

4.6.3 Passenger safety

When a vehicle comes to a sudden stop in a crash, the safety of the passenger depends on how quickly they slow down. The quicker the passenger comes to a halt the larger the forces they will experience.



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Before the crash, the passenger has momentum, and once they have come to a stop, they have zero momentum. Their momentum has changed. We have seen that a force is required to change the momentum of an object:

$$\Delta p = F\Delta t$$

Therefore:

$$F = \frac{\Delta p}{\Delta t}$$

The force is equal to the rate of change of momentum (Newton's 2nd law).

(1) A 70kg person is travelling at 100kmh⁻¹. What momentum do they have (in kgms⁻¹)?

(2) In a crash, what is their change of momentum?

(3) Does how quickly they stop affect their change of momentum?

(4) Calculate the stopping force on this person for $\Delta t = 0.1s$ and $1.0s$.

(5) How does the stopping force compare?

(6) How do car manufacturers design vehicles to allow the passengers to slow down over a longer period of time?