The Kinematic Equations

IB PHYSICS | MOTION

Motion Variables

Displacement	Initial Velocity	Final Velocity	Acceleration	Time

Whenever we are describing the motion of an accelerating object, there are five variables that we need to take into account

Note: The variables used in IB Physics vary slightly from other nomenclature standards

Calculating Acceleration





Think about this unit...



What is the acceleration of a car that accelerates from 15 m s⁻¹ to 35 m s⁻¹ in 10 seconds?

и	
v	
a	
t	

$$a = \frac{v - u}{t}$$

Find the average acceleration of a northbound train that slows down from 12 m s⁻¹ to a complete stop in 8 sec **Tip: You can get a negative value!*

u	
v	
a	
t	

$$a = \frac{v - u}{t}$$

Solve for v

$$a = \frac{v - u}{t}$$

Physics Data Booklet

Sub-topic 2.1 – Motion v = u + at $s = ut + \frac{1}{2}at^{2}$ $v^{2} = u^{2} + 2as$ $s = \frac{(v+u)t}{2}$

How far have I gone?



Use the graphs to tell you MORE!





Slope

Velocity vs Time



How far have I gone?



Physics Data Booklet

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What if I don't know v?

$$S = \frac{(v+u)t}{2}$$

$$v = u + at$$

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One more equation

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

Equations

	т	т s ⁻¹	т s ⁻¹	т s ⁻²	S
v = u + at		и	v	а	t
$s = ut + \frac{1}{2}at^2$	S	u		а	t
$v^2 = u^2 + 2as$	S	u	v	а	
$s = \frac{(v+u)t}{2}$	S	u	v		t

You speed up with a uniform acceleration from 0 m/s to 30 m/s in 5 seconds. How far have you gone?

S	
u	
v	
a	
t	

If a plane on a runway is accelerating at 4.8 m s^{-2} for 15 seconds before taking off, how long should the runway be?

S	
u	
v	
a	
t	

A driver slams on the brakes and skids for 3 seconds before coming to a stop. You go and measure that the skid marks show a deceleration over 9 m. What was the initial speed of the car?

S	
u	
ν	
a	
t	

Lesson Takeaways

- □ I can identify the 5 primary variables of motion
- I can identify the proper kinematic equation to use for a problem that is presented
- □ I can rearrange to solve for the unknown variable
- □ I can calculate for an unknown