

# 2 | Motion

# IB Physics Content Guide

## Big Ideas

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- Motion is described relative to a chosen coordinate system.
- Vector quantities can be combined to find resultant vectors or divided into their component parts
- Displacement-time, velocity-time, and accel-time graphs are connected in the representation of physical motion.
- When an object is at constant velocity, displacement-time is linear.
- When an object is at constant acceleration, displacement-time is quadratic (curved), and velocity-time is linear.
- Kinematic equations can take three of the *suvat* variables to solve for the remaining two
- X and Y motion are independent of each other for a two-dimensional projectile

## Content Objectives

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### 2.1 – Vectors

 p. 15-22

I can describe the difference between distance and displacement			
I can calculate distance and displacement for 1D and 2D straight line motion			
I can add and subtract vectors to find a resultant			
I can calculate an angle from two components of a right triangle			
I can calculate the x and y components of a vector given the magnitude and angle			
I can describe the difference between distance and displacement			

### 2.2 – Velocity

 p. 22-27

I can describe the difference between speed and velocity			
I can compare the difference between a vector and scalar quantity			
I can solve problems using the mathematical definition of constant velocity			
I can plot constant velocity on a displacement vs time graph			
I can calculate velocity from a displacement vs time graph			
I can describe the difference between speed and velocity			

### 2.3 – Acceleration

 p. 24, 27-34

I can define acceleration in terms of velocity			
I can graphically compare “average” and “instantaneous” velocity			
I can calculate constant acceleration from a velocity vs time graph			
I can calculate displacement from a velocity vs time graph			
I can use the kinematic equations to solve for an unknown variable			
I can describe when the kinematic equations are no longer valid			

## 2.4 – Free Fall

 p. 35-37

I can identify the constant acceleration due to gravity neglecting air resistance			
I can interpret a free fall problem to identify hidden values			
I can use the kinematic equations to solve free fall problems			
I can experimentally determine the acceleration due to gravity			

## 2.5 – Graphing Motion

 p. 25-32

I can describe an object's motion by interpreting its displacement vs time and velocity vs time graphs			
I can create $d$ vs $t$ , $v$ vs $t$ , and $a$ vs $t$ graphs for an object in freefall			
I can create a velocity vs time graph when given a displacement vs time graph			
I can create a displacement vs time graph when given a velocity vs time graph			

## 2.6 – Horizontal Projectiles

 p. 41-44

I can recognize that the $x$ and $y$ -direction have different $a$ values, and need to be analyzed separately			
I can identify hidden values for a horizontal projectile problem			
I can use information about a horizontal projectile's motion to calculate the initial velocity			
I can use the $x$ and $y$ velocity components to calculate a projectile's impact velocity and angle			

## 2.7 – Projectiles at an Angle

 p. 44-47

I can identify hidden values for a projectile launched at an angle			
I can calculate the $x$ and $y$ components for an initial velocity at an angle			
I can calculate max height for a projectile launched at angle			
I can calculate distance traveled for a projectile launched at angle			
I can calculate total air time for a projectile launched at angle			

# 2 | Motion

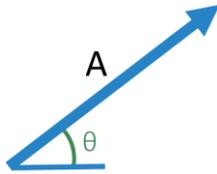
## Shelving Guide

	Scalar	Vector
How far (m)		
How fast ( $\text{m s}^{-1}$ )		

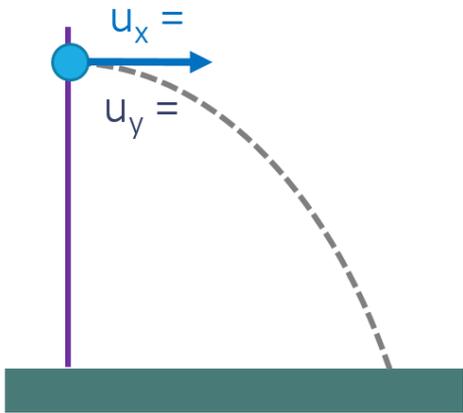
	Displacement vs Time	Velocity vs Time	Acceleration vs Time
Meaning of the Graph	Slope:	Slope: Area under the Curve:	Slope: Area under the Curve:
Constant Displacement			
Constant Positive Velocity			
Constant Negative Velocity			
Constant Positive Acceleration (speeding up)			
Constant Negative Acceleration (slowing down)			

	Variable Symbol	Unit
Displacement		
Initial Velocity		
Final Velocity		
Acceleration		
Time		

Kinematic Equations	s	u	v	a	t

Horizontal Component	$A_H =$	
Vertical Component	$A_V =$	

	x	y
s		
u		
v		
a		
t		



	x	y
s		
u		
v		
a		
t		

