

Question #69873, Physics / Mechanics | Relativity

State impulse momentum theorem. A batsman hits a cricket ball of mass 120 g with a speed of 40 ms⁻¹. The fielder stops the ball and the ball comes to rest in his hands in 10⁻³s. Calculate the average force exerted by the fielder's hands on the ball. Using the work-energy theorem, calculate the work done on the ball by this average force.

Solution:

Impulse momentum theorem: An impulse delivered to an object causes the object's momentum to change as follows: $F\Delta t = \Delta p = mv_{final} - mv_{initial}$

$$F = \frac{mv_{final} - mv_{initial}}{\Delta t} = 0.12 \text{ kg} * \frac{(40 - 0) \frac{\text{m}}{\text{s}}}{10^{-3} \text{ s}} = 4800 \text{ N}$$

$$A = \Delta E = \frac{mv_{final}^2}{2} = 0.12 \text{ kg} * \frac{40^2 \text{ m}^2}{2 \text{ s}^2} = 96 \text{ J}$$

Answer: Average force: 4800N

Work done: 96J

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