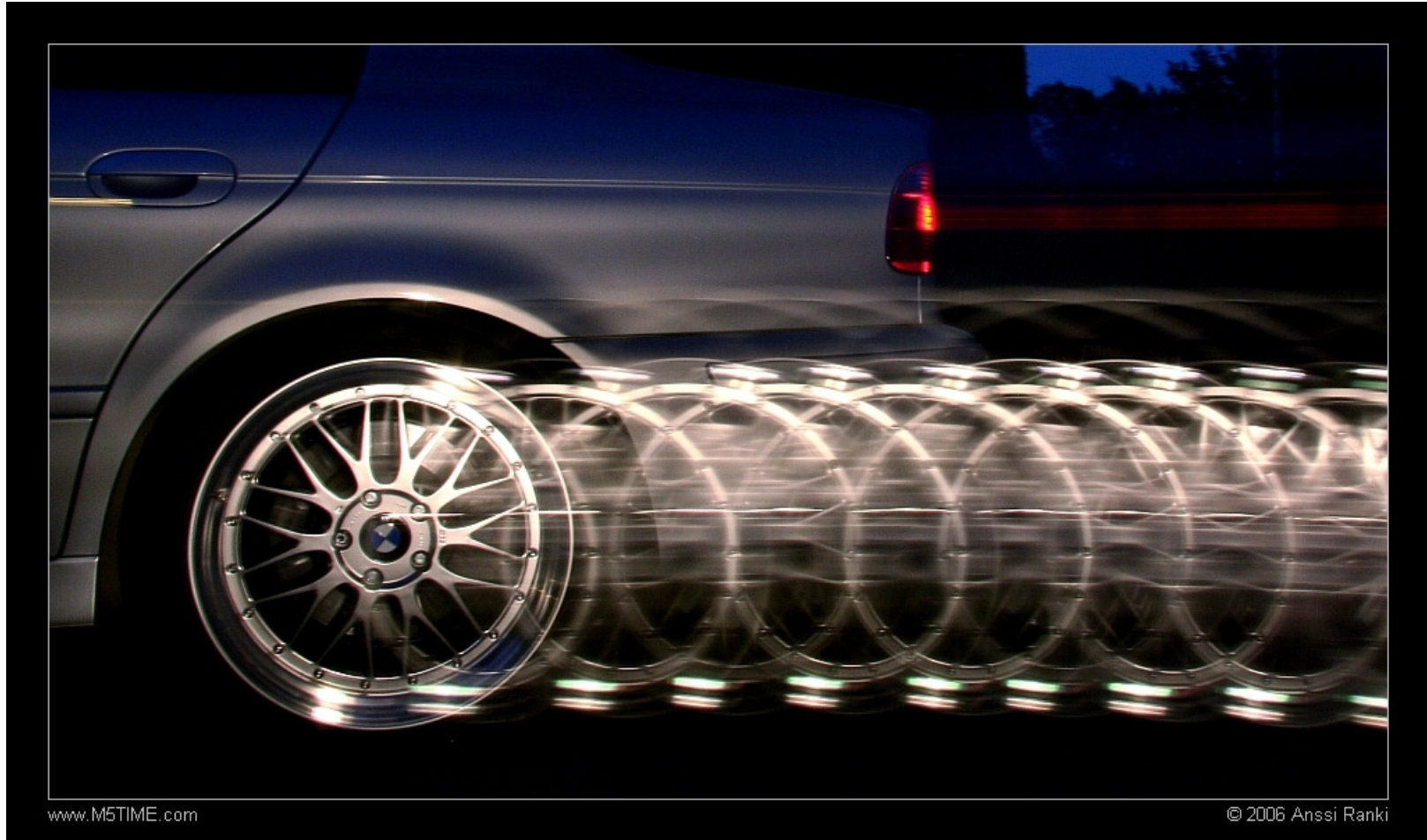


Acceleration

Honors Physics



www.M5TIME.com

© 2006 Anssi Ranki

Acceleration – The Definition

The **RATE** of **CHANGE** of **VELOCITY**

$$a = \frac{\Delta v}{\Delta t} = \frac{\text{meters/second}}{\text{seconds}} = m/s/s \text{ or } m/s^2$$

Δ = Change = FINAL - INITIAL

Δv = Final velocity – Initial velocity

Example

Example: A Cessna Aircraft goes from 0 m/s to 60 m/s in 13 seconds. Calculate the aircraft's acceleration.

$$a = \frac{\Delta v}{\Delta t} = \frac{60 - 0}{13} = \mathbf{4.62 \text{ m/s/s}}$$

Example

Example: The Cessna now decides to land and goes from 60 m/s to 0 m/s in 11 s.
Calculate the Cessna's **deceleration** ?

$$a = \frac{\Delta v}{\Delta t} = \frac{0 - 60}{11} = \mathbf{- 5.45 \text{ m/s/s}}$$

Free-Fall Acceleration

If an object is in **FREE FALL** in the **VERTICAL DIRECTION**, the acceleration is due to **GRAVITY**.

$$a_y = g = -9.8 \text{ m / s / s}$$

- It NEVER ceases to exist
 - It ALWAYS works DOWN
 - It is NEVER zero
-

Acceleration due to Gravity

Example: A person throws a ball straight upward into the air.

Q1: What is the Acceleration at the TOP of its path? -9.8 m/s/s

Q2: What is the VELOCITY at the TOP of its path?
ZERO

Acceleration due to Gravity

Q3: What is the magnitude(#value) and direction of the acceleration, HALF way up?

-9.8 m/s/s - ALWAYS DOWNWARD

Q4: What is the magnitude(#value) and direction of the acceleration, HALF way down?

-9.8 m/s/s - ALWAYS DOWNWARD

THE BOTTOM LINE: EVERYTHING will accelerate at -9.8 m/s/s in a **VACUUM**, that is any situation involving **NO AIR**.

Acceleration

$$\textit{Slope} = \frac{\textit{Rise}}{\textit{Run}}$$

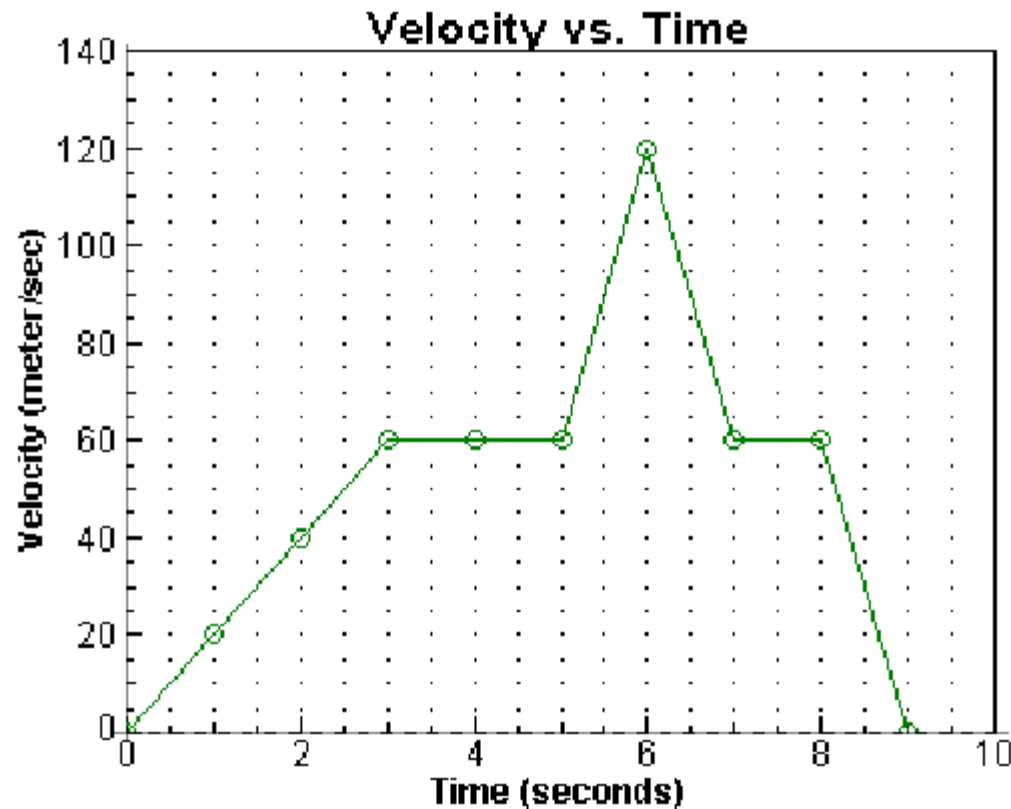
$$a = \frac{\Delta v}{\Delta t}$$

$$\Delta v = \textit{Rise}$$

$$\Delta t = \textit{Run}$$

$$a = \textit{Slope}$$

Acceleration – Graphical Representation



What is the acceleration from
 $t=0\text{s}$ to $t=3\text{s}$?

$$60/3 = 20 \text{ m/s/s}$$

What is the acceleration from
 $t=3\text{ s}$ to $t=5\text{s}$?

$$0/2 = 0 \text{ m/s/s}$$

What is the acceleration from
 $t=8\text{s}$ to $t=9\text{s}$?

$$0-60/1 = -60 \text{ m/s/s}$$