
Road Safety 2 (Acceleration) and Be a Crash Test Investigator
S3 PHYSICS

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In this block we will cover
Acceleration
What is acceleration?
How to measure acceleration
Using the equations to calculate acceleration
Velocity Time graphs
Plotting the graphs
Finding the acceleration
Finding the distance travelled
Be a Road Crash Investigator
Using your knowledge to be a real traffic cop

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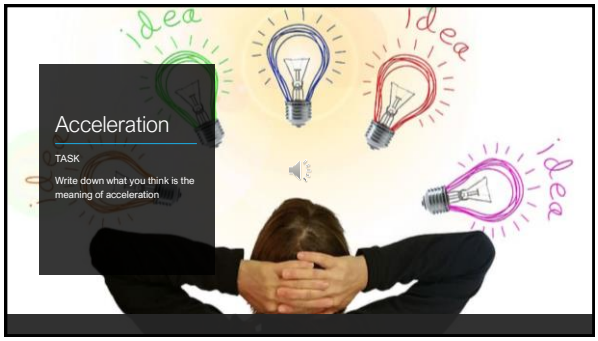
Acceleration
TASK
Write down what you think is the meaning of acceleration

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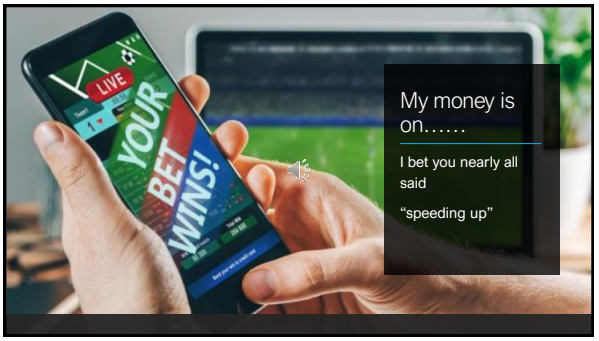
My money is on……
I bet you nearly all said
"speeding up"

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Hidden dip
Warning!
For all of our examples we will assume you are travelling in a straight line so the value (magnitude) of your speed is the same as the magnitude of the velocity so I might be a little careless in my language.
You should always try to use velocity with acceleration

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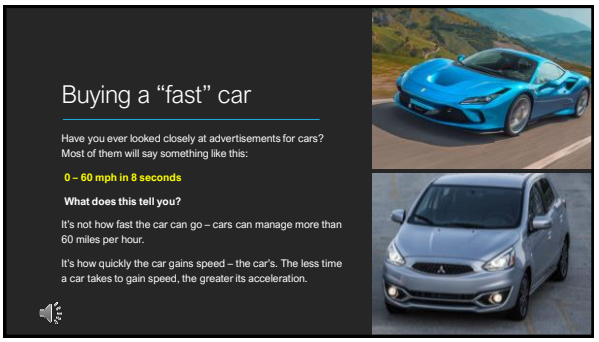
Buying a "fast" car
Have you ever looked closely at advertisements for cars? Most of them will say something like this:
0 – 60 mph in 8 seconds
What does this tell you?
It's not how fast the car can go – cars can manage more than 60 miles per hour.
It's how quickly the car gains speed – the car's. The less time a car takes to gain speed, the greater its acceleration.

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Time how long it takes this car to get from 3 mph to 63 mph, it isn't long

I think this car was going for top speed rather than maximum acceleration. You could later work out the acceleration for different changes of velocity. Do you see how the road is long and straight so the magnitude of speed = size of velocity along the road.

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Vauxhall Nippy:
Top speed: 115 mph
Engine size: 1.2 litres
0 – 60 mph: 10 seconds

Ferrari Flyer:
Top speed: 130 mph
Engine size: 2.4 litres
0 – 60 mph: 5 seconds

Ford Speeda:
Top speed: 125 mph
Engine size: 1.6 litres
0 – 60 mph: 7.5 seconds

Mazda Vroom:
Top speed: 135 mph
Engine size: 2.0 litres
0 – 60 mph: 6 seconds

1. Which car has the highest top speed?
2. Which car has the greatest acceleration?
3. Which car would you prefer to drive? Why?

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ACCELERATION

Imagine two drivers side by side at a set of traffic lights, the lights are on red. Angus is in a boring saloon car, and Caitlin is sitting on her motorbike. The lights turn green and both vehicles set off. Both vehicles accelerate, the speed of both vehicles increases.

After a while both vehicles reach the same speed; but we can tell that the motorbike will have a greater acceleration than the car.

Acceleration is not just about the increase in your ~~speed~~ /velocity it takes account of the time it takes to change your ~~speed~~/velocity.

The **time it takes** your ~~speed~~ velocity to change must be in the equation.

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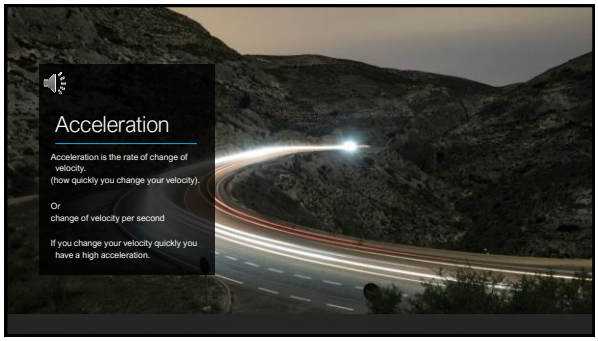

Acceleration

Acceleration is the rate of change of velocity.
(how quickly you change your velocity).

Or
change of velocity per second

If you change your velocity quickly you have a high acceleration.

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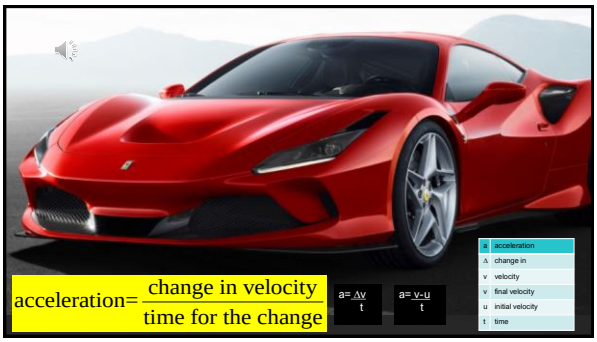

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time for the change}}$$

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

a	acceleration
Δ	change in
v	velocity
v	final velocity
u	initial velocity
t	time

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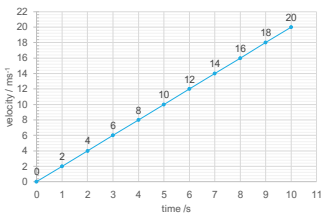
Units of Acceleration

If the change in velocity is measured in metres per second (m/s) and the time is measured in seconds, then the acceleration is measured in metres per second per second (m/s²).

For example, if a car accelerates at 2 m/s², then its speed increases by 2 metres per second every second.

If it was stationary when the clock is started, then after the first second it will be going at 2 m/s, after the second second it will be travelling at 4 m/s, and after ten seconds the car will be travelling at 20 m/s, what will be the speed of the car after sixty seconds?

Graph of a car accelerating at 2 m/s every second or 2 m/s²



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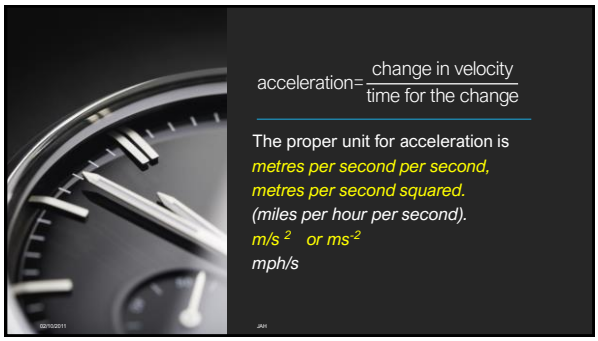
acceleration= change in velocity / time for the change
The proper unit for acceleration is
metres per second per second,
metres per second squared.
(miles per hour per second).
m/s 2 or ms-2
mph/s

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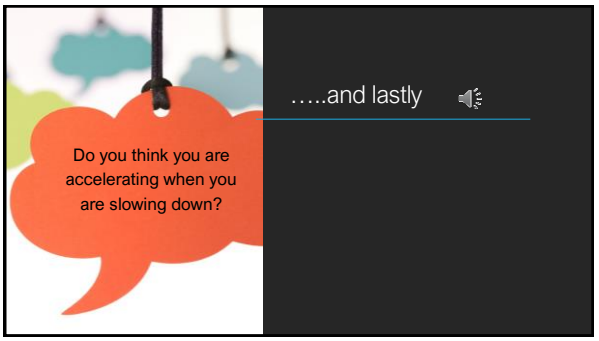
Do you think you are accelerating when you are slowing down?
…..and lastly

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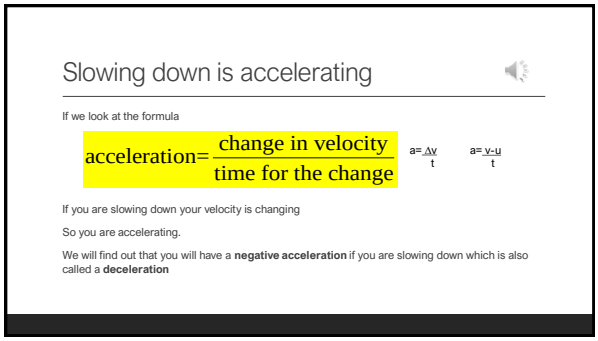
Slowing down is accelerating
If we look at the formula
acceleration= change in velocity / time for the change
a= Δv / t
a= v-u / t
If you are slowing down your velocity is changing
So you are accelerating.
We will find out that you will have a negative acceleration if you are slowing down which is also called a deceleration

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