Introduction to Motion

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What is a Vector Quantity?

A vector quantity is a physical quantity which is completely defined by both magnitude and direction.

Some examples are:

- Force
- Velocity
- Momentum
- Acceleration
- Displacement

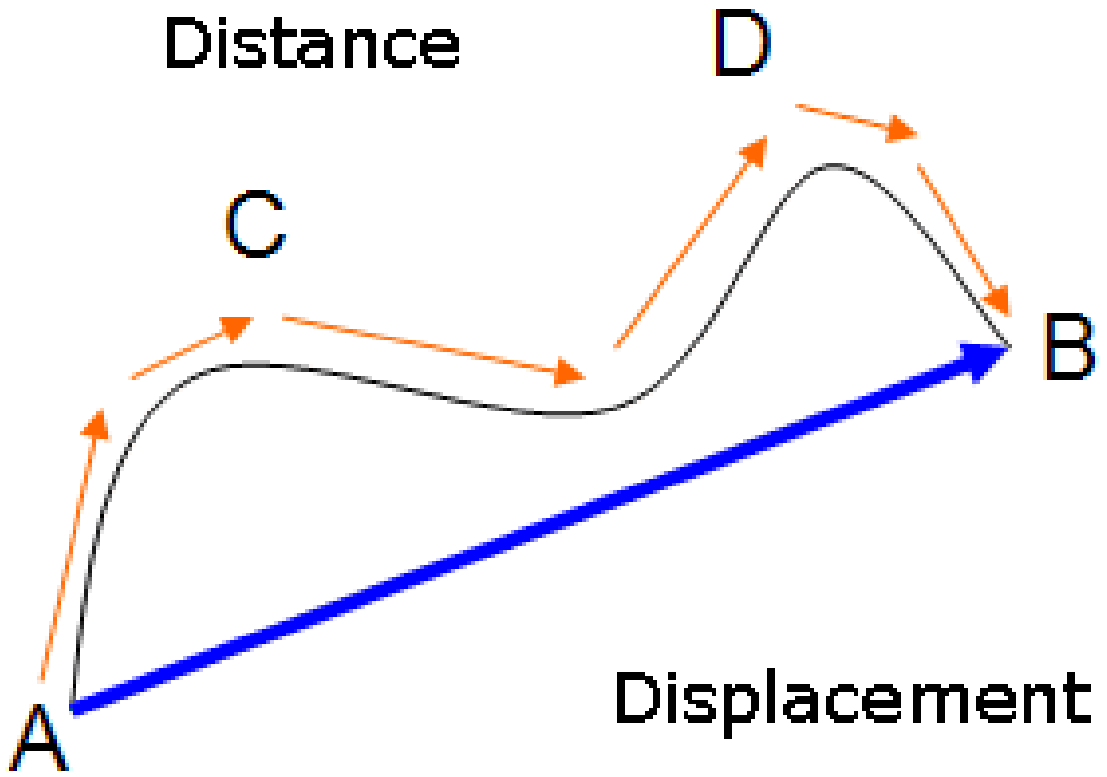
What is a Scalar Quantity?

A scalar quantity is a physical quantity which is completely defined by both magnitude only.

Some examples are:

- Time
- Temperature
- Energy
- Distance
- Speed

Distance Vs Displacement



Distance: Movement from point A to point B in no particular direction.
Displacement: Distance moved in a particular direction.

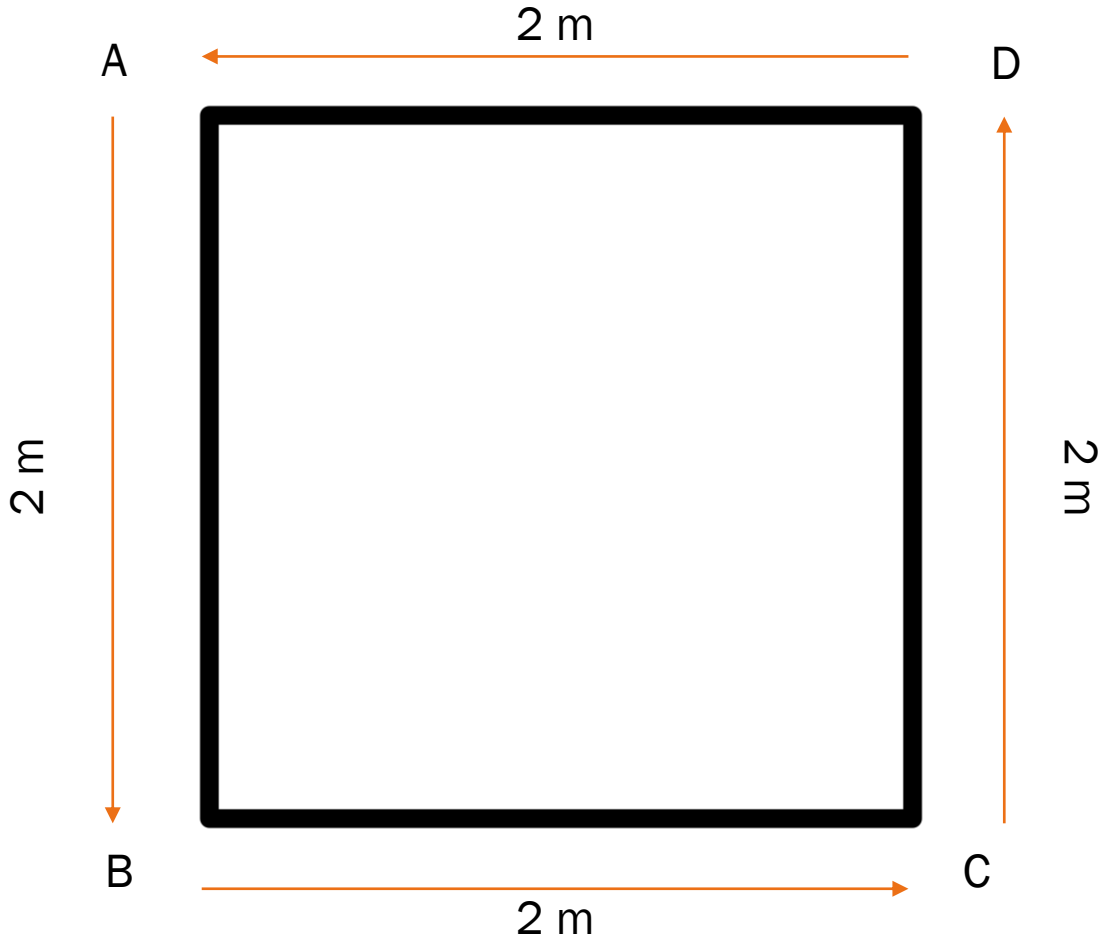
NB: Distance and displacement are both measured in metres (m)

Zero Displacement

The value of distance is found to be:
x = 2m + 2m + 2m + 2m
x = 8m
The value of displacement is found to be:
s = 2m - 2m + 2m - 2m
s = 0m

When an object's final and initial position is the same, there is no displacement.

An object moves from rest at point A, to point B and from point B, to point C and from point C, to point D. Finally, the object comes to rest at point A.



Speed, Velocity and Acceleration

Click the picture to get more information

Speed

Speed is defined as the distance travelled per second.

Speed = $\frac{DIstance\ travelled}{Time\ Taken}$

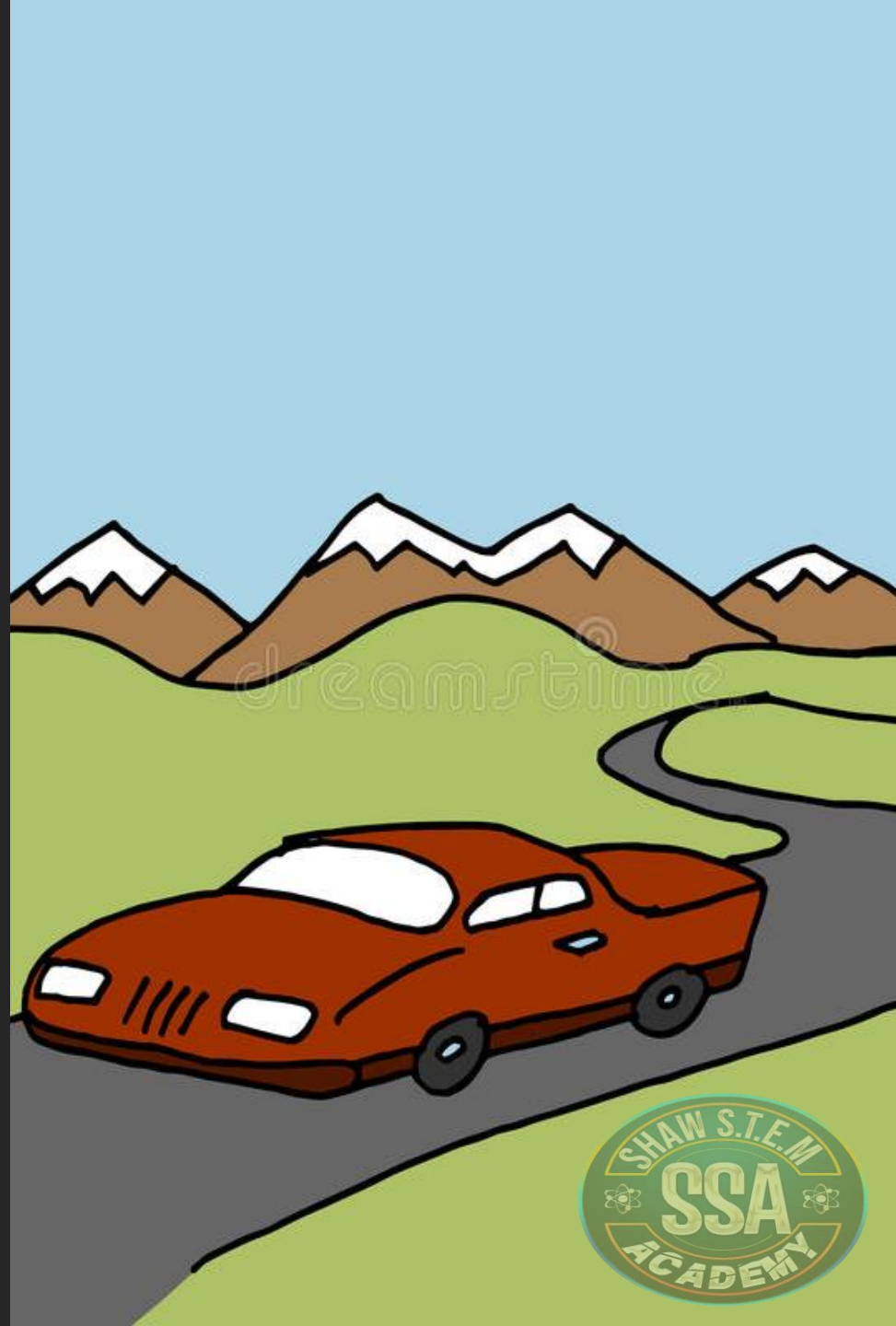
v = $\frac{x}{t}$

Where: v – Speed/ms^{-1}

x – Distance travelled/m

t – Time Taken/s

NB: The unit of speed is metres per second (ms^{-1})



Speed Questions

1) The speed of a car travelling from point A to point B is 60 ms^{-1}, while the time taken to do so was 2 minutes. What was the distance travelled in SI units? 7200 m

v = 60 ms^{-1}, x = ?, t = 2 minutes

$v = \frac{x}{t}$ ⟶ x = v*t

2) The speed of a car travelling from point C to point E is 20 kmh^{-1}, the distance travelled was $1.0x10^6$ m. What was the time taken? 50 s

v = 20 kmh^{-1}, x = $1.0x10^6$ m, t = ?

$v = \frac{x}{t}$ ⟶ $t = \frac{x}{v}$

Velocity

Velocity is defined as the rate of change of displacement.

Velocity = $\frac{Displacement}{Time\ Taken}$

$v = \frac{x}{t}$

Where: v – Velocity/ms^{-1}

x – Displacement/m

t – Time Taken/s

NB: The unit of velocity is metres per second (ms^{-1})

NB: Initial velocity is expressed as “u”

NB: When an object starts from rest, it’s initial velocity is zero

Velocity Questions

1) The velocity of a car travelling is 20 ms^{-1}, while the time taken to do so was 3 and a half minutes. What was the distance travelled in SI units? 4200 m

v = 20 ms^{-1}, x = ?, t = 3.5 minutes

$v = \frac{x}{t}$ ⟶ x = v*t

2) The speed of a car travelling from point C to point E is 120kmh^{-1}, the distance travelled was 3.5x10^6 m. What was the time taken? 29,166.7 s

v = 120 kmh^{-1}, x = 3.5x10^6 m, t = ?

$v = \frac{x}{t}$ ⟶ t = $\frac{x}{v}$

Acceleration

Acceleration is defined as the rate of change of velocity.

Acceleration = $\frac{Change\ in\ velocity}{Time\ Taken}$

$a = \frac{v - u}{t}$

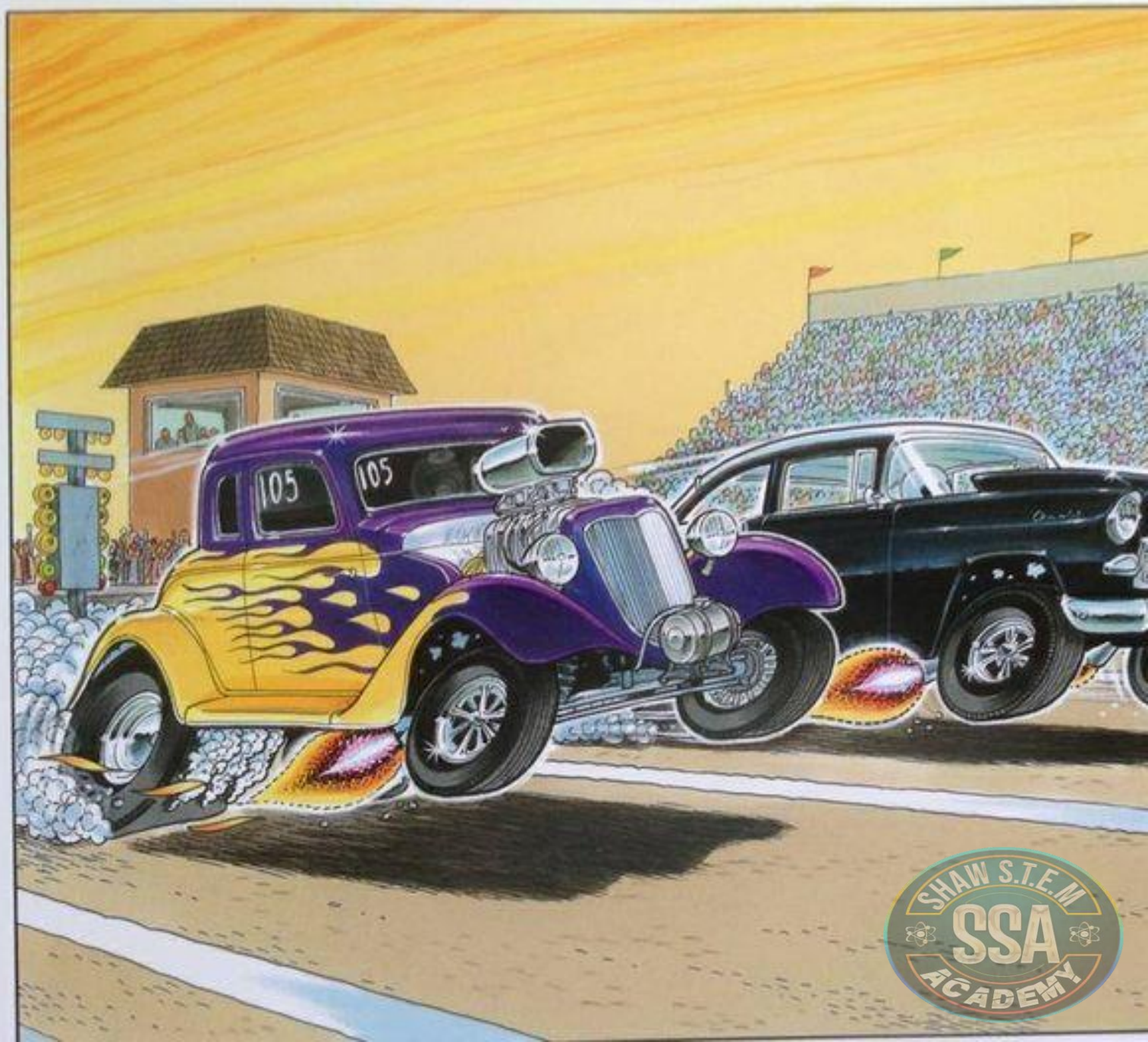
Where: a – Acceleration/ms^{-2}

v – Final Velocity/ms^{-1}

u – Initial Velocity/ms^{-1}

t – Time Taken/s

NB: The unit of acceleration is metres per second squared (ms^{-1})



Acceleration Questions

1) The final velocity of a car travelling was 1000 ms^{-1}, the acceleration of the car was 5 ms^{-2} while the time taken to do so was 100 s. What was the initial velocity in SI unit? 500 ms^{-1}

a = 5 ms^{-2}, v = 20 ms^{-1}, u = ?, t = 100 seconds

$a = \frac{v-u}{t}$ ⟶ u = v - at

2) A vehicle at rest started to accelerate with an acceleration 10 ms^{-2} while the time taken to do so was 15 s. What was the final velocity in SI units? 150 ms^{-1}

a = 10 ms^{-2}, v = ?, u = 0, t = 15 seconds

$a = \frac{v-u}{t}$ ⟶ v = at + u