OL Academy

PHYCS101

General Physics I

Chapter (2)
Motion in One Dimension

Done by: T. Abeer Abdulla

PHYCS101

General Physics I

مع الأستاذة عبير عبدالله

ساعتين أسبوعيًا، كل خميس وسبت
7:30 مساءً

لمشاهدة فيديوات الدروس

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Displacement (m)

Vector Quantity and it can have a positive or negative value

Formula: $\Delta x = x_f - x_i$

Distance (m)

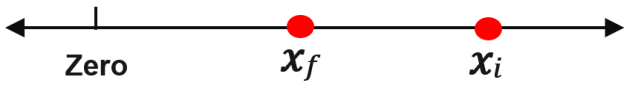
Scalar quantity and it is always positive

Formula: $d = x_1 - x_2$

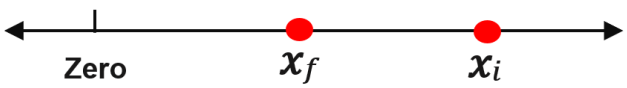
Example:

x_i = 110 m and ending at x_f = 60 m.

Displacement:

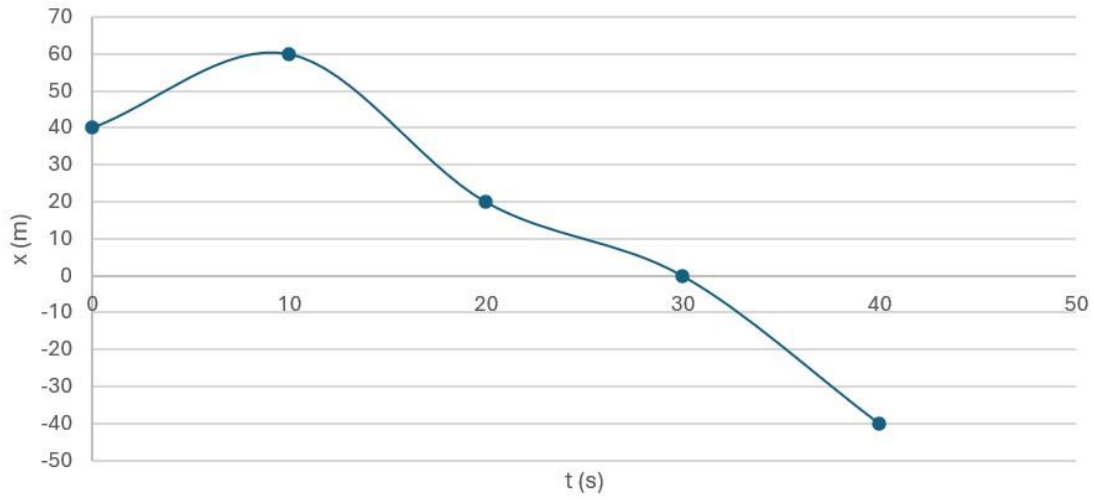


Distance:



The position – time graph

x – t plot is considered for the distance and the displacement



What is the displacement between A & B?

What is the distance between B & C?

What is the total distance?

What is the total displacement?

Average Velocity (m/s):

It is a vector quantity and it can be positive or negative

Formula: the displacement Δx divided by time interval Δt

$$\bar{\mathbf{v}} = \frac{\Delta \mathrm{x}}{\Delta \mathrm{t}} = \frac{x_f - x_i}{t_f - t_i}$$

Average speed (m/s):

Scalar quantity and it is always positive

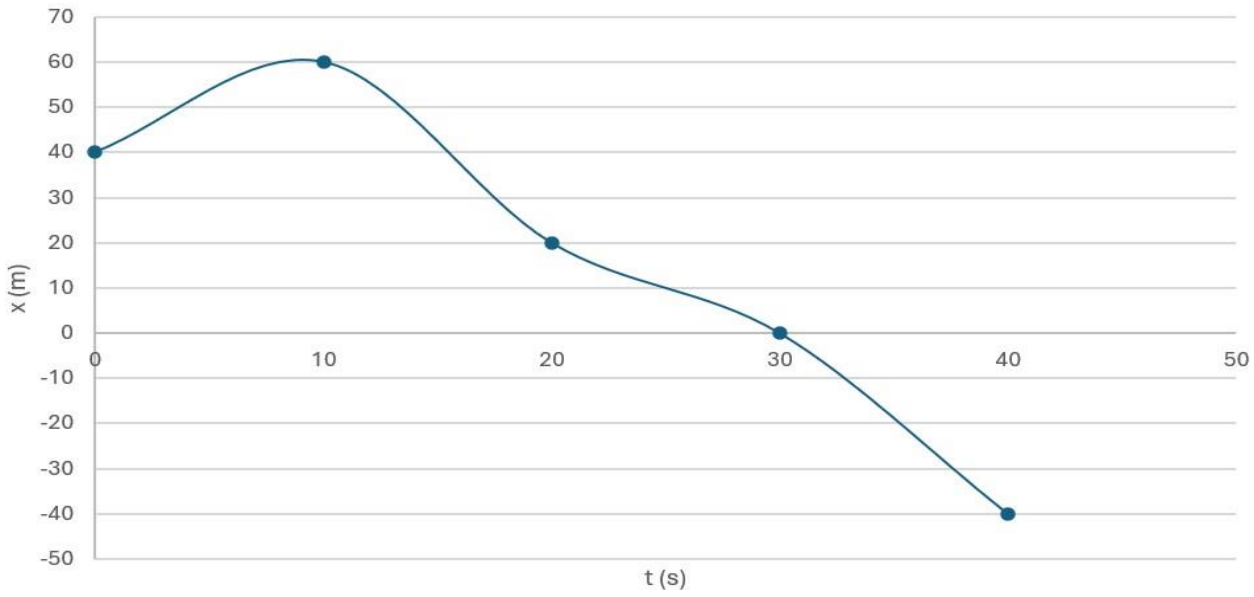
Formula: $Average\ speed = \frac{total\ distance}{total\ time}$ or $|average\ Velocity|$

Examples:

1- **A particle moving along x-axis is located at $x_i = 12m$ at $t_i = 1\ s$ and at $x_f = 4m$ at $t_f = 3s$. Find its displacement, average velocity and average speed.**

2- **If a truck travels 16 m in 2 s, then its average velocity is:**

3- **If a car travels 40 km in 4 h, then its average speed is:**



What is the average velocity?

What is the average speed?

Instantaneous velocity

$$x(t) = at^2 + bt + c$$

$$v = \frac{dx}{dt}$$

Velocity cases in position – time graph

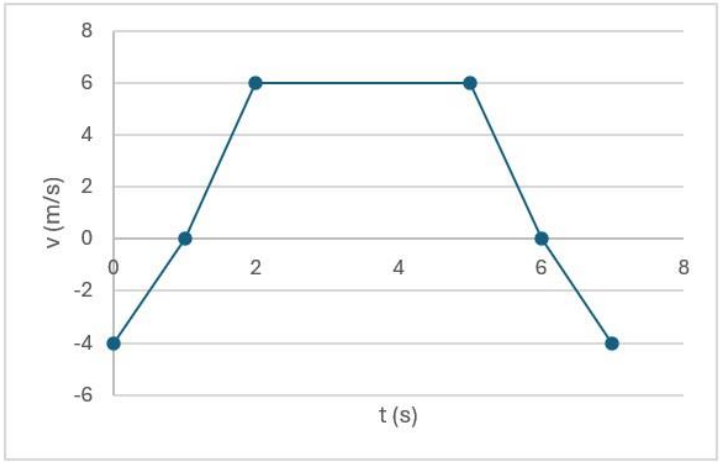
Acceleration (m/s^2):

$$avg = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$$

Instantaneous Acceleration:

$$a = \frac{dv}{dt} = \frac{d^2x}{d^2t}$$

Acceleration cases in position – time graph



One Dimensional Motion Formula:

$$v_f = v_i + at$$

$$\Delta x = v_i t + \frac{1}{2} at^2$$

$$v_f^2 = v_i^2 + 2a\Delta x$$

Examples:

1- A motorcycle starts to move from rest with constant acceleration of 2 $\_^{m}{}_{2}$

a. Find the velocity in t=2s

b. At what time the position be 200m?

c. What is the position at t=6s?

d. What is the velocity after travelling distance of 50 m?

2- A car has an initial speed of 15 m/s and an acceleration of 2 m/s^2. How long will it take the car to come to stop?

3- **A train starts from rest with constant acceleration 0.5 m/s^2. Find the final velocity V_f of the train after 60s, the calculate the distance of this train during this time**

4- **An airplane must reach a velocity of 27.8 m/s before taking off and its acceleration is 2m/s^2 from the rest.**

a. **If the runway is 150 m long, can the plane reach the proper velocity?**

b. **If not, what is the minimum length must the runway have?**

5- **A van moves at constant velocity 15 m/s at school crossing it overtook an officer who started his motion from the rest with constant acceleration of m/s^2. When and where he will overtake the van?**

Free Fall:

An object that is free in the air or object under influence of gravity WITHOUT any other force.

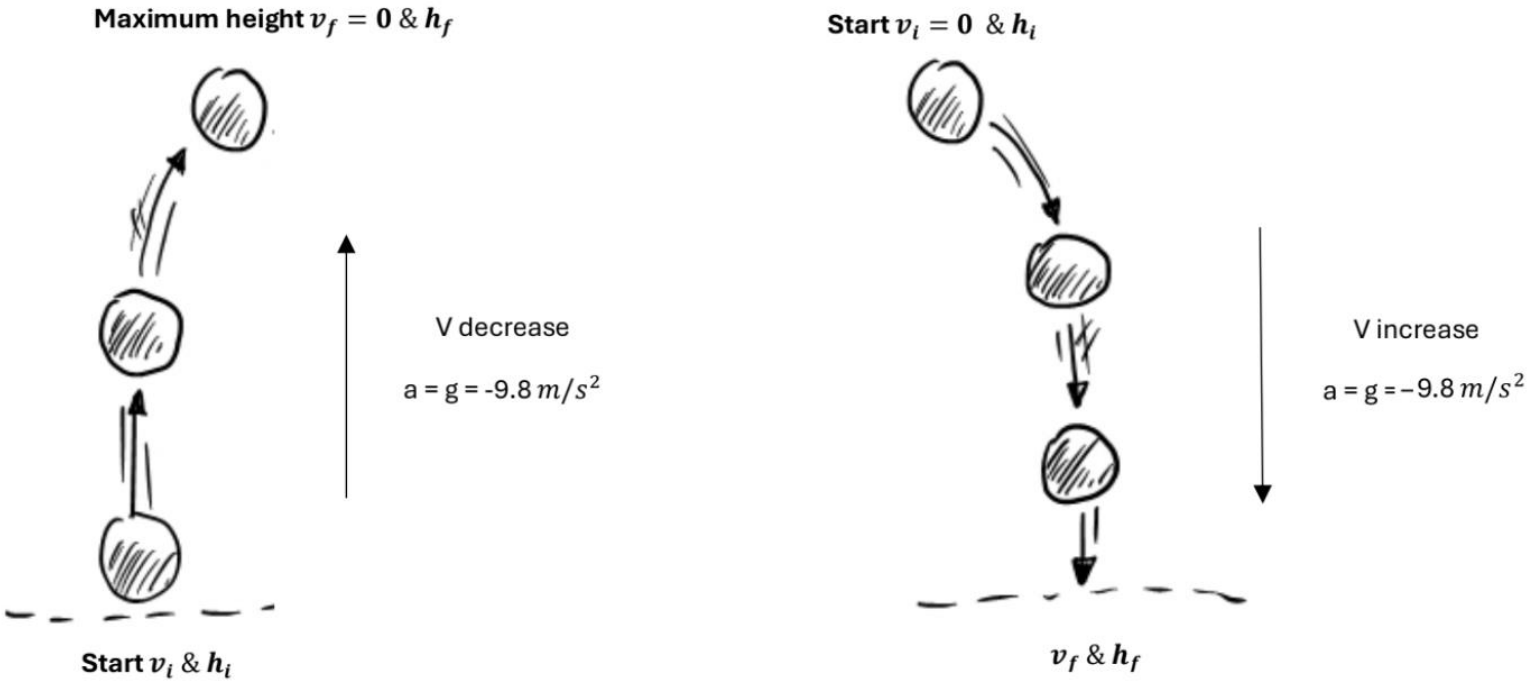
Gravity:

The acceleration of the earth.

Gravity has a magnitude of 9.8 and its direction is down towards the earth.

There are two types of free fall:

Object going to up & down:



Examples:

1- A boy throws a ball directly upward with an initial speed 8 m/s, find the maximum height it reaches.

2- A ball is dropped downward from the rest from a height of 500m above the ground. How much time it takes the ball to reach the ground?

3- A boy throws a ball directly upward with an initial speed 20 m/s from the initial height of 50 m.

i. What is the velocity of the ball just before it hits the ground?

ii. How long does it take the ball to reach the ground?

4- A stone is thrown from the top of a building with initial velocity of 20 m/s straight upward. The building is 50 m high, and the stone just misses the edge of the roof on its way down.

a. Time needed to reach the maximum height.

b. The maximum height?

c. **The time for the stone to return back to the top of building?**

d. **Find the velocity at the instant when it reaches the roof?**

e. **Find the velocity of the stone just before it hits the ground?**