s	Distance (m)

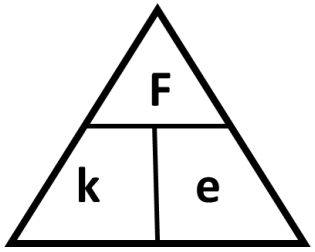
W = F x s
Work done = Force x Distance



5. Hooke's law

Symbol	Name
F	Force (N)
k	Spring constant (N/m)
e	Extension (m)

F = k x e
Force = Spring constant x Extension



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6. Energy stored in a spring

Symbol	Name
Ep	Elastic potential energy stored (J)
1/2	Half (0.5)
k	Spring constant (N/m)
e	Extension (m)

$$Ep = 1/2\ ke^2$$

To calculate extension:
1.Measure the original length of the object 2.Measure the stretched length of the object
3.Extension = stretched length – original length

7. Moments

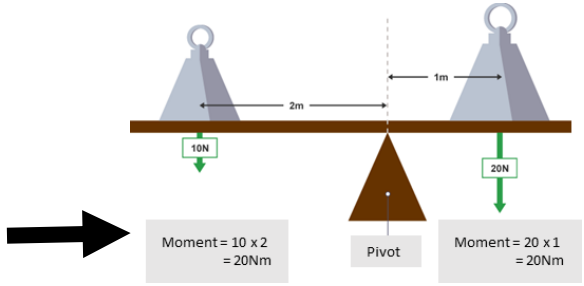
1.To calculate a moment you need to know:
How much force is being applied (Newtons, N)

The distance from the pivot that the force is being applied (Meters, m)

Moment = force x distance

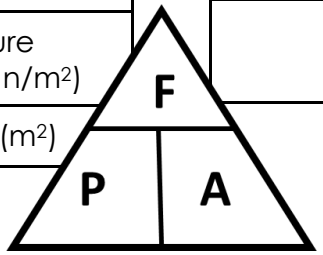
2.The unit for moment is newton metre (Nm)

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



8. Calculating pressure

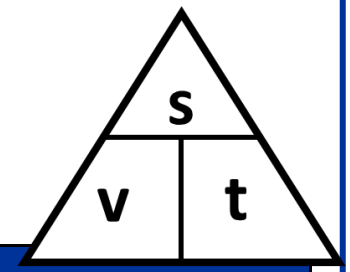
Symbol	Name
F	Force (N)
p	Pressure (Pa = n/m²)
A	Area (m²)



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

Symbol	Name
g	Gravitational field strength (10 N/Kg)
p	Pressure (Pa =n/m²)
h	Height (m)
ρ	Density (kg/m³)

$$p = h\rho g$$



10. Calculating speed

Symbol	Name
S	Distance (m)
v	Speed/Velocity (m/s)
t	Time (s)

11. Keywords

Speed	Distance ÷ time. Scalar quantity
Velocity	Distance (in a certain direction) ÷ time. Vector quantity
Distance	How far and object moves. Scalar quantity
Displacement	The straight line distance from the start point to the end point. Vector quantity
Terminal velocity	The maximum speed reached when the forces are balanced

12. Typical speeds

Walking	1.5 m/s
Running	3 m/s
Cycling	6 m/s
Sound	330 m/s

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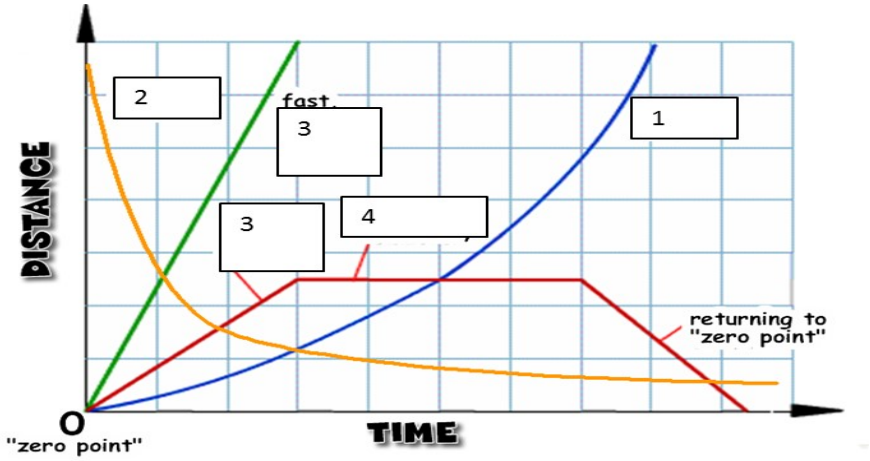
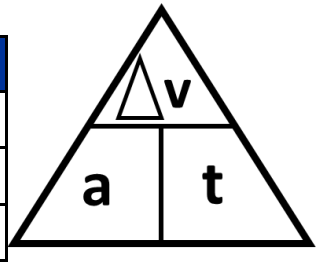
13. D/T graph keywords

Keyword	Meaning	Position on distance time graph
Accelerate	Speeding up	1
Decelerate	Slowing down	2
Constant speed	Staying the same speed	3
Stationary	Not moving	4
Speed	Distance covered in a certain time	The steepness of the line



14. Acceleration

a	Acceleration (m/s²)
Δv	Change in velocity (m/s)
t	Time (s)



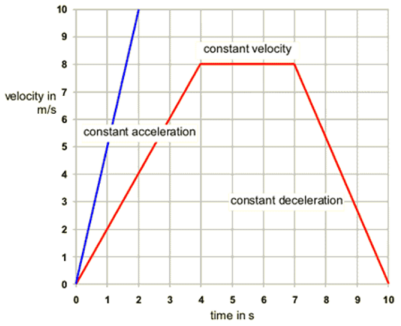
15. Uniform acceleration

$$v^2 - u^2 = 2as$$

v	Final velocity (m/s)
u	Start velocity (m/s)
a	Acceleration (m/s²)
s	Distance (m)

16. Uniform acceleration

Area under graph = total distance travelled

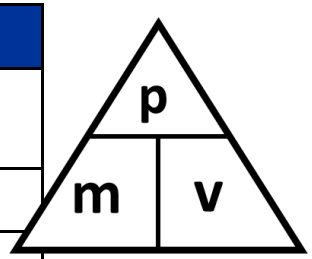


9. Forces and braking

Stopping distance	The thinking distance + braking distance
Thinking distance	The distance travelled in the time it takes to react (typically 0.2s)
Factors affecting thinking distance	1.Tiredness 2.Drugs 3.Alcohol 4.Distractions (phones)
Braking distance	The distance travelled under a braking force
Factors affecting braking distance	1.Road conditions (ice, water) 2.Tyre condition 3.Brake condition

10. Momentum (HT ONLY)

p	Momentum (Kgm/s)
m	Mass (Kg)
v	Velocity (m/s)
Conservation of momentum	The total momentum before = the total momentum after



17. Newtons laws of motion

1st	If the resultant force on an object is zero the object either remains stationary or at a constant speed
2nd	Force = mass x acceleration
3rd	When two objects interact the forces are equal and opposite