

Physics 112 - Momentum-Impulse

- A train having 85 cars in all including the engine, each of which has a mass of 8.0×10^4 kg, is moving down the track at 0.50 m/s.
 - What is the momentum of the train? (3.4×10^6 kg · m/s)
 - What impulse would have to be put on the train in order to stop it? (-3.4×10^6 kg · m/s)
 - What impulse was given to the train in the first place to get it up to speed? (3.4×10^6 kg · m/s)
- How long must an unbalanced force of 500 N act on a 1500 kg car in order to increase its speed from 5.0 m/s to 15 m/s? (30 s)
- A ball that weighs 2.3 N is moving at a velocity of 15 m/s when it is hit by a bat causing it to move in the opposite direction at 30 m/s. Find the force exerted by the bat if the blow lasts for 0.01 seconds. (1.06×10^3 N)
- A car of mass 1400 kg crashes into a solid wall and is stopped in 0.50 seconds. If the car was travelling at a speed of 5.0 m/s when it hit the wall,
 - what is the force of the wall on the car? (-1.4×10^4 N)
 - what is the force of the car on the wall? (1.4×10^4 N)
 - what impulse did the car put on the wall? (7.0×10^3 N)
- A 150 gram baseball travelling at 30 m/s is stopped by a catcher's mitt in 0.050 s. What force must the catcher exert while stopping the ball? (-90 N)
- If a bullet of mass 50 grams is moving at 400 m/s when it encounters a retarding force of 3000 N, find
 - the time required to stop the bullet and (6.7×10^{-3} s)
 - the distance it will go in that time. (1.3 m)
- A small red cart of mass 2.0 kg is travelling west at 4.0 m/s when it collides "head-on" with a blue cart of mass 5.0 kg travelling east at 3.0 m/s. If the carts remain stuck together after the collision, find:
 - the common velocity after the collision (1.0 m/s East)
 - the impulse on the red cart. (10 N·s)
- A 4000 kg truck travelling east at 8.0 m/s hits a 2500 kg car that was travelling west at 6.0 m/s. If they lock bumpers, find the common velocity after the collision. (2.6 m/s East)
- A 16 gram bullet is fired into a 484 gram block of wood resting on a large ice surface. If the bullet strikes the wood horizontally at 80 m/s and remains in the wood after impact,
 - what will the velocity of the wood be after impact? (2.56 m/s)
 - what impulse will the ice put on the block in getting it stopped? (-1.28 N·s - to stop the block *with* the bullet in it)
- A plastic ball having a mass of 250 grams and a velocity of 20.0 cm/s east collides with another ball having a mass of 100 grams moving along the same line, also east, but at 10.0 cm/s. After the collision, the 250 g ball has a velocity of 15.0 cm/s east.
 - What is the velocity of the other ball? (22.5 cm/s)
 - What impulse does the 100 g ball put on the 250 g ball? (1250 g·cm/s West)
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