

$F\Delta t = m\Delta v$

1) If you exert a force of 45 N on a 52 kg frictionless cart at rest for 3.5 seconds, what is its change in velocity?

2) A 295 kg spacecraft has rockets that exert a force of 0.050 N (ion propulsion).

For what time must you "burn" these engines to change the velocity of the spacecraft by 350. m/s?

3) A 540 kg stage set floating on air bearings undergoes a change in velocity of 1.2 m/s in 31 seconds.

What force was exerted?

Velocity reversal: the change of 34 m/s to the left to 40 m/s to the right is a **change** of 74 m/s, so

$\Delta v = 74$ m/s. (Use **$F\Delta t = m\Delta v$**)

4) A 0.145 Kg baseball going 40.0 m/s, strikes a bat, and heads straight back to the outfield at 61.0 m/s. If the collision lasted for 0.0120 seconds, what force did the bat exert on the baseball?

5) A 0.141 Kg baseball going 32.0 m/s, strikes a bat, and heads straight back to the outfield at 50.0 m/s. If the bat exerted a force of 1960 N, for what time was it in contact with the bat?

6) A ball going 35.0 m/s, strikes a bat, and heads straight back to the outfield at 42.0 m/s. If the bat exerted a force of 1780 N for 0.00630 seconds, what is the mass of the ball?

1) 3.03 m/s, 2) 2,065,000 s, 3) 20.9 N, 4) 1220 N, 5) 0.00590 s, 6) 0.146 kg

Rocket Thrust: $F\Delta t = m\Delta v$ - remember, if it says 45 grams per second that is 0.045 kg in 1 second

7) A rocket engine produces 410. N of thrust for 17.0 s with an exhaust velocity of 710. m/s.

What mass of fuel does it burn in this time?

8) A rocket engine burns 1.20 kg of fuel generating 72.0 N of thrust with an exhaust velocity of 540. m/s.

What time does the engine burn?

9) A rocket engine burns fuel at a rate of 13.0 **grams** per second, and has an exhaust velocity of 690. m/s.

What thrust does it develop? (1000 grams = 1 kg)

10) A rocket engine burns fuel at a rate of 12.0 **grams** per second, and develops a thrust of 8.50 N.

What must be the exhaust velocity? (1000 grams = 1 kg)

Initial and final acceleration:

11) A 8.30 kg rocket, 5.20 kg of which is fuel, burns all of its fuel in 12.0 seconds with an exhaust velocity of 610. m/s. What are its initial and final acceleration as it takes off from earth? (Thrust = 264.3 N)

12) A 320. kg rocket, 280. kg of which is fuel, burns all of its fuel in 32.0 seconds with an exhaust velocity of 780. m/s. What are its initial and final acceleration as it takes off from earth? (Thrust = 6825 N)

13) A 71.0 kg rocket (total mass of fuel and rocket), burns 51.0 kg of fuel at a rate of 2.10 kg/s with an exhaust velocity of 650. m/s. What are its initial and final acceleration as it takes off from earth? (Thrust = 1365 N)

14) A 140. kg rocket (total mass of fuel and rocket), burns 110.0 kg of fuel at a rate of 3.20 kg/s with an exhaust velocity of 810. m/s. What are its initial and final acceleration as it takes off from earth? (Thrust = 2592 N)

7) 9.82 kg, 8) 9.00 s, 9) 8.97 N, 9), 10) 708 m/s, 11) 22.0 and 75.5 m/s/s, 12) 11.5 m/s/s and 161 m/s/s, 13) 9.43 m/s/s and 58.5 m/s/s, 14) 8.71 m/s/s and 76.6 m/s/s

Name _____

School Pet Peeve _____

Show your work, and circle your answers and use sig figs to receive full credit.

1. A 600. kg stage set on frictionless air bearings goes from rest to 0.850 m/s in 12.5 seconds.

What force acted on the set?

2. A 0.142 Kg baseball going 41.0 m/s, strikes a bat, and heads straight **back** to the outfield at 53.0 m/s. If the bat exerted a force of 2350 N, for what **time** was it in contact with the bat?

3. A rocket engine burns 12.0 grams of fuel (0.0120 kg) in 1.10 seconds with an exhaust velocity of 782 m/s. What is the thrust of this engine?

4. A rocket engine burns fuel at a rate of 53.5 grams per second, and develops a force of 65.2 N. What must be the exhaust **velocity**? (1000 grams = 1 kg)

5. A 60.0 kg rocket, 48.0 kg of which is fuel, burns 2.15 kg of fuel per second with an exhaust velocity of 982 m/s. What are its initial and final acceleration as it takes off from earth? For what time do the engines burn?

optional: (What is its acceleration at $t = 10.0$ s? Make a graph of the acceleration.)

Quizlette 6.2 - Conservation of Momentum

Name _____



1) A 6.10 g bullet going 830. m/s imbeds in a stationary 310. g block of wood. What is the velocity of the block of wood just after the collision? (16.0 m/s)

2) A 6.50 g bullet imbeds in a stationary 170. g block of wood. The bullet and block combo are going 21.0 m/s after the collision. What was the velocity of the bullet before the collision? (570. m/s)



3) A person at rest fires a 1.70 g rifle bullet to the right at 1320. m/s. The person recoils at 0.0290 m/s to the left after this. What must be the mass of the person? (77.4 kg)

4) A 52.0 kg person at rest fires a 1.80 g rifle bullet to the right. The person recoils at 0.0720 m/s to the left after this. What must be the velocity of the bullet? (2080 m/s)

5) A 61.0 kg person fires a 5.40 g rifle shell at 870. m/s. If the person is initially at rest on a frictionless surface, what is their recoil velocity after firing? (0.0770 m/s)



6) A 3500 kg car going 23.0 m/s strikes a 1400 kg car traveling in the same direction at 13.0 m/s from behind. The two cars stick together. What velocity are they going after the collision? (20.1 m/s)

7) A 3800 kg car (going an unknown velocity) strikes a 1100 kg car traveling in the same direction at 17.0 m/s from behind. The two cars stick together and have a velocity of 23.0 m/s. What velocity was the first car going before the collision? (24.7 m/s)

8) A 1200 kg car going 24.0 m/s strikes a 2600 kg car traveling in the same direction from behind. The two cars stick together and are going 19.0 m/s just after the collision. What velocity did the other car have before the collision? (16.7 m/s)

Don't forget to do the EXCITING second side!!!

Draw your own picture!

9) Two football players strike each other head on. Player 1 has a mass of 120. kg and is running 3.30 m/s to the East, and player 2 has a mass of 95.0 kg is running 6.20 m/s to the West. What is their post-collision velocity if they stick together? (Speed and direction)

(0.898 m/s west)

10) Two football players strike each other head on. Player 1 has a mass of 110. kg and is running 3.50 m/s to the East, and player 2 has a mass of 85.0 kg is running to the West. If they stick together, and are together moving 1.90 m/s to the **West** after the collision, was the velocity of player 2 before the collision? (Speed and direction) (8.89 m/s west)

11) Bumper car A (340. Kg) with velocity 4.50 m/s East collides with the rear of car B (610. Kg) which has a velocity of 2.40 m/s East. After the collision, car A has a velocity of 1.40 m/s to the West. What is the velocity of car B after the collision? (Speed and direction) (5.69 m/s east)

12) Bumper car A (480. Kg) with velocity 3.90 m/s East collides with the front of car B (410. Kg) which has a velocity of 5.10 m/s West. After the collision, car B has a velocity of 1.50 m/s to the East. What is the velocity of car A after the collision? (Speed and direction) (1.74 m/s west)

13) 85.0 kg Thor is standing on a 35.0 kg cart, and is holding a 6.40 kg hammer. Everything is moving to the right at 3.40 m/s. What is the velocity of Thor and cart if he throws the hammer 25.0 m/s to the left? (Speed and direction) (4.91 m/s right)

14) 82.0 kg Thor is standing on a 25.0 kg cart, and is holding a 6.20 kg hammer. Everything is moving to the right at 2.40 m/s. What is the velocity of Thor and cart if he throws the hammer 18.0 m/s to the left? (3.58 m/s right)

15) 88.0 kg Thor is standing on a 42.0 kg cart, and is holding a 8.40 kg hammer. Everything is moving to the right at 4.30 m/s. After he throws the hammer, he and the cart are moving 6.60 m/s to the right. What speed and in what direction did he throw the hammer? (31.3 m/s left)

Name _____

Driving Pet Peeve _____

1. A bullet going 481 m/s imbeds in a stationary block of wood. The bullet and block combo are going 5.27 m/s after the collision, and the combo has a mass of 12.1 kg (Bullet and block). What was the **mass** of the bullet?
2. A 65 kg person dives 3.68 m/s to the right off of a 23 kg cart. What is the velocity of the cart if the cart and person were initially at rest?
3. 68 kg-Francois running 7.8 m/s jumps on a 45.3 kg cart already rolling at 2.3 m/s in the same direction. What speed are they going after he jumps on?
4. A 1240 kg Toyota Camry going 12.0 m/s to the east, strikes a 2530 kg SUV going west at 16.3 m/s. What is the velocity of the wreckage after the collision?
5. A 65 kg person is riding a 23 kg cart to the right at 3.15 m/s. What speed must he dive off the cart, and in what direction, to give the cart a velocity of 22.3 m/s to the right?

