

Answer on Question #45541, Physics, Other

Question:

A ball of mass 10Kg is initially moving with a velocity of 50 m/s. On applying a constant force on ball for 2s, it acquires a velocity of 70m/s. Calculate:

- The initial momentum of the ball
- The final momentum of the ball
- The rate of change of momentum
- The acceleration of the ball
- The magnitude of the force applied

Answer:

- a) The initial momentum of the ball equals:

$$p_i = mv_i = 10 \text{ kg} \cdot 50 \frac{\text{m}}{\text{s}} = 500 \text{ kg} \frac{\text{m}}{\text{s}}$$

where m is mass of the ball, v_i is initial velocity.

- b) The final momentum of the ball equals:

$$p_f = mv_f = 10 \text{ kg} \cdot 70 \frac{\text{m}}{\text{s}} = 700 \text{ kg} \frac{\text{m}}{\text{s}}$$

where m is mass of the ball, v_f is final velocity.

- c) The rate of change of momentum equals:

$$\Delta p = p_f - p_i = (700 - 500) \text{ kg} \frac{\text{m}}{\text{s}} = 200 \text{ kg} \frac{\text{m}}{\text{s}}$$

- d) The acceleration of the ball equals:

$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t} = \frac{70 - 50 \text{ m}}{2 \text{ s}^2} = 10 \frac{\text{m}}{\text{s}^2}$$

- e) The magnitude of the force equals (Newton's second law of motion):

$$F = ma = 10 \text{ kg} \cdot 10 \frac{\text{m}}{\text{s}^2} = 100 \text{ N}$$