

Answer on Question 58026, Physics, Mechanics, Relativity

Question:

A player hits a football which is initially at rest and moves 22 ms^{-1} .

Find the:

- a) momentum of the football if it has a mass of 0.48 kg
- b) force exerted on it when the time of contact is 0.03 s
- c) impulse in the football

Solution:

- a) By definition of the momentum, we have:

$$p = mv = 0.48 \text{ kg} \cdot 22 \text{ ms}^{-1} = 10.56 \text{ kgms}^{-1}.$$

- b) Because the force is the rate of change of momentum, we get:

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

$$F = \frac{\Delta p}{\Delta t} = \frac{m(v - v_0)}{\Delta t} = \frac{0.48 \text{ kg} \cdot (22 \text{ ms}^{-1} - 0 \text{ ms}^{-1})}{0.03 \text{ s}} = 352 \text{ N}.$$

- c) By definition of the impulse, we have:

$$J = \Delta p = p - p_0 = mv - mv_0 = m(v - v_0) = 0.48 \text{ kg} \cdot (22 \text{ ms}^{-1} - 0 \text{ ms}^{-1}) = 10.56 \text{ kgms}^{-1}.$$

Answer:

- a) $p = 10.56 \text{ kgms}^{-1}$.
- b) $F = 352 \text{ N}$.
- c) $J = 10.56 \text{ kgms}^{-1}$.