

Physics 112

Thursday Nov 30th

Impulse

Impulse - Momentum

Impulse

$$j = F \Delta t$$

$$j = \Delta p \\ = m(v_2 - v_1)$$

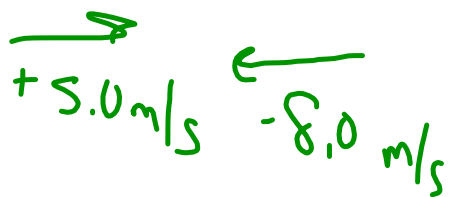
Impulse-Momentum

$$F \Delta t = m(v_2 - v_1)$$

A volleyball ($m = 0.50 \text{ kg}$) come over the net at 5.0 m/s and is hit straight back at 8.0 m/s . If the player's hand and volleyball were in contact for 0.025 seconds, determine the force the player's hand exerted on the ball.

$$F \Delta t = m(v_2 - v_1)$$

$$F = \frac{m(v_2 - v_1)}{\Delta t}$$



$$F = \frac{0.5 \text{ kg}(-8.0 - 5.0)}{0.025}$$

$$F = \textcircled{-} 260 \text{ N}$$

opposite direction to which the ball was originally moving.

Why is it important to follow through when hitting a baseball?

$$F \Delta t = m (v_2 - v_1)$$

- If you follow through or not, the following variables will not change \rightarrow
 - F
 - m
 - v_1

$$F \Delta t = m (v_2 - v_1)$$

$$F \Delta t = m (v_2 - v_1)$$

- By following through, we increase the contact time (Δt)
- If (Δt) increases, then v_2 must also increase so that both sides of equal sign remain the same.

Explain why it is important for vehicles to crumple upon impact.

$$F \Delta t = m (v_2 - v_1)$$

- The following variables will not change if the vehicle crumples or not →
 - m - car's mass
 - v_2 - stopped (0 m/s)
 - v_1 - velocity of car before impact

$$F \Delta t = m (v_2 - v_1)$$

$$F \Delta t = m (v_2 - v_1)$$

- If the vehicle crumples, this will increase (Δt).
If Δt goes up, then F must go down to equal the value on the other side of the equal sign.
 F is what you feel!

Green text

p 209 (41, 43, 44 r. 46)

p 213 (45. r. 47)

41. a) $j = F \Delta t$
 $= 9.1 \text{ N} \times 0.0025 \text{ sec}$
 $= 0.022 \text{ N}\cdot\text{s} \text{ [East]}$
 $= 2.2 \times 10^{-2} \text{ N}\cdot\text{s} \text{ [East]}$

b) $j = F \Delta t$
 $= 4.2 \text{ N} \times 0.0086 \text{ sec}$
 $= 3.6 \times 10^{-2} \text{ N}\cdot\text{s} \text{ [South]}$

43.

$$j = F \Delta t$$

$$\frac{j}{F} = \Delta t$$

$$\frac{2.0 \text{ N}\cdot\text{s}}{55 \text{ N}} = \Delta t$$

$$0.036 \text{ sec} = \Delta t$$

$$3.6 \times 10^{-2} \text{ seconds} = \Delta t$$

contact
time
—

$$44. \quad a) \quad j = F \Delta t = m (v_2 - v_1)$$

$$j = m (v_2 - v_1)$$

$$j = 0.300 \text{ kg} (-9.2 - 44)$$

$$j = -16 \text{ kg} \cdot \text{m/s}$$

$$j = -16 \text{ N} \cdot \text{s}$$

$$j = 16 \text{ N} \cdot \text{s} \text{ [south]}$$

$$(b) \quad j = F \Delta t$$

$$-16 \text{ N} \cdot \text{s} = -2.5 \times 10^3 \text{ N} (\Delta t)$$

$$0.0064 = \Delta t$$

$$6.4 \times 10^{-3} \text{ seconds} = \Delta t$$

4b.

$$W = Fd$$

$$W = \Delta KE$$

$$W = KE_2 - KE_1$$

$KE_2 = 0$
(stopped)

$$W = -KE_1$$

$$Fd = -\frac{1}{2}mv^2$$

$$F(1) = -\frac{1}{2}(75)(28)^2$$

$$F = -29400 \text{ N}$$

$$\begin{aligned} 45. \quad a) \quad j &= m (v_2 - v_1) \\ &= 0.150 \text{ kg} (0 - 44 \text{ m/s}) \\ &= -6.6 \text{ kg} \cdot \text{m/s} \end{aligned}$$

$$\begin{aligned} b) \quad j &= m (v_2 - v_1) \\ &= 5.0 \text{ kg} (0 - 8 \text{ m/s}) \\ &= -40 \text{ kg} \cdot \text{m/s} \end{aligned}$$

$$\begin{aligned} c) \quad j &= m (v_2 - v_1) \\ &= 12000 \text{ kg} (0 - 2.5 \text{ m/s}) \\ &= -30000 \text{ kg} \cdot \text{m/s} \end{aligned}$$

47.

$$j = F \Delta t$$

$$F = \frac{j}{\Delta t} = \frac{2.5 \text{ N}\cdot\text{s}}{0.055 \text{ s}}$$

$$F = 45 \text{ N}$$

$$j = m(v_2 - v_1)$$

$$2.5 \text{ N}\cdot\text{s} = 0.060 \text{ kg}(v_2)$$

$$42 \text{ m/s} = v_2$$