**Fourth Form Physics**

**Kinematics**

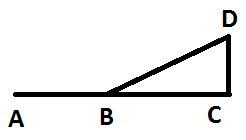
**Distance** travelled by an object is the length of path taken.

* [SI unit](https://www.miniphysics.com/physical-quantities.html) is metre (m)
* [Scalar quantity](https://www.miniphysics.com/scalar-and-vector-quantities.html)
* Can never be negative and distance travelled will never decrease

**Displacement** is the shortest distance from the initial to the final position of an object.

* [SI unit](https://www.miniphysics.com/physical-quantities.html) is metre (m)
* [Vector quantity](https://www.miniphysics.com/scalar-and-vector-quantities.html)
* Can be negative

 If you have problems grasping the difference in concept of displacement and distance travelled, please study the example below.

[](https://i2.wp.com/www.miniphysics.com/wp-content/uploads/2014/02/Displacement-vs-distance.png?ssl=1)

**Consider the diagram above:**

**Difference between distance and displacement:** If an object started travelling from B to C and **ends** at D, distance travelled is BC + CD. Displacement is BD.

**Displacement can be ZERO:** If the object started travelling from B to C to D and **ends** at B, distance travelled is BC + CD + DB. Displacement is ZERO. (The object ends at the same place it started)

**Displacement can be NEGATIVE:** If the object travels from B to A, the displacement is negative. By CONVENTION, the direction towards the right and top are positive. A way to remember: Go right = positive, go left = negative.

**Another example to ensure that you understand the difference between displacement and distance:**

Ali walked 1 km to the North, then 1 km to the East and followed by 1 km to the South. What is the distance covered by Ali? What is his final displacement?

**Answer:**

Distance: 1+1+1=3km

Displacement: 1 km east of starting point.

Speed is the distance moved per unit time.

SI unit is metre per second (ms−1)

Scalar quantity

Equation: Speed=d t, where d is distance travelled and t is time taken

Average speed, ⟨speed⟩ can be calculated using total distance travelled/total time taken

Instantaneous speed is the speed at any instant

Measured by a speedometer

A speedometer measures the instantaneous speed

Velocity (v) of an object is the rate of change of displacement with respect to time.

SI unit is metre per second (ms−1)

Vector quantity

The magnitude of velocity is speed

v=s t, where s is displacement and t is time taken

Average velocity, ⟨v⟩

can be calculated using total displacement /total time taken

As velocity is a vector quantity, you have to specify its magnitude and direction to completely describe it.

**Acceleration** of an object is the rate of change of [velocity](https://www.miniphysics.com/speed-vs-velocity.html) with respect to time.

* [SI unit](https://www.miniphysics.com/base-quantity.html) is metre per second square or metre per second per second (*ms*−2)

 [Vector quantity](https://www.miniphysics.com/scalar-and-vector-quantities.html)

 *a*=*v*–*u/t* , where v is final velocity, u is initial velocity and t is time taken.

* If the velocity of an object **increases**, the object is undergoing **acceleration**. Hence, if the velocity of an object **decreases**, it is undergoing **deceleration**.
* If the velocity of the object is **constant**, the acceleration is **zero**.
* An object is said to be undergoing uniform acceleration when there is a constant change in velocity per unit time.

**Note:** If the direction of an object changes, it is undergoing acceleration by definition. Change direction = change in velocity = acceleration.