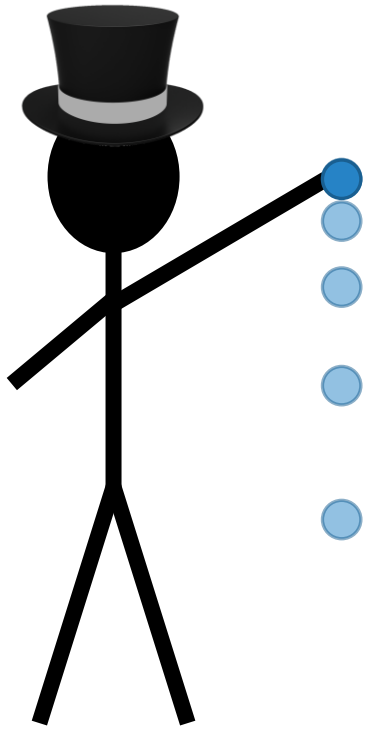
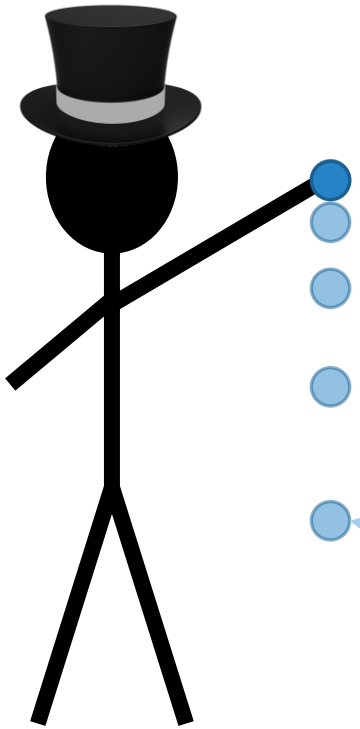
Free Fall



IB PHYSICS - MOTION

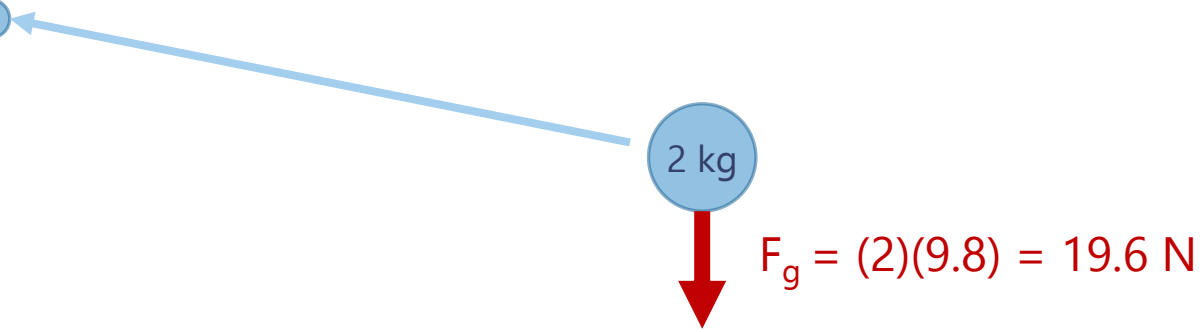
What is Free Fall?

A.2



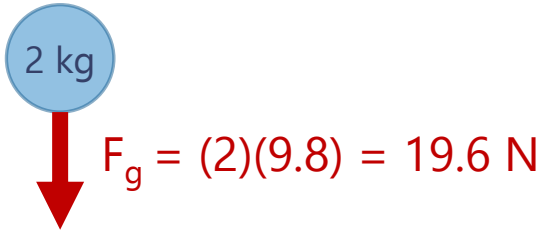
The only force acting on the object is gravity

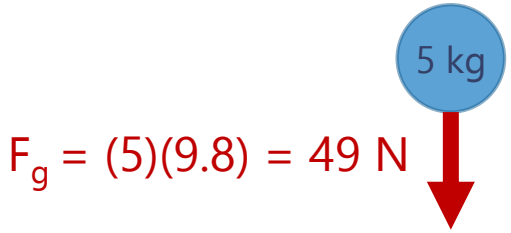
No Air Resistance



Acceleration due to Gravity

A.2





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

$$a = \frac{F}{m} = \frac{19.6}{2} = \mathbf{9.8\ m\ s^{-2}}$$

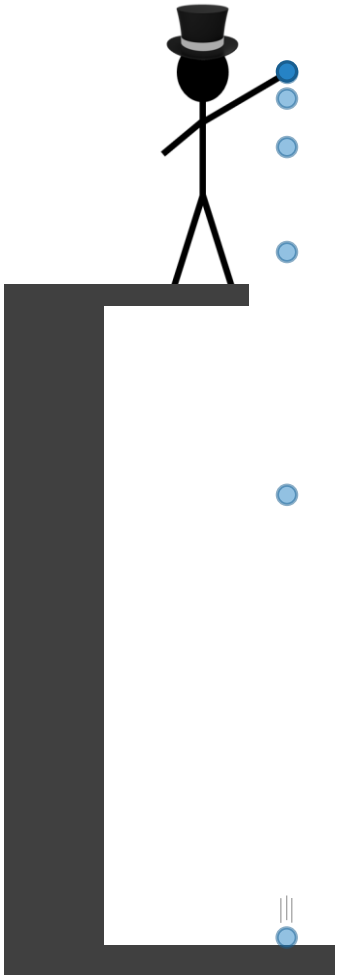
$$a = \frac{F}{m} = \frac{49}{5} = \mathbf{9.8\ m\ s^{-2}}$$

-9.8 m s^{-2}

negative ↓

What If You Drop Something?

A.1



What do you know?

s	
u	0 m s^{-1}
v	
a	-9.8 m s^{-2}
t	

What If You Throw Something Up?

A.1

What do you know?

1st Half

s	
u	
v	0 m s^{-1}
a	-9.8 m s^{-2}
t	

2nd Half

s	
u	0 m s^{-1}
v	
a	-9.8 m s^{-2}
t	

What If You Throw Something Down?

A.1

What do you know?

s	
u	
v	
a	-9.8 m s^{-2}
t	

Reminder of Our Equations

A.1

Units	m	$m\ s^{-1}$	$m\ s^{-1}$	$m\ s^{-2}$	s
$s = \frac{u+v}{2}t$	s	u	v		t
$v = u + at$		u	v	a	t
$s = ut + \frac{1}{2}at^2$	s	u		a	t
$v^2 = u^2 + 2as$	s	u	v	a	

Dropping a Marble

A.1

If you drop a marble off the Empire State Building (~380 m), how fast will it be going once it reaches the ground?

$$v^2 = u^2 + 2as$$

$$v = \sqrt{0^2 + 2(-9.8)(-380)}$$

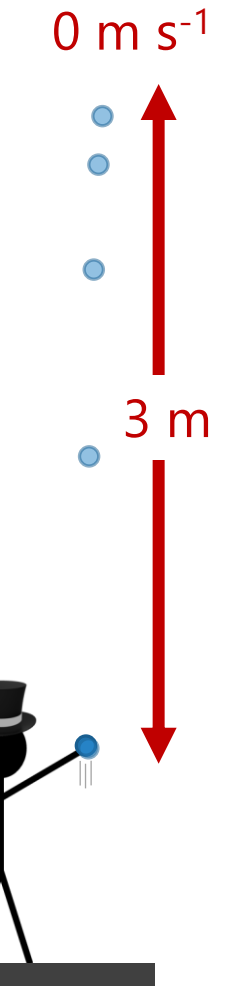
$$v = -86.3 \text{ m s}^{-1}$$

*The negative indicates a downward direction

s	-380 m
u	0 m s^{-1}
v	?
a	-9.8 m s^{-2}
t	---

Shooting a Basket

A.1



What is the vertical velocity of a basketball required to reach the rim of the basketball hoop? (~3.0 m high)

$$v^2 = u^2 + 2as$$

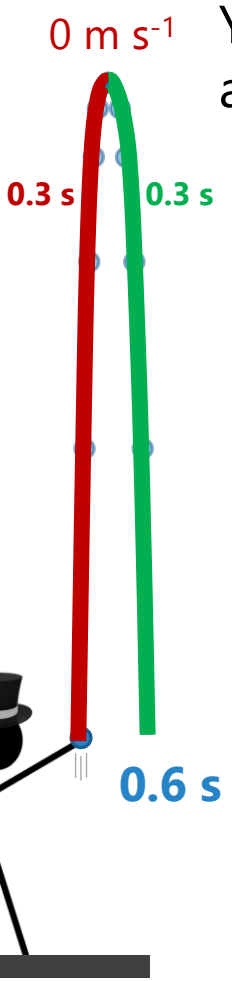
$$0^2 = u^2 + 2(-9.8)(3)$$

$$u = 7.67 \text{ m s}^{-1}$$

s	3 m
u	?
v	0 m s^{-1}
a	-9.8 m s^{-2}
t	---

Flipping a Coin

A.1



You flip a coin and catch it. It is in the air for a total of 0.6 seconds. How high did it go?

$$s = ut + \frac{1}{2}at^2$$

$$s = \frac{1}{2}(-9.8)(0.3)^2$$

$$s = 0.441 \text{ m}$$

s	?
u	0 m s^{-1}
v	---
a	-9.8 m s^{-2}
t	0.3 s

Half the time

Lesson Takeaways

- ❑ I can identify the constant acceleration due to gravity neglecting air resistance.
- ❑ I can interpret a free fall problem to identify hidden values and understand when to look at only half of the problem.
- ❑ I can use the kinematic equations to solve a free fall problem.