Chapter 8.2

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What is impulse?

The quantity $\mathbf{F}_{net} \Delta t$ is given the name of impulse

Impulse is the same as change in momentum

Change in momentum is the difference between the final and initial momentum

Lab

The Egg Drop!

To complete the lab, you must observe all of the conditions and take note on whether the egg breaks, fractures, or is safe.

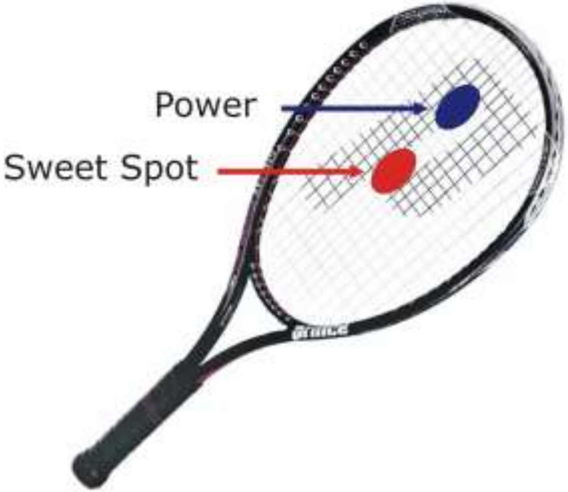
Check your email and click on the link:

http://www.physicsclassroom.com/Physics-Interactives/Momentum-and-Collisions/Egg-Drop/Egg-Drop-Interactive

Question 7

Tennis racquets have sweet spots. If the ball hits a sweet spot, then the player's arm is not jarred as much as it would be otherwise. Explain why this is the case.

This is the case because the tension is the weakest at the center where the sweet spot is.



PROBLEM 7

A bullet is accelerated down the barrel of a gun by hot gases produced in the combustion of gun powder. What is the average force exerted on a 0.0300-kg bullet to accelerate it to a speed of 600 m/s in a time of 2.00 ms (milliseconds)?

You start with equation $F_{net}=\Delta p/\Delta t$. Which becomes $F_{net}=m\Delta v/\Delta t$. When you plug everything in you get $0.0300 \times 600/2.00\times10^{-3}$. Then you plug everything in 9.00×10^3 as the answer.

Problem 10

A professional boxer hits his opponent with a 1000-N horizontal blow that lasts for 0.150 s. (a) Calculate the impulse imparted by this blow. (b) What is the opponent's final velocity, if his mass is 105 kg and he is motionless in midair when struck near his center of mass? (c) Calculate the recoil velocity of the opponent's 10.0-kg head if hit in this manner, assuming the head does not initially transfer significant momentum to the boxer's body. (d) Discuss the implications of your answers for parts (b) and (c).

a) change in p=Netf x change in t

change in p=1000N(0.15 s)

150 N/s

b) Vi=0

Vf=?

m=105 kg

change in p=150

change in V=Vf-Vi=f x change in t/m+w

Problem 10 (cont'd)

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c) m=10 kg

change in p=150 N/s

Vf=?

Vi=0

Vf=f x change in t/m + Vi

Vf=150/10 + 0

Vf=15 m/s

d) **An object with less mass will receive a greater acceleration from the same force than an object with less mass.**

Problem 16

16. Calculate the final speed of a 110-kg rugby player who is initially running at 8.00 m/s but collides head-on with a padded goalpost and experiences a backward force of 1.76×10^4 N for 5.50×10^{-2} s.

110 kg rugby player

8.00 m/s =V1

backward force (opposite)

1.76 x 10^4 N for 5.5 x 10^-2 s

(-1.76 x 10^4)(5.5 x 10^-2)=MV2

(-1.76 x 10^4)(5.5 x 10^-2)/110=V2

Vf=V1-V2

VF=8-8.8

Problem 19

Q: Starting with the definitions of momentum and kinetic energy, derive an equation for the kinetic energy of a particle expressed as a function of its momentum.

You start with $p=mv$,

then you $p^2=m^2xv^2$,

Then you get rid of the m^2 by $p^2/m=mv^2$,

then you add the 1/2 so its KE: $p^2/m=1/2mv^2=KE$,

So $KE=p^2/2m$.

Problem 13

(A) A 75.0-kg person is riding in a car moving at 20.0 m/s when the car runs into a bridge abutment. Calculate the average force on the person if he is stopped by a padded dashboard that compresses an average of 1.00 cm.

net F=ma, and vf^2=vi^2+2ad, so a=(vf^2-vi^2)/(2d). Then plug everything in and get: (0−20^2)/(22(0.0100)): which equals −2.00×10^4. Then use net F=ma. And plug everything in: (75.0)(−2.00×10^4) and that equals −1.50×10^6

(B)A 75.0-kg person is riding in a car moving at 20.0 m/s when the car runs into a bridge abutment. Calculate the average force on the person if he is stopped by an airbag that compresses an average of 15.0 cm.

a=(vf^2-vi^2)/(2d). Then plug everything in and get: (0−20^2)/(22(0.0150)). which equals: −1.33×10^2. Then use net F=ma. And plug everything in: (75.0 kg)(−1.33×10^3) and that equals −1.00×10^5.

Problem 22

22. A punter drops a ball from rest vertically 1 meter down onto his foot. The ball leaves the foot with a speed of 18 m/s at an angle 55° above the horizontal. What is the impulse delivered by the foot (magnitude and direction)?

Vf^2=Vo^2+2ad

Vf^2=-20

V=4.47

x

change in Vh=10.324

y

Change in Vv=19.218