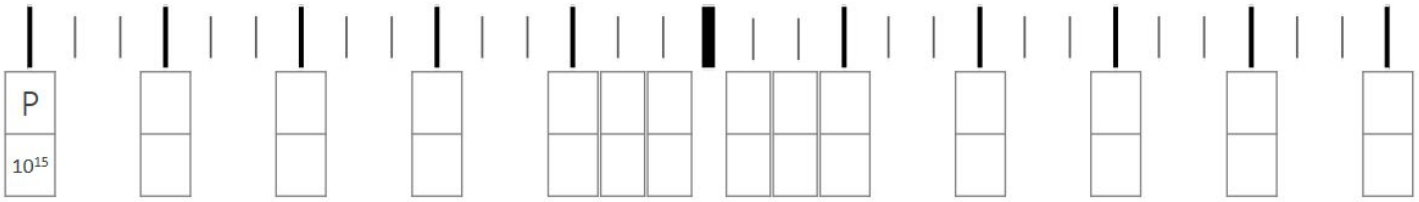
IB Physics SL - Study Guide

1 | Science Skills

List the seven fundamental base units and their abbreviations:

	Unit	Abbreviation
Length		
Mass		
Time		
Electric Current		
Temperature		
Amount of Substance		
Luminous Intensity		

Metric Prefixes – List the unit prefixes in their appropriate decimal position



Dimensional Analysis

Convert the following:

20 mi hr^{-1} ? m s^{-1}

0.0007 km^2 ? m^2

Determine the units for Q:

$Q = mc\ \Delta T$		
	m (mass)	kg
	c (specific heat)	J kg^{-1} K^{-1}
	ΔT (change in temp)	K

2 | Motion

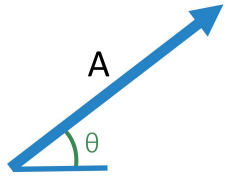
	Scalar	Vector
How far (m)		
How fast (m s^{-1})		

	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)			

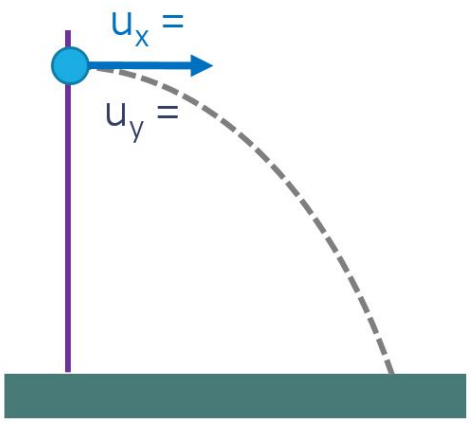
	Variable Symbol	Unit
Displacement		
Initial Velocity		
Final Velocity		
Acceleration		
Time		

Kinematic Equations	s	u	v	a	t

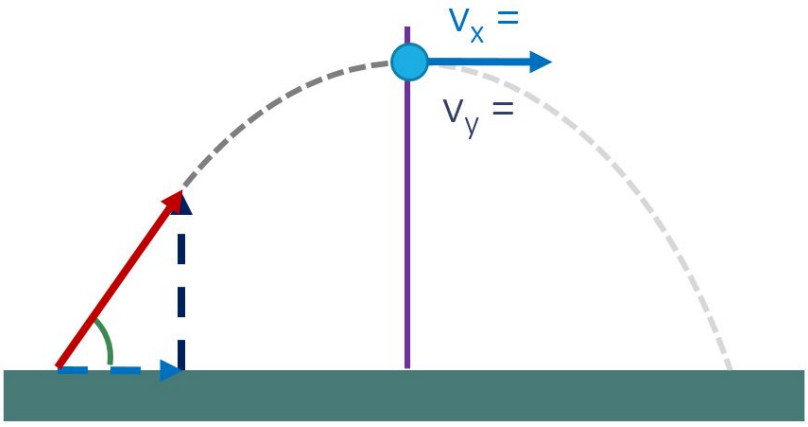
Horizontal Component	A_H =
Vertical Component	A_V =



	x	y
s		
u		
v		
a		
t		



	x	y
s		
u		
v		
a		
t		



3 | Forces

Type of Force	Variable	Description/Important Properties	Equation
	F_g		
	F_T		
	R		
	F_f		
	F_{air}		

If an object has a net force of zero its motion is either:

	or	

Newton's Laws

Newton's First Law	
Newton's Second Law	
Newton's Third Law	

Data Booklet Equations:

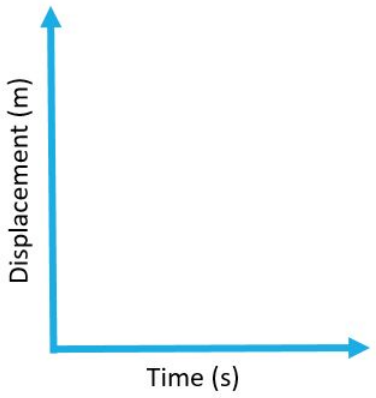
$F = ma$

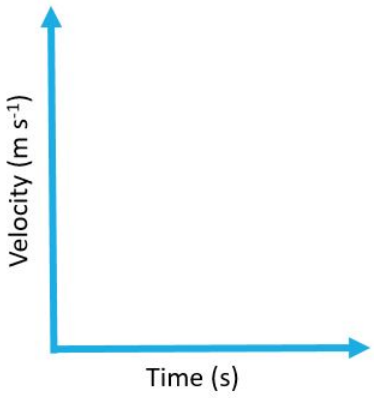
$F_f \leq \mu_s R$

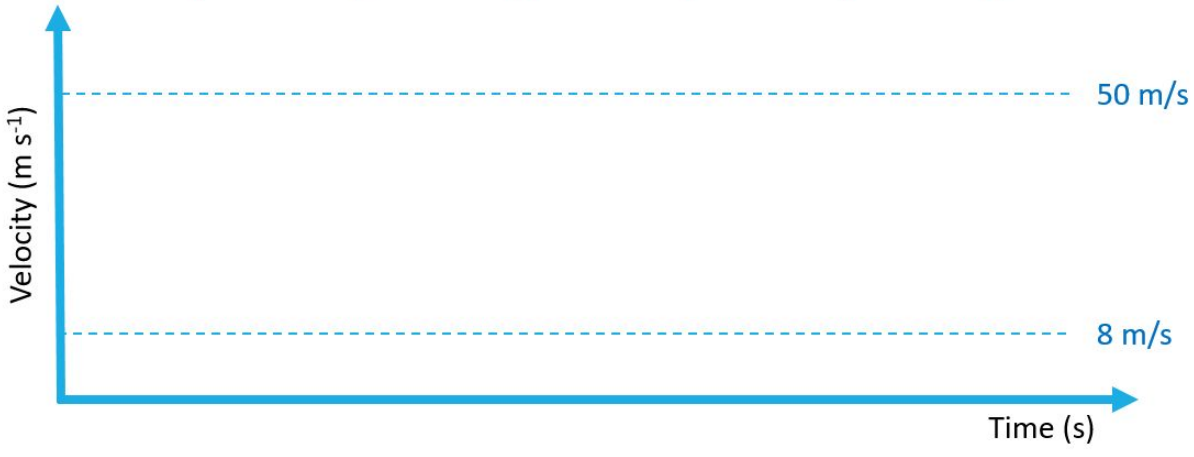
$F_f = \mu_d R$

	Variable Symbol	Unit
Force		
Mass		
Acceleration		
Normal Reaction Force		
Coefficient of Kinetic Friction		
Coefficient of Static Friction		

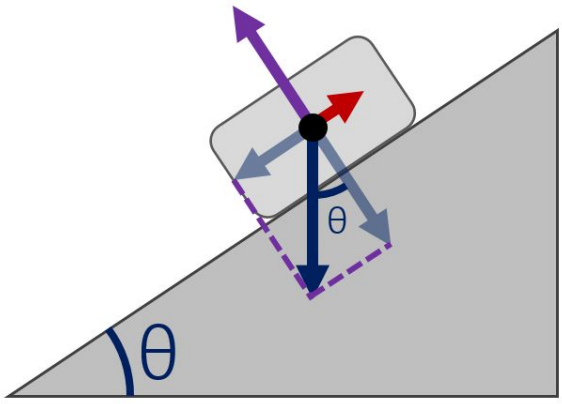
Terminal Velocity	







Sliding to a Stop	Constant Velocity	
F_{net} =	F_{net} =	F_{pull} =



$F_{\perp}$	
$F_{\parallel}$	

Forces on a Ramp

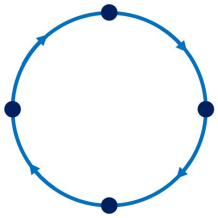
Equilibrium	
R	
F_f	
F_{net}	
a	

Accelerating	
R	
F_f	
F_{net}	
a	

4 | Circular Motion

	Variable Symbol	Unit
Distance		
Angular Distance		
Angular Velocity		
Linear Velocity		
Centripetal Acceleration		
Centripetal Force		

Draw in vectors for v, a_c, and F_c ⍰



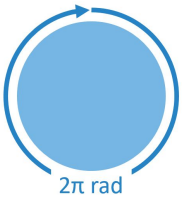
Data Booklet Equations:

$v = \omega r$

$a = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$

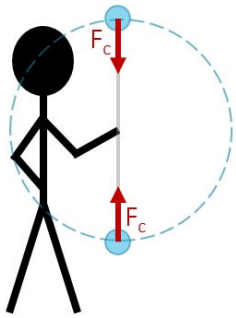
$F = \frac{mv^2}{r} = m\omega^2 r$

Defining Circular Motion

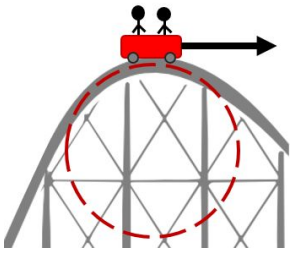
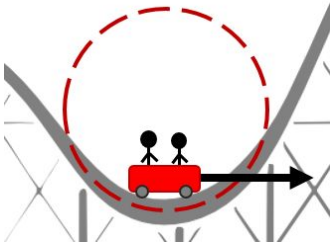


Period			Angular Velocity		

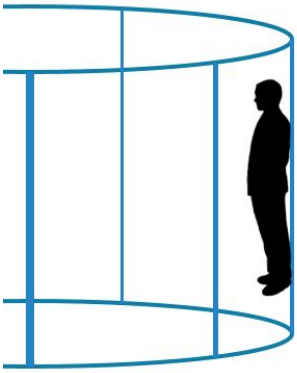
Vertical Circular Motion

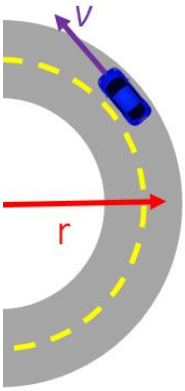


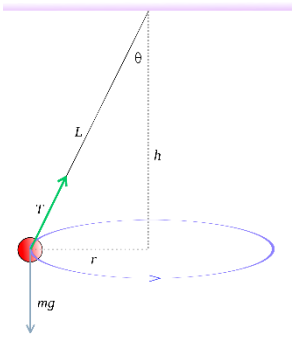
Top:	Bottom:
$F_{net} = F_c =$	$F_{net} = F_c =$

Top:		Bottom:	
			
$F_{net} = F_c =$		$F_{net} = F_c =$	

Circular Motion with Friction and Angles

		Relationships between variables:

		Relationships between variables:

		Relationships between variables:

5 | Energy

	Variable Symbol	Unit
Work		
Power		
Kinetic Energy		
Elastic Potential Energy		
Gravitational Potential Energy		
Spring Constant		
Spring Stretch		

Data Booklet Equations:

$$W = Fs\cos\theta$$

$$E_k = \tfrac{1}{2}mv^2$$

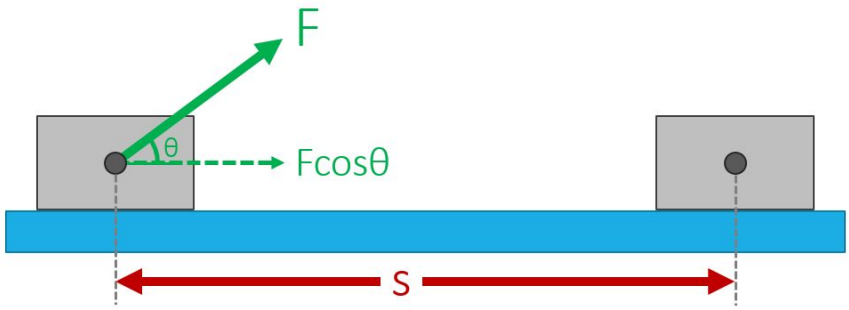
$$E_p = \tfrac{1}{2}k\Delta x^2$$

$$\Delta E_p = mg\Delta h$$

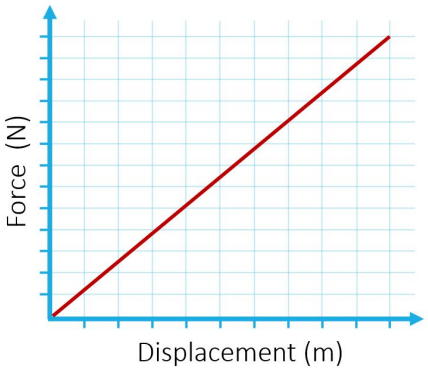
$$power = Fv$$

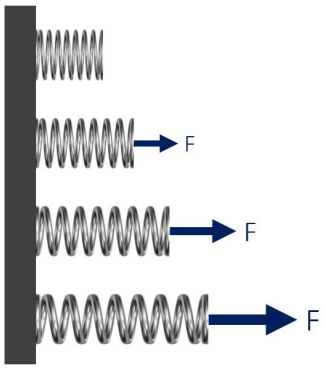
Calculating Work

Constant force at an angle:



Varying Force:





Examples of no work being done for an object in motion:

Calculating Power

In terms of work and time:	*In terms of force and velocity:*

Units

	Standard Unit	From Equation	Fundamental SI Units
Work			
Power			

Types of Energy

Kinetic Energy	Elastic Potential Energy	Gravitational Potential Energy

Conservation of Energy

Work-Energy Theorem

6 | Momentum

	Variable Symbol	Unit
Momentum		
Mass		
Velocity		
Time		
Kinetic Energy		
Impulse	Impulse	

Data Booklet Equations:

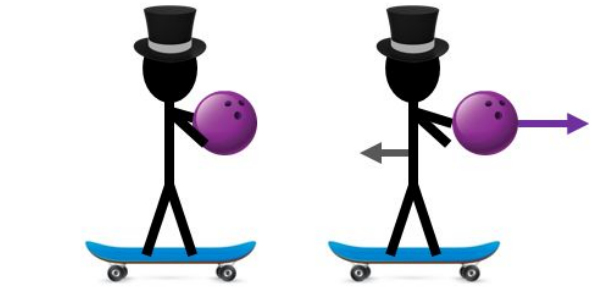
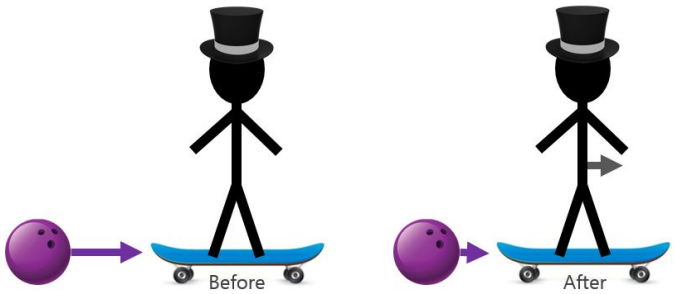
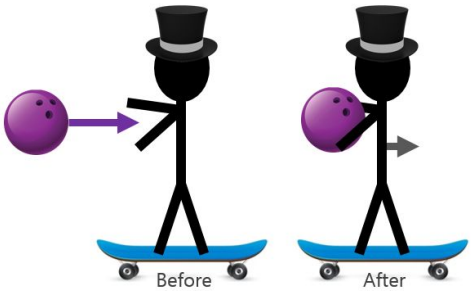
$$p = mv$$

$$F = \frac{\Delta p}{\Delta t}$$

$$E_K = \frac{p^2}{2m}$$

$$Impulse = F\Delta t = \Delta p$$

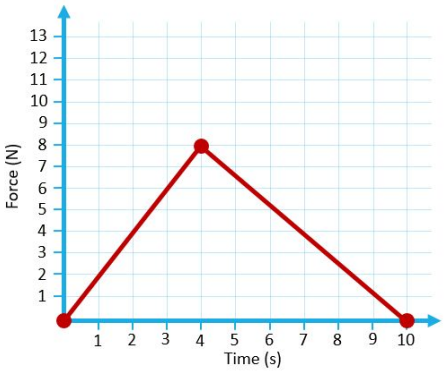
Conservation of Energy Problems

Types of Collisions

Elastic	
Inelastic	

Calculating Impulse

Constant force:	
Varying Force:	

Impulse-Momentum Equation

Collision Safety

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