

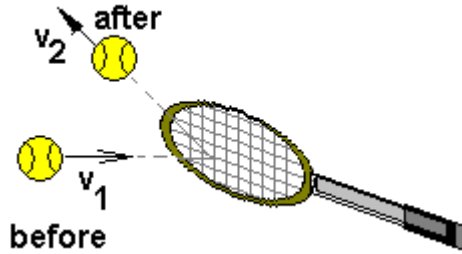
Physics I

Linear Momentum

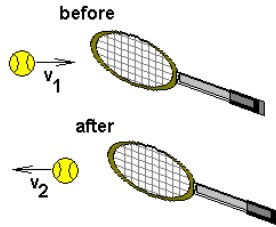
Linear momentum = $p = mv$

Newton's second law in term of momentum: $F = \frac{\Delta p}{t}$

Problem 1.- In playing a “drop shot” a tennis ball that had an initial velocity of 22m/s horizontally is returned at an angle of 45° above the horizontal with a speed of 7m/s. Calculate the average force on the ball if its mass is 0.057 kg and the contact with the racket lasted 7.5 ms.



Problem 1a.- In playing a “drop shot” a tennis ball than had an initial velocity of $v_1=23\text{m/s}$ horizontally is returned also horizontally with a speed of only $v_2=2\text{m/s}$. Calculate the average force on the ball if its mass is 0.057 kg and the contact with the racket lasted 7.5 ms.

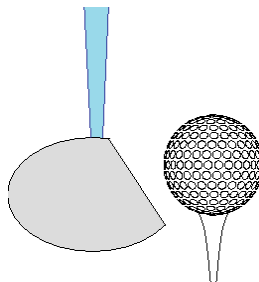


Problem 2.- A constant 18 N force acts on a 12-kg object for 3.5 s. What is the object's change in velocity?

Problem 2a.- A horizontal force of 230 N is applied to move a 66-kg cart, initially at rest, across a 13 m level surface. What is the final speed of the cart?

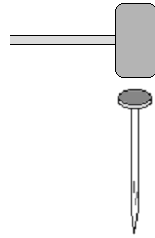
[Ignore friction in this problem]

Problem 3.- Calculate the average force that a club imparts on a golf ball if it is hit off the tee with a speed of 45 m/s and the time they are in contact is 2.5ms. Take the mass of the golf ball as 0.046 kg.



Problem 3a.- A golf ball of mass 45.9g is hit by a club in a collision that lasts 1.5ms. Estimate the force applied on the ball if it traveled 275m horizontally and its initial velocity was at 45° above the horizontal. Ignore air resistance.

Problem 4.- A 1.5kg hammer with an initial velocity of 1.2m/s hits a nail and slows down to rest in 0.012 s. Calculate the average force that the hammer applies on the nail.



Problem 5.- A baseball that had an initial horizontal velocity of 30m/s is hit straight up with a velocity of 16m/s. Calculate the average force exerted by the bat on the ball if the mass of the ball is 0.140kg and the time of contact was 5ms.

Answer with the magnitude of the force.

