
ACCELERATION
The sudden realization that the 4.5 Hemi might just be a tad too much power for you, the pup, the kids, the groceries and the soccer team.

Acceleration (a)

acceleration describes all situations where the velocity is changing.

symbol to represent acceleration is a

v_f = final velocity

v_i = initial velocity

t = time

Formula: $a = \frac{\Delta v}{t} = \frac{v_f - v_i}{t}$

During **constant acceleration (uniform acceleration)** the same change in velocity occurs in each equal interval of time. The object accelerates at the same rate.

Average acceleration (a_{av})occurs when acceleration changes over a period of time. The acceleration rate varies.

If you are slowing down your acceleration can be negative

For ALL our calculations acceleration is assumed to be constant

If your acceleration was 2m/s² that means you are increasing your velocity by 2m/s for every second you travel. $2\ \frac{m/s}{s}$

So at the end of the 1st second your instantaneous velocity is 2m/s; at the end of the 2nd second your instantaneous velocity is 4m/s.

1s → 2m/s

2s → 4m/s

3s → 6m/s

4s → 8m/s

4.5s → 9m/s

If your acceleration was 5.0 m/s² how fast would you be going at the end of the 2nd second?

$v = 5.0\ m/s^2 \times 2s = 10\ m/s$

1. If your acceleration was 5m/s. What will the change in your velocity be after 3seconds?

$at = v_f - v_i$

$\Delta v = v_f - v_i$

$a = 5.0 m/s^2$

$t = 3s$

$at = \Delta v$

$(5.0)(3) = \Delta v$

$15 m/s = \Delta v$

velocity increased by 15 m/s

2. It takes 40 seconds to change the velocity of a ball by 8.0m/s. Find its acceleration.

$\Delta v = 8.0 m/s$

$t = 40s$

$a = ?$

$at = \Delta v$

$a(40) = 8$

$40a = 8$

$a = \frac{8 m/s}{40 s}$

$a = 0.2 m/s^2$

3. If a car increases its velocity from 20m/s to 60m/s in 8.0 s, what was the car's acceleration?

$v_i = 20 m/s$

$v_f = 60 m/s$

$t = 8.0s$

$a = ?$

$at = v_f - v_i$

$a(8) = 60 - 20$

$8a = 40 m/s$

$a = \frac{40 m/s}{8s} = 5.0 m/s^2$

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Sample Problem:

$at = v_f - v_i$

A skateboarder rolls down a hill and changes his speed from rest to 1.9m/s. If the acceleration was 0.40m/s², for how long was the skateboarder on the hill?

$v_i = 0 m/s$

$v_f = 1.9 m/s$

$a = 0.40 m/s^2$

$t = ?$

$(0.4)t = 1.9 - 0$

$0.4t = 1.9$

$t = \frac{1.9}{0.4} = \boxed{4.75 s}$

Sample Problem:
A bus with an initial speed of 12m/s accelerated at 0.62 m/s for 15s. What is the final speed of the bus?

$v_f = ?$

$v_i = 12\ m/s$

$a = 0.62\ m/s^2$

$t = 15s$

$at = v_f - v_i$

$(0.62)(15) = v_f - 12$

$9.3 = v_f - 12$

$9.3 + 12 = v_f$

$21.3\ m/s = v_f$

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