Motion

IB Physics Content Guide

Big Ideas

- The total momentum of an isolated system is always constant
- The impulse of a collision is equal to the change in momentum
- If you have the acceleration of an object, you can find the net force causing that acceleration and vice versa
- Kinematic equations can take three of the *suvat* variables to solve for the remaining two

1 – Conservation of Momentum

I can define and calculate momentum			
I can calculate "before" and "after" momentums for multiple objects			
I can use the conservation of momentum to solve for missing variables in linear collisions			
I can describe the process required for explosion, hit and bounce, and hit and stick scenarios			

2 – Impulse

I can describe the meaning of impulse and how it is related to momentum change			
I can use impulse and momentum to solve for an unknown in a collision problem			
I can conceptually describe how to decrease the force experienced in a collision			
I can determine the impulse of a collision from a force vs time graph			

3 – Newton's 2nd Law and Kinematic Equations

I can identify the 5 primary variables of motion (suvat)			
I can describe Newton's second law in terms of momentum			
I can explain the connection between constant velocity and balanced forces			
I can use the kinematic equations to solve for an unknown variable with constant acceleration			
I can combine Newton's second law with the kinematic equations to solve force/motion problems			

4 – Free Fall

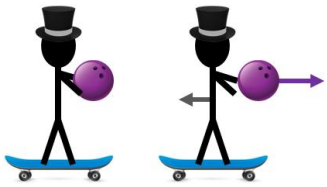
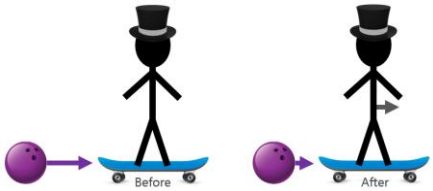
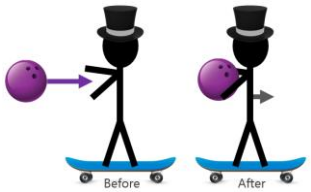
I can identify the constant acceleration due to gravity neglecting air resistance			
I can interpret a free fall problem to identify hidden values			
I can use the kinematic equations to solve free fall problems			
I can experimentally determine the acceleration due to gravity			

5 – Drag

I can identify the variables that affect drag and air resistance			
I can describe the motion and forces for an object that is experiencing terminal velocity			
I can recognize the d vs t and v vs t graphs for an object falling with air resistance			
I can calculate drag force using Stokes' Law			

Momentum and Impulse

	Variable Symbol	Description	Unit
$p = mv$ $J = F\Delta t$ $F = \frac{\Delta p}{\Delta t}$	p		
	m		
	v		
	J		
	F		
	Δt		

Impulse-Momentum Problem Solving

Initial Momentum	+	Event	=	Final Momentum

Collision Safety

Explain (using impulse, force, and time) how to decrease the force acting on an object undergoing a collision:

Newton's 2nd Law

	Variable Symbol	Description	Unit
$F = ma$	F		
	m		
	a		

$F_{net} = 0$ N	$F_{net} \neq 0$ N

Kinematic Equations

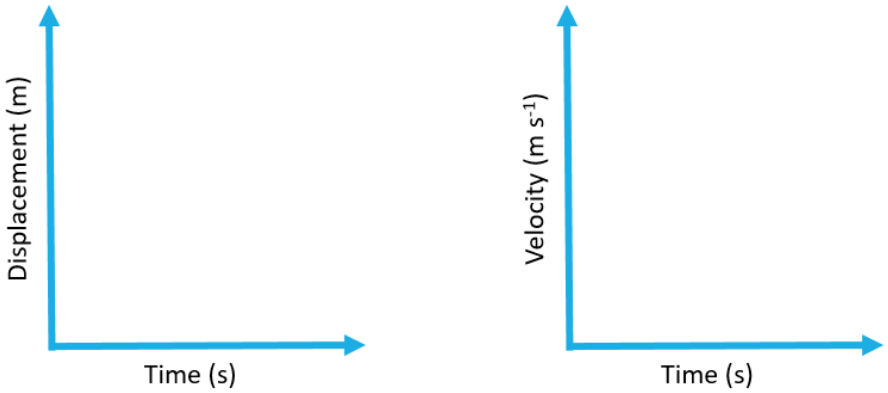
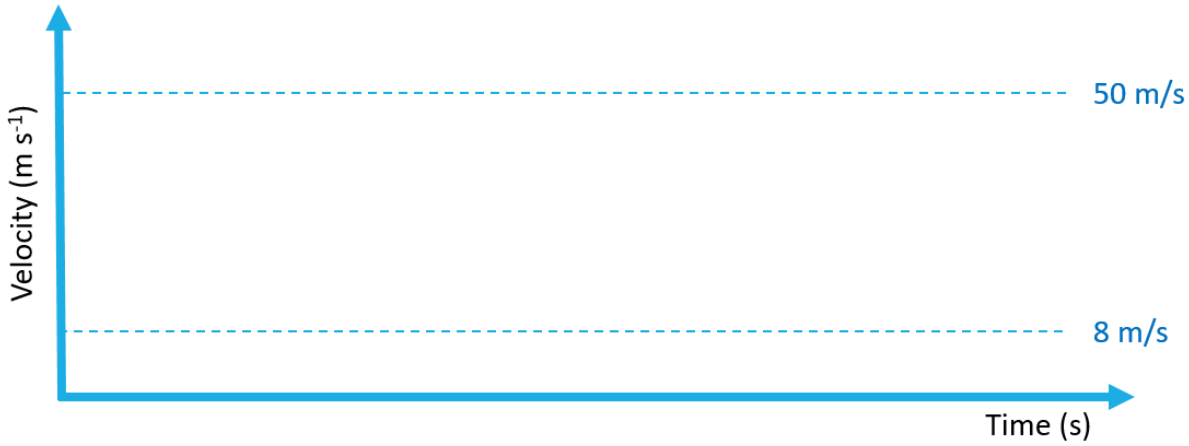
	Variable Symbol	Description	Unit
$s = \frac{u+v}{2}t$ $v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$	s		
	u		
	v		
	a		
	t		

Free Fall

What is freefall?		a =

Initial velocity when dropped		Velocity at Highest point	

Drag

	Variable Symbol	Description	Unit
$F_d = 6\pi\eta r v$	F_d		
	η		
	r		
	v		

Terminal Velocity