

Conservation of momentum

James Stewart: Conservation of momentum means that total momentum stays the same before and after a collision, provided there are no external forces.

That's when two or more objects crash into each other.

The law of conservation of momentum states that in a closed system, total initial momentum is equal to total final momentum.

Momentum depends on the motion of an object.

It's calculated as mass multiplied by velocity, or p equals mv .

So, let's imagine two rugby players colliding in a big tackle on a very muddy pitch.

To calculate their final velocity as they move off together after the collision, first we calculate the starting momentum of each player.

Velocity is a vector, so always has direction, and we usually use a positive value for objects moving in one direction, like to the right, and a negative value for objects moving in the opposite direction, like to the left.

Momentum of person one equals 110 kilograms times six metres per second, which equals 660 kilogram metres per second.

Momentum of person two equals 90 kilograms times minus four metres per second, which equals minus 360 kilogram metres per second.

So, the total momentum equals the momentum of person one added to the momentum of person two, which equals 660 kilogram metres per second plus minus 360 kilogram metres per second, which equals 300 kilogram metres per second.

So, the overall starting momentum equals 300 kilogram metres per second to the right.

Now, you can calculate their final velocity since you know the final momentum will equal initial momentum.

The combined mass of the players is still 110 kilograms plus 90 kilograms, which equals 200 kilograms.

So, p equals mv for after the collision gives 300 kilogram metres per second equals 200 kilograms times velocity.

Divide both sides by 200 kilograms.

Velocity equals 1.5 metres per second to the right since we specified right as positive.

So, both athletes end up moving in the same direction of the athlete with greater initial momentum.

In any momentum calculation, remember that the total momentum before an event equals the total momentum after it, provided there are no external forces.

(MUSIC)