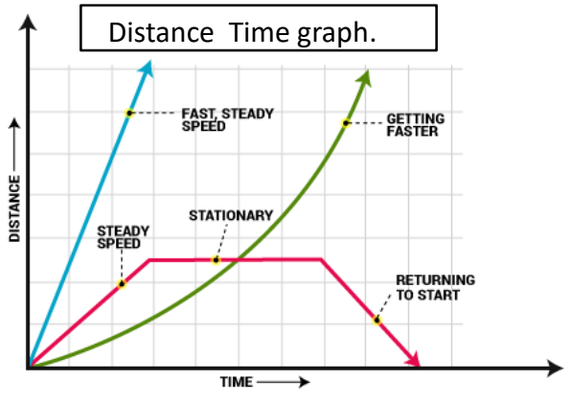
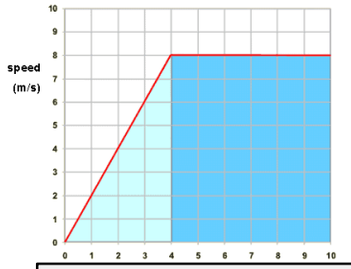
AQA FORCES – motion

Distance Time graph.

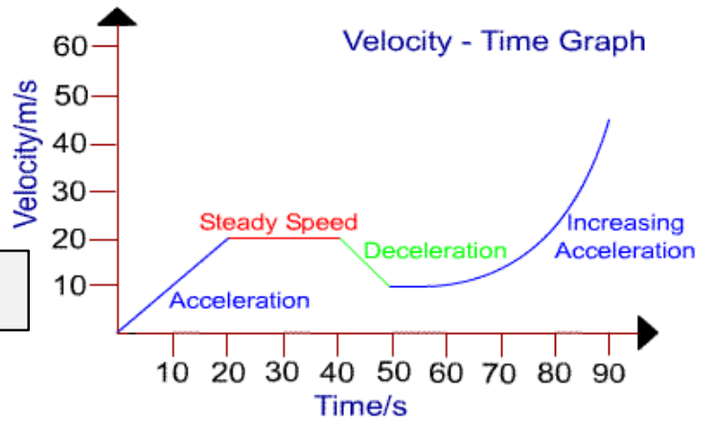


Car on motorway	*30m/s*
Train	*60m/s*
Sound in air	*330m/s*

Walking	*1.5m/s*
Running	*3m/s*
Cycling	*6m/s*



Higher – area under graph = distance



Acceleration = change in velocity ÷ time taken a = v – u / t

v = final speed u = initial starting speed t = time

Acceleration	*Change in velocity*	Vector

Speed	*How fast an object moves*	Scalar
Displacement	*Includes the distance and direction an object moves*	vector
Distance	*How far an object moves*	scalar

Accelerating	*Object getting faster*
Decelerating	*Object slowing down*

Speed = distance ÷ time — v = s ÷ t

Velocity	*The speed of an object with direction*	Vector

Newton's second Law	*Unbalanced forces*	When the resultant force is greater than 0, the object accelerates. It could speed up, slow down or change direction.

Force = mass X acceleration — F = m X a

Acceleration is inversely proportional to mass.

Acceleration is proportional to resultant force.

Forces and braking

Stopping distance = thinking distance + braking distance

Thinking distance = speed x reaction time

Speed affects both thinking and braking distances.

Thinking distance	*Distance travelled whilst the driver reacts*
Braking distance	*Distance travelled whilst the car is stopped by the brakes*
Stopping distance	*Total thinking and braking distances*

Factors affecting stopping distances	*Drivers reaction times*	Drinking alcohol, taking drugs, tired.
	Braking distances	Weather conditions, worn brakes or tyres, road surface, size of braking force.
Braking and kinetic energy	*Work done by braking force, reduces kinetic energy*	Kinetic energy decreases, temperature of brakes increases due to frictional forces.

Speed / velocity	*Metres per second (m/s)*
Distance	*Metres (m)*
Time	*Seconds (s)*
Acceleration	*Metres per second squared (m/s²)*
Force	*Newton (N)*
Mass	*Kilogram (Kg)*
Momentum	*Kilograms metres per second (Kgm/s)*

Falling objects accelerate due to gravity.	In no air resistance, objects accelerate at 9.8m/s²	Air resistance slows falling objects down.

Terminal velocity	*Weight of an object is balanced by drag forces*	Object moves at a constant velocity. Resultant force = 0.

HIGHER ONLY

Inertial mass	*How difficult it is to change the velocity of an object*

Inertial mass = force ÷ acceleration

If the mass is large, to change velocity a big force is needed.

How difficult it is to change an objects motion

Momentum

Is a vector

Momentum = mass X velocity — p = m X v

Separates - Changes in momentum
Crumple zones and safety features designed to increase the time an objects takes to stop
F = change momentum / time

Conservation of momentum

When two objects collide, the momentum they have before the collision = the momentum they have after the collision

Explosions - initial momentum equals zero

$m_1 \times v_1 + m_2 \times v_2 = 0$

$m_1 \times v_1 = - m_2 \times v_2$

(final velocity)^2 – (initial velocity)^2 = 2 X acceleration X distance

$V^2 - u^2 = 2 \times a \times s$

https://www.bbc.co.uk/bitesize/topics/ztmttv4 bbcbitesize-ks4 science-physics – aqa combined science – energy – Forces

https://www.senecalearning.com Seneca-combined science physics – AQA foundation or higher – forces and motion