- Terms

Scalar quantities are physical quantities that have magnitude only.
Vector quantities are physical quantities that have both magnitude and direction.

Kinematics Equations
① $v = u + at$
② $v^2 = u^2 + 2as$
③ $s = ut + \frac{1}{2}at^2$
where v = final velocity, u = initial velocity, a = acceleration, t = time, s = displacement.

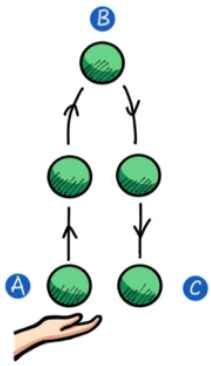
- Part I: Physical Quantities

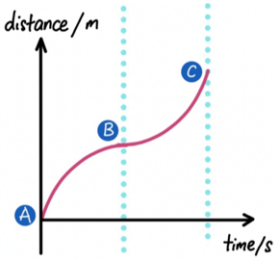
Quantities	Definition	SI Unit	Type of quantity	Formula
Distance	Distance is the total length covered by an object, regardless of its direction of motion.	metre (m)	Scalar	
Displacement	Displacement is the change of position of an object.		Vector	
Speed	Speed is the distance moved per unit time.	metre per second (ms^{-1})	Scalar	$\frac{d}{t}$
Velocity	Velocity is the rate of change of displacement.		Vector	$\frac{s}{t}$
Acceleration	Acceleration is the rate of change of velocity.	metre per second squared (ms^{-2})	Vector	$\frac{v-u}{t}$

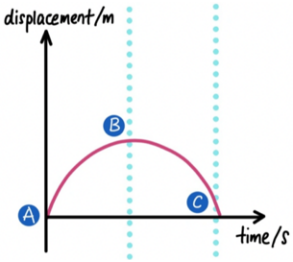
where d = distance, t = time taken, s = displacement, v = final velocity, u = initial velocity.

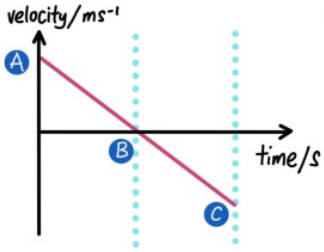
- Part II: Graphs of Motion

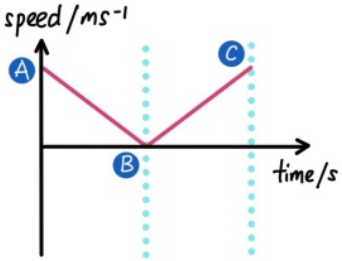
Type of Graph	Area	Gradient
Distance-time graph	Distance covered	Speed
Displacement-time graph	Displacement covered	Velocity
Speed-time graph	Distance covered	Acceleration
Velocity-time graph	Displacement covered	
Acceleration-time graph		Average velocity

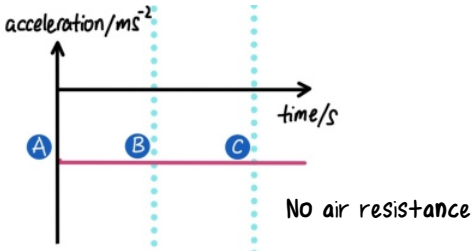












- Part III: Acceleration

- Acceleration with no air resistance (free fall)
  When an object is moving up (against gravity) or moving down in free fall, the acceleration is $-10ms^{-2}$.

  Acceleration due to gravity = $-10ms^{-2}$

  Therefore, regardless of mass, when air resistance is not considered, all objects will fall at the same acceleration due to Earth's gravity.
  Tip: Even if acceleration applies to an entire system of objects, it applies to a single object individually as well.

- Acceleration with air resistance
  Air resistance is a frictional force and will…
  a. always oppose the motion of moving objects.
  b. increases with the speed of the objects.
  c. increases with surface area of the objects.
  d. increases with density of air.

Note!
Deceleration is used when the speed of an object reduces. When acceleration is negative, it is said to be **accelerating in the negative direction**!

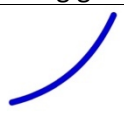
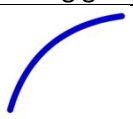
- Part IV: Terminal Velocity
  When objects' air resistance increases with the object's speed, when the **air resistance is equal to the weight** of the object, the object has reached its **terminal velocity**. Hence, it travels at a constant speed with zero acceleration.

  Terminal velocity is when the object is no longer accelerating and moving at a constant velocity. Terminal velocity occurs when the upward force and downward force is equal in a free fall.

- Factors affecting Terminal Velocity
  1. Weight
     The heavier an object is, the longer it will take to reach its terminal velocity and will have greater terminal velocity.

  2. Surface Area
     The smaller the surface area of an object is, the longer it will take to reach its terminal velocity and will have greater terminal velocity.

- Part VI: Type of Graph Gradients

Positive Gradient			
Linear (constant) increase	Increasing gradient	Decreasing gradient	At rest
			

Negative gradient			
Linear (constant) increase	Increasing gradient	Decreasing gradient	At rest