**What is biomechanics?**

Biomechanics is the sport science field that applies the laws of mechanics and physics to human performance, (in order to gain a greater understanding of performance in athletic events).

Discuss and write down ways in which you think elite athletes are successful because of nature or nurture (training).

**What are scalars and vectors?**

A scalar quality has only magnitude.

- Examples
    o Speed: distance (m) / time (seconds)
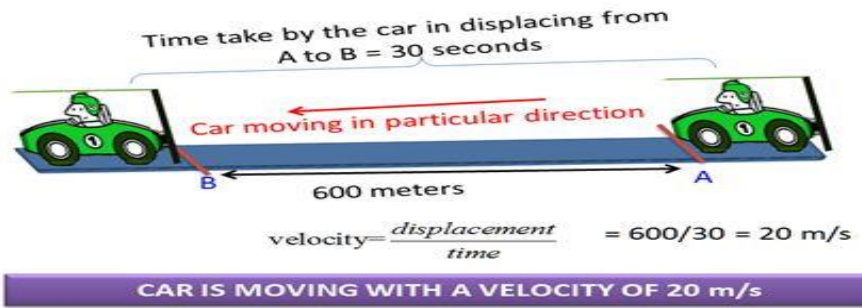    o Distance: speed x time (seconds)

A vector quality has magnitude and direction.

- Force is the mechanical interaction between 2 objects and is measured in newtons.
    o Force = mass x acceleration
- Displacement is how far and object has moved in a given direction
    o Displacement = ½ (initial velocity + final velocity) x time (seconds)

| TERM | DEFINITION |
| --- | --- |
| Scalar | Quantities that are fully described by a magnitude (or numerical value) alone |
| Vector | Quantities that are fully described by both a magnitude and direction |

| TERM | EXPLANATION | VECTOR OR SCALAR | EQUATION | SYMBOLIC EQUATION | MEASUREMENTS |
| --- | --- | --- | --- | --- | --- |
| Speed | The rate of change of distance | Scalar | Speed = $\dfrac{\text{Distance}}{\text{Time}}$ | $S = \dfrac{D}{T}$ | S = (m/s) D = (m) T = (s) |
| Velocity | The speed of a body in a given direction and is the rate of change of displacement | Vector | Velocity = $\dfrac{\text{Displacement}}{\text{Time}}$ | $V = \dfrac{D}{T}$ | V = (m/s) D = (m) T = (s) |
| Force | The cause of an object with mass to change its velocity | Vector | Force = Mass X Gravity | F = M X G | F = (N) M = (kg) (g) G = (N kg) |
| Acceleration | The rate at which a body changes its velocity | Scalar | Acceleration = $\dfrac{\text{Change in Velocity}}{\text{Time}}$ | $A = \dfrac{V_1 - V_2}{T}$ $V_1$ = Final Velocity $V_2$ = Initial Velocity | A = (m/s$^2$) $V_1$ - $V_2$ = (m/s) T = (s) |
| Displacement | The shortest distance between the initial point and the final point | Vector | Displacement = ½ (Initial Velocity + Final Velocity) X Time | S = ½ (U + V) T | S = (m) U + V = (m/s) T = (s) |
| Momentum | The product of mass and velocity: 'Quantity of Motion' | Vector | Momentum = Mass X Velocity | P = M X V | P = (m/s$^2$) M = (kg) (g) V = (m/s) |

- Velocity= Displacement change / time

Time take by the car in displacing from A to B = 30 seconds

Car moving in particular direction

B — 600 meters — A

$$velocity = \frac{displacement}{time} \quad = 600/30 = 20 \text{ m/s}$$

**CAR IS MOVING WITH A VELOCITY OF 20 m/s**

- Acceleration is change in velocity/time

- Momentum is the mass of an object x its velocity

**Vector Diagram**

Case A
$v_i = 10$ m/s

$v_f = 5$ m/s

Case B
$v_i = 30$ m/s

$v_f = 28$ m/s
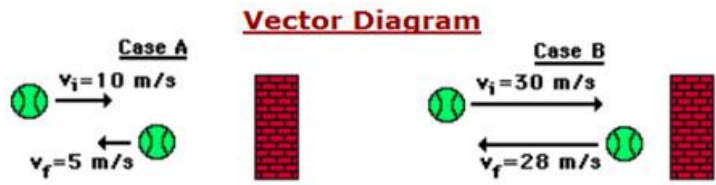
Which ball has a greater momentum?

**Question**:

Two NFL players approach each other. Just before impact player 1 moves with a velocity of 6m/s and and a mass of 90kg. Player 2 moves with a velocity of 7m/s amd a mass of 80kg. What is the momentum of each before impact?

Impulse= force x time

- Whenever a force is being applied it always takes time. When a person applies a force over a certain time then we can say that they have applied an **impulse**.

- **How force and time are combined depends on:**
  o the physical capabilities of the person applying the force: compare elite athletes to beginners in a task.
  o the requirements of the task: compare sprinting verses rowing, speeding something up verses slowing something down

- **Why are the following variables important in maximising impulse?**

  o **Strength:**

  o **Speed:**

  o **Flexibility:**