| Strand | MECHANICS |
|---|---|
| Sub Strand | MOMENTUM |
| Content Learning Outcome | At the end of the lesson students should be able to Apply quantitatively the Law of conservation of momentum |

**Conservation of momentum**

Provided no external forces are acting momentum of a system will always be conserved. Ie **initial momentum of a system will always be equal to the final momentum of the system.**

➢ **Always write an expression for the initial momentum of the system depending on the number masses in the system.**
➢ **Common velocity of the masses means If the masses move off together with the same velocity**

**Elastic collision**

1. **Momentum is conserved**
2. Kinetic energy is conserved
3. Total energy is conserved

**Inelastic collision**

1. **Momentum is conserved**
2. **Total energy is conserved**
3. Kinetic energy is not conserved

Eg A 2000kg car travelling at 5m/s hits 90kg man who is standing on the road. After the collision both the car and the person move off with a common velocity.



5m/s

Common velocity $V_C$

Stationery so v =0m/s
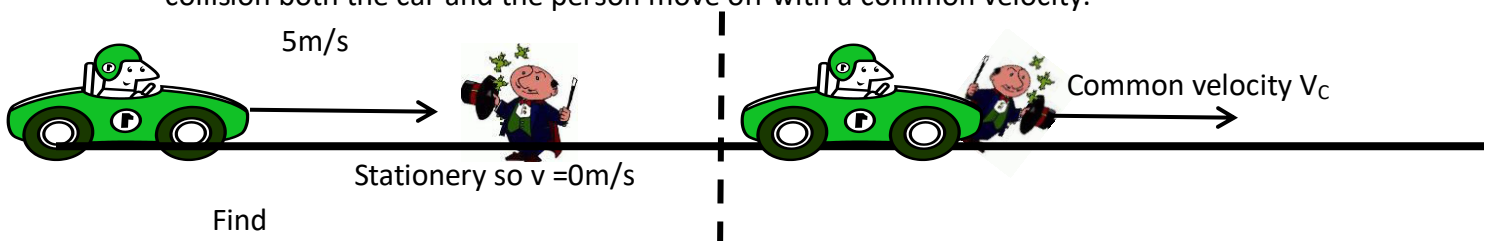
Find

i. The initial momentum of the car

P = mv

= 2000 (5 )

= 10,000kgm/s

ii. The initial momentum of the person

P = mv

= 90 (0 )

= 0kgm/s

iii.     The initial momentum of the system

$P_{i\,system} = P_{CAR} + P_{PERSON}$

= 10,000 + 0 $\overrightarrow{\phantom{xxx}}$

= 10,000 $\overrightarrow{\phantom{xxx}}$

iv.     Final momentum of the system
        The final momentum of the system should be equal to the initial momentum of
        the system

$P_{f\,system}$ =   $\overrightarrow{\phantom{xxx}}$
                    10,000

v.      The common velocity after the collision

P = m v

10,000 = ( 2000 + 90 ) v

10,000 = 2090 v
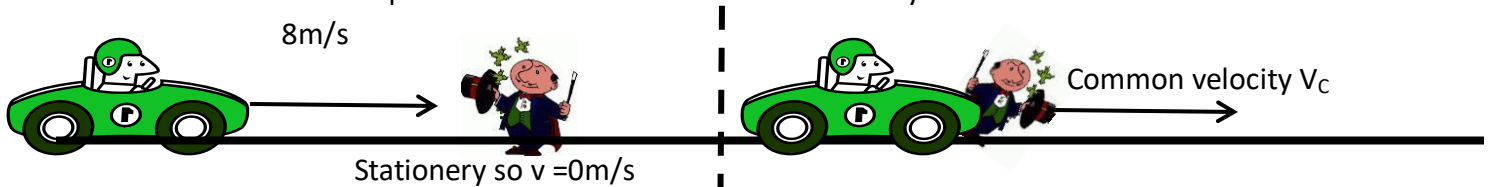
V =    2090/10,000

= 2.09m/s

> Since both the masses are moving together put the total mass in the formula

Exercise

A 3000kg car travelling at 8m/s hits 50kg man who is standing on the road. After the collision both the car and the person move off with a common velocity.

8m/s

Common velocity V$_C$

Stationery so v =0m/s

Find

i.      The initial momentum of the car
ii.     The initial momentum of the person
iii.    The initial momentum of the system
iv.     Final momentum of the system
v.      The common velocity after the collision
vi.     Find out if the collision is elastic or not. ( find the kinetic energy of the system before and after the collision. Take the masses separately and find the kinetic energy using $E_K = \frac{1}{2}mv^2$  If the kinetic energy of the system before and after is same it is elastic, if it is different than it is inelastic )