1. Acceleration

Most objects do not travel at the same velocity all the time. If they speed up, they are said to accelerate. If they slow down, they decelerate.

Acceleration is the rate at which velocity changes, how much it changes each second.

e.g. An object with an acceleration of $3ms^{-2}$, will be increasing its velocity by $3ms^{-1}$ every second.

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

$$v = u + at$$

a is the acceleration in ms^{-2}
v is the final velocity in ms^{-1}
u is the initial velocity in ms^{-1}
t is the time taken for the velocity to change in s

Example 1 – calculation

A car is moving at 15ms-1, when it starts to accelerate at 2ms-2. Calculate the velocity of the car if it accelerates at this rate for 4s.

$a = 2ms^{-2}$
$v = ?$
$u = 15ms^{-1}$
$t = 4s$

$v = u + at$
$v = 15 + (2 \times 4)$
$v = 15 + 8$
$v = 23ms^{-1}$

Note

In examples where the final velocity is smaller than the initial velocity, the value for the acceleration will be a negative. A negative acceleration is called a deceleration.

Example 2 – Graph

Calculate the acceleration for the motion graph.

The upward sloping line represents the acceleration.

Method 1 – Equation

$a = ?$
$v = 6ms^{-1}$
$u = 0ms^{-1}$
$t = 60s$

Method 2 – Gradient

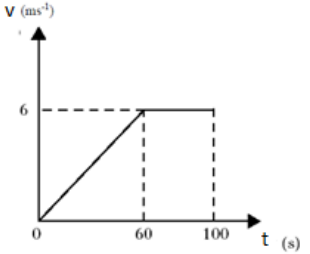
The gradient of a v-t graph is equal to acceleration.

Gradient (m) = acceleration

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{6 - 1}{60 - 0}$$

$$a = 0.1ms^{-2}$$



3. MOTION 2

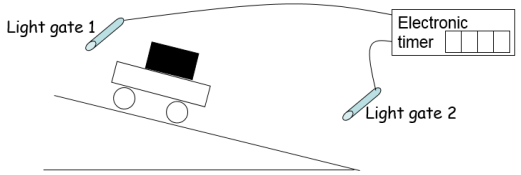
N5 Past Paper HW
2014 – Sec 2 Q10
2015 – MC Q15 Sec 2 Q8
2016 – Sec 2 Q10

2. Experiment to determine Acceleration

Method 1

Two light gates connected to an electronic timer and a single flag. As the flag breaks the first beam the timer starts, as flag leaves beam the timer for that gate stops. Similarly for the second beam.

Initial speed = the length of the flag/ time taken to pass through 1st beam
Final speed = the length of the flag/ time taken to pass through 2nd beam
Time taken for flags to pass between two beams is taken from timer.



Method 2

One light gate connected to an electronic timer and a double flag. As the first part of the flag breaks the beam the timer starts, as first part of flag leaves timer stops. Similarly for the second part of the flag.

Initial speed = the length of the first part of flag/ time taken to pass through beam
Final speed = the length of the second part of flag/ time taken to pass through beam
Time taken for flags to pass through beam is taken from timer.