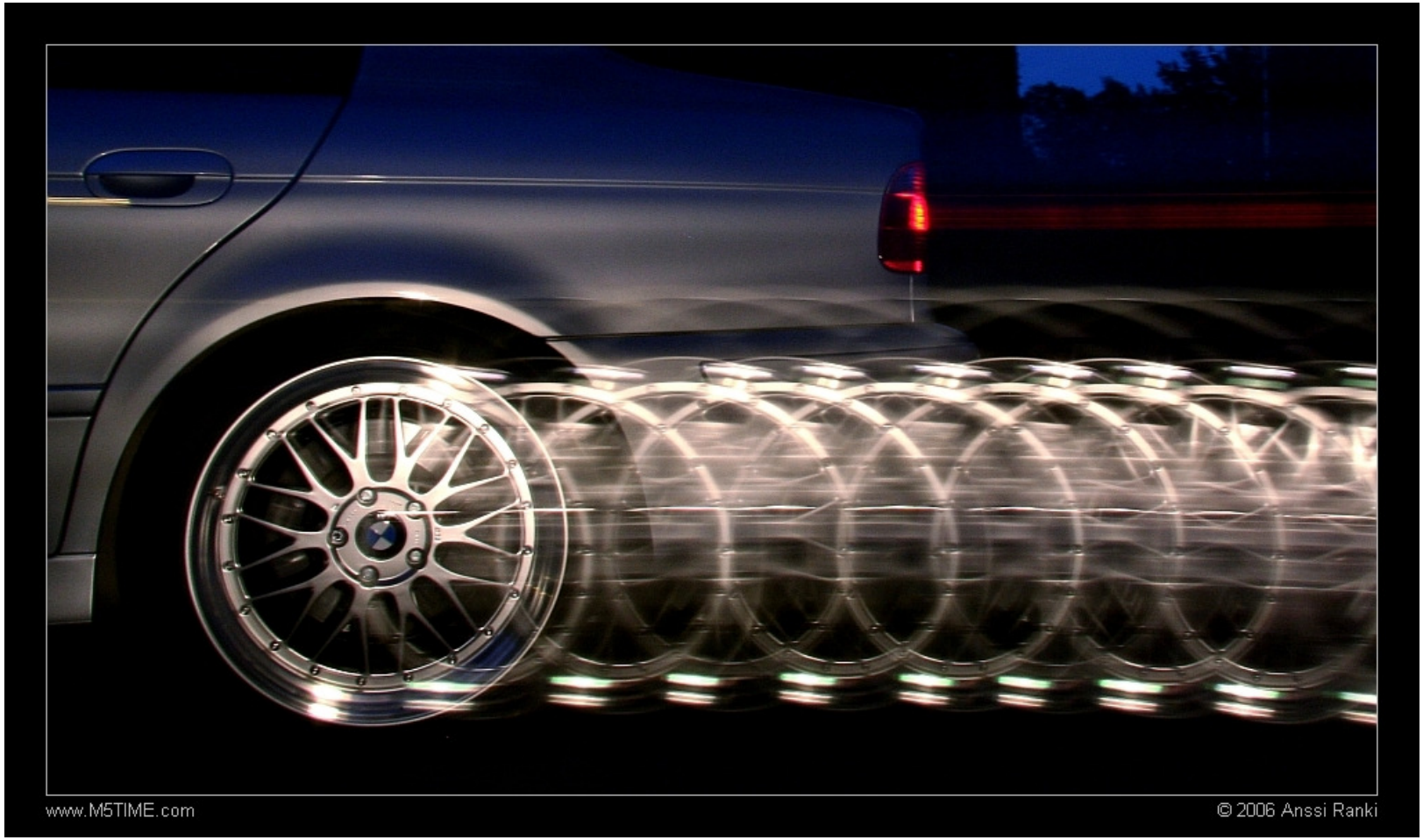
Acceleration

Honors Physics



Acceleration – The Definition

The RATE of CHANGE of VELOCITY

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

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.

$$a = \frac{\Delta v}{\Delta t} = \frac{60 - 0}{13} =$$ **4.62 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 ?

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

Free-Fall Acceleration

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

$$a_y = g = -9.8\, m/s/s$$

- 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

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

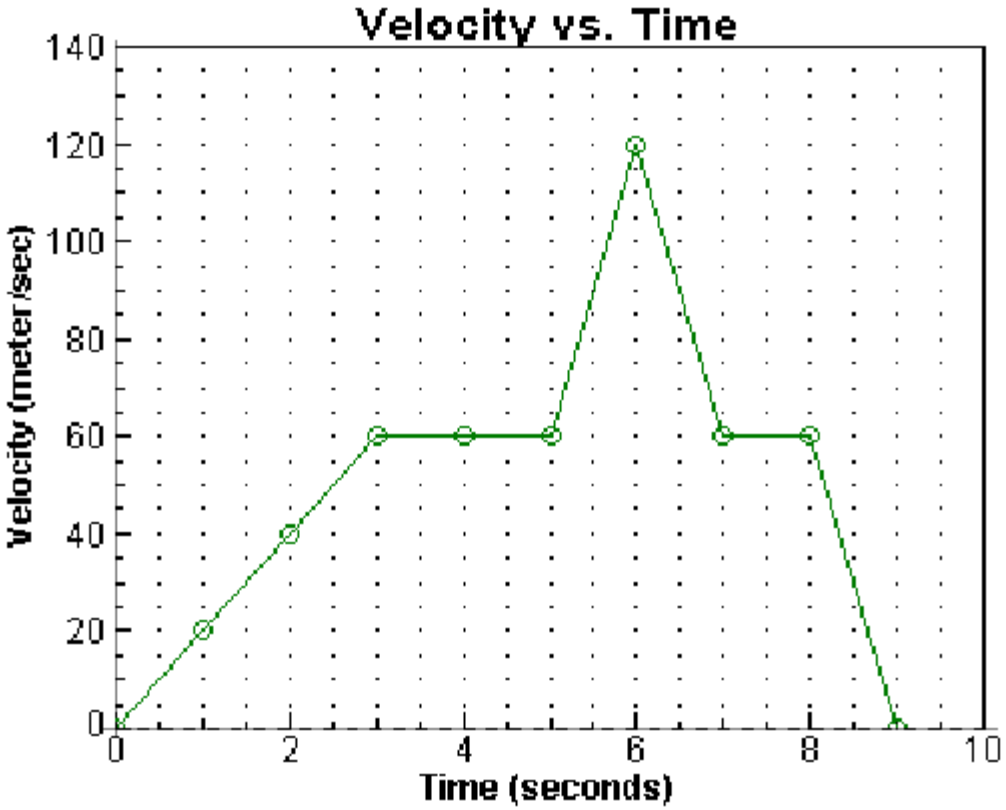
$$a = \frac{\Delta v}{\Delta t}$$

$$\Delta v = Rise$$

$$\Delta t = Run$$

$$a = Slope$$

Acceleration – Graphical Representation



What is the acceleration from t=0s to t=3s?

60/3= 20 m/s/s

What is the acceleration from t=3 s to t=5s?

0/2 = 0 m/s/s

What is the acceleration from t=8s to t=9s?

0-60/1 = -60 m/s/s