Answer on Question 59420, Physics, Mechanics, Relativity

Question:

How large an average force is required to stop a $1400\ kg$ car in $5.0\ s$ if the car's initial speed is $25\ ms^{-1}$?

a) $2000\ N$

b) $3500\ N$

c) $9000\ N$

d) $7000\ N$

Solution:

We can find an average force that required to stop the car from the definition of the impulse:

$$\Delta p = F_{avg}\Delta t,$$

$$m\Delta v = F_{avg}\Delta t,$$

$$m(v_{final} - v_{initial}) = F_{avg}\Delta t$$

here, m is the mass of the car, $v_{initial}$ is the initial speed of the car, v_{final} is the final speed of the car, F_{avg} is the average force that required to stop the car, Δt is the change in time.

Then, from the last formula we can calculate the average force:

$$F_{avg} = \frac{m(v_{final} - v_{initial})}{\Delta t} = \frac{1400\ kg \cdot (0\ ms^{-1} - 25\ ms^{-1})}{5.0\ s} = -7000\ N.$$

The sign minus indicates that the average force directed opposite to the direction of the motion of the car. The magnitude of the average force is equal to $7000\ N$.

Answer:

d) $7000\ N$