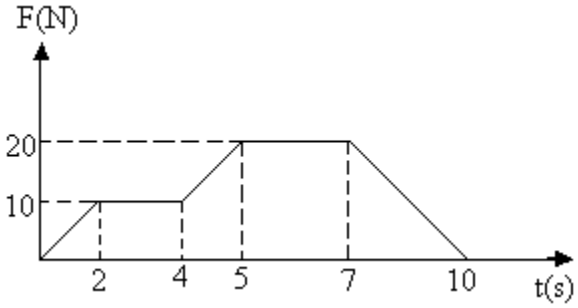
Week 15 - Momentum

Read Page 94 (Non-Constant Forces)

TQ1. How do you find the impulse applied on an object if you have a Force-time graph?



QQ2. What is the impulse from 2 – 4 seconds on the graph above?

QQ3. What is the change in momentum from 7 – 10 seconds in the graph above?

QQ4. If the graph above is a force-time graph of a 2 kg cart, what would the velocity be of that cart after the first 2 seconds on the graph if it started from rest?

Read Pages 94-95 (Conservation of Momentum)

TQ5. In an isolated system, what can be said always about momentum?

TQ6. Write the equation for the law of conservation of momentum?

TQ7. Where does this law of conservation of momentum come from?

TQ8. When analyzing collisions and explosions, what can you use to help you out?

QQ9. An 8 kg cart is traveling at 4 m/s and collides with a 4 kg cart at rest. If the 8 kg cart is traveling 2 m/s in the same original direction after the collision, what velocity is the 4 kg cart moving after the collision?

QQ10. An 50 kg bumper car is moving north at 12 m/s and hits another bumper car with a mass of 40 kg head-on. As a result of the collision, both bumper cars get locked together and immediately come to a stop. What is the speed and direction of the 40 kg bumper car before the collision?

CQ11. A 0.75 kg hammer traveling at 40 m/s hits a 0.006 kg nail at rest. The hammer hits the nail with a force of 800 N. Determine the magnitude of the force that the nail exerts on the hammer during the collision.

CQ12. A red sphere of mass M_R is moving to the right at a velocity V. The red sphere collides with a blue sphere of mass M_B which is at rest. Upon collision, the two masses stick together. Determine the algebraic equation to find the final velocity V_F of the two spheres when they stick together (only use variables in your answer).

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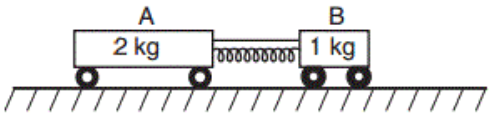
QQ13. Two students facing each other are wearing ice skates and standing on a frictionless surface of ice both at rest. A girl of mass 60 kg pushes a boy of mass 80 kg. The boy travels to the right at 6 m/s. What speed and direction does the girl travel?



QQ14. The diagram above shows two carts initially at rest on a horizontal, frictionless surface tied together by a string. There is compressed spring between the two carts. Cart A has a mass of 2 kg and Cart B has a mass of 1 kg. When the string is cut, Cart B moves to the right at a speed of 0.76 m/s. What speed and direction will Cart A move?

CQ15. A 1.0 kg cart (shown above) is traveling to the right at 8 m/s. While it is moving, a 1.0 kg weight is dropped on the top. Did the speed of the cart increase, decrease, or stay the same? Did the momentum of the cart increase, decrease, or stay the same?

Read Page 99 (Types of Collisions)

TQ16. What kind of collisions occurs when objects bounce off of each other?

TQ17. What is the primary difference between an elastic collision and an inelastic collision?

TQ18. What is ALWAYS conserved whether it is an elastic or inelastic collision?

QQ19. Cart 1 (2 kg) is moving with a velocity of 4 m/s to the right. Cart 2 (also 2 kg) is at rest. Both carts collide together and after the collision, Cart 1 immediately comes to a stop. What is the velocity of Cart 2 after the collision? Is this collision elastic or inelastic? Justify your answer with a calculation.

QQ20. Cart 1 (5 kg) is moving with a velocity of 12 m/s to the right. Cart 2 (4 kg) is at rest. Both carts collide and stick together after the collision. What velocity are both cars (now one large mass) moving after the collision? Is this collision elastic or inelastic? Justify your answer with a calculation.

CQ21. A truck and a compact car are traveling down the road with the same momentum. Which is moving a faster velocity?

CQ22. The truck and the compact car in CQ49 are now brought to a rest with an applied force of the brakes. If both objects (the truck and the compact car) take an equal amount of time coming to a stop, which one needs to apply more force – the truck, the compact car, or neither?