Answer on Question #44596 – Physics – Mechanics | Kinematics | Dynamics

A car of mass 120 kg is moving at 100 m/s. If it slows down to 40 m/s in 50 seconds:

A. The impulse and force that are being provided by the breaking mechanism is when the mechanism is brought to a stop and then "throw it back." Impulses are greater when bouncing occurs.

Solution:

$\mathrm{m} = 120\ \mathrm{kg} - \text{mass of the car;}$

$\mathrm{v_1} = 100\frac{\mathrm{m}}{\mathrm{s}} - \text{initial velocity of the car;}$

$\mathrm{v_2} = 40\frac{\mathrm{m}}{\mathrm{s}} - \text{final velocity of the car;}$

$\mathrm{t} = 50\ \mathrm{s} - \text{deceleration time;}$

The impulse of force can be extracted and found to be equal to the change in momentum of an object provided the mass is constant:

$$\mathrm{Impulse} = \mathrm{m}\Delta\mathrm{v} = \mathrm{mv_2} - \mathrm{mv_1} = \mathrm{m}(\mathrm{v_2} - \mathrm{v_1}) = 120\ \mathrm{kg}\cdot\left(40\frac{\mathrm{m}}{\mathrm{s}} - 100\frac{\mathrm{m}}{\mathrm{s}}\right)$$
$$= -7200\ \mathrm{N}\cdot\mathrm{s}$$

Formula for the impulse:

$$\mathrm{Impulse} = \mathrm{F}\cdot\mathrm{t}$$
$$\mathrm{F} = \frac{\mathrm{Impulse}}{\mathrm{t}} = \frac{-7200\ \mathrm{N}\cdot\mathrm{s}}{50\ \mathrm{s}} = -144\ \mathrm{N}$$

We have a minus sign before force and impulse because the direction of force and impulse is opposite to the direction of motion (deceleration) of the car.

Answer: $\mathrm{Impulse} = -7200\ \mathrm{N}\cdot\mathrm{s};\ \mathrm{F} = -144\ \mathrm{N}.$