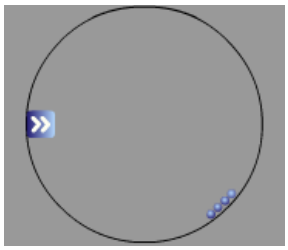
Wednesday Feb 29, 2012

Intro to Acceleration

Warm- Up

Bugatti Veyron Super Sport is the fastest car in the world. How many seconds do you think it takes this car to go from 0mph to 60mph?



Acceleration (a)

acceleration describes all situations where the speed is changing.

Examples:

- **a car speeding up or slowing down**

If there is no change in velocity (speed) there is no acceleration. However the object is still in motion.

How would you describe the velocity (speed) of an object with zero acceleration?

During **constant acceleration (uniform acceleration)** the same change in speed 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

symbol to represent acceleration is *a*

Formula: $a = \frac{\text{final speed - initial speed}}{\text{time}} = \frac{v_f - v_i}{t}$

The units of acceleration are different than the units for Velocity.

Velocity was measured as a distance vs time i.e. m/s or km/h

Acceleration is measured as a velocity vs time so it's common units are different

i.e. $a = \frac{v}{t}$ (v: m/s, t: s) therefore acceleration has units of $\frac{m/s}{s}$ or $\frac{m}{s^2}$ or m/s^2

Other examples of units are km/h/s , km/h^2 etc

If your acceleration was $2m/s^2$ that means you are increasing your speed by 2m/s for every second you travel.

So at the end of the 1st second your speed is 2m/s
at the end of the 2nd second your speed is 4m/s

If your acceleration was $4.5m/s^2$ how fast would you be going at the end of the 2nd second?

Example Problem 1:

You speed up a motorcycle from rest (0m/s) to 9m/s in a time of 2.0s. What is your acceleration?

$v_i = 0$ m/s

$v_f = 9.0$ m/s

$t = 2.0$s

$$a = \frac{v_f - v_i}{t} = \frac{9.0\text{m/s} - 0\text{m/s}}{2.0\text{s}} = \frac{9.0\text{m/s}}{2.0\text{s}} = 4.5\text{m/s}^2$$

Your acceleration is 4.5m/s for every second you travel.

Example Problem 2:

A car passes the fire department traveling 6 m/s. When it passes the grocery store 3 seconds later, the car is traveling 12 m/s. What was the car's acceleration?

$v_i = 6$m/s
$t = 3$s
$v_f = 12$m/s
$a = ?$

$$a = \frac{v_f - v_i}{t} = \frac{12\text{m/s} - 6\text{m/s}}{3\text{s}} = \frac{6\text{m/s}}{3\text{s}} \quad 2\text{m/s/s}$$

The car accelerates at a rate of 2m/s for every second it travels.

Example Problem 3:

A race car travelling at 100km/h comes to a stop in 6.0s. What is the average acceleration of the race car?

v_i = 100 km/h
v_f = 0km/h
t = 6.0 s
a = ?

$$a = \frac{v}{t} = \frac{0\text{km/h} - 100\text{km/h}}{6.0\text{s}} = -17\ \text{km/h/s}$$

The average acceleration of the race car is - 17km/h/s

What does this acceleration mean?

An acceleration of 17km/h/s means that the speed of the race car is increasing at a rate of 17km/h for every second it travels.

Complete questions pg 388 #1-5, 7-9