Name: _____

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Momentum In Class Review

A. $p_{1+2B} = p_{1A} + p_{2A}$

B. $p_B - I = 0$

C. $0 = p_{1A} + p_{2A}$

D. $p_B + I = p_A$

E. $p_{1B} + p_{2B} = p_{1A} + p_{2A}$

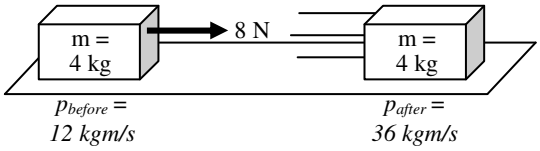
F. $p_{1B} + p_{2B} = p_{1+2A}$

1. A car speeds up.
2. A person running catches a football.
3. Two moving cars hit and bounce off.
4. A moving airplane drops a bomb.
5. A rocket at rest turns on its engine: hot gases go back; the rocket goes forward.
6. A moving car uses its brakes to stop.

7. Which has more momentum?
   A. A fast baseball or a slow baseball?
   B. A bowling ball or a baseball with the same speed?
   C. A slow ping pong ball or a house?
8. What does an impulse equal?

9. Does a large force always cause a large impulse? Explain.

10. 15 N acts for 8 seconds. How much momentum was gained?



11. A. How much momentum was gained by the 4 kg object?

    B. How big was the impulse acting on the object?

    C. Calculate the time the force acted.

    D. Calculate the acceleration of the object.

    E. What is the final velocity of the object?

12. Elastic, Inelastic, or Perfectly Inelastic (could be more than one)?

    A. _____ $\Sigma p_{before} = \Sigma p_{after}$, $\Sigma E_{kbefore} \neq \Sigma E_{kafter}$

    B. _____ $\Sigma p_{before} = \Sigma p_{after}$, $\Sigma E_{kbefore} = \Sigma E_{kafter}$

    C. _____ $\Sigma p_{before} = \Sigma p_{after}$, and $m_{after} = m_{1+2}$

    D. _____ There is little or no sound.

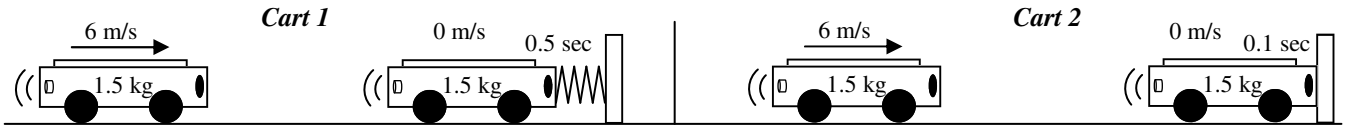
    E. _____ There is a lot of noise.

    F. _____ The objects are mangled, or crushed.

13. Two objects collide. They don't stick together.
    A. What happens to the momentum of the 4 kg object?

    B. What happens to the momentum of the 6 kg object?

    C. What happens to the total momentum of the system?



14. Two identical carts moving 6 m/s stop. The Cart 1 hits a spring. The Cart 2 just hits a wall.
    A. Calculate the initial momentum of the carts.

    B. Calculate the change of momentum of the carts.

    C. Which cart experienced the bigger change of momentum?
    D. Which cart felt the bigger impulse?
    E. Which cart felt the bigger force?
    F. Calculate the force on each cart.

    G. So, to give the same Δp you have two choices:

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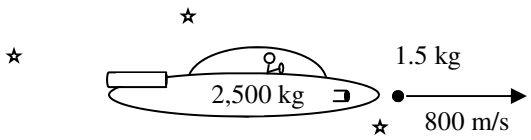
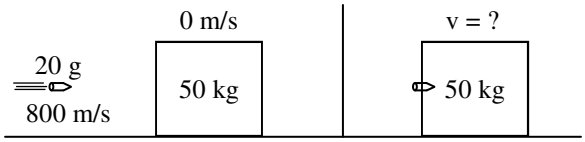


15. Slim Jim is also an astronaut. His space ship "*Galactic Cruiser*" is at rest when he shoots his space cannon.

A. What is the mass of the ship?
B. What is the weight of the ship?
C. Calculate the final velocity of the ship.

D. Which has more momentum afterwards: the ship or the projectile?

16. A 20 g bullet is shot 800 m/s into a 50 kg object that is at rest.

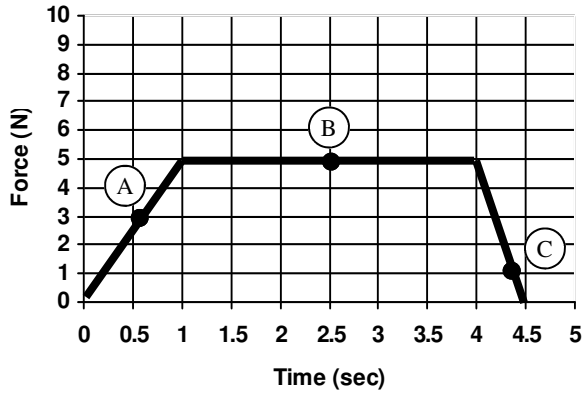


A. If 1000 g = 1 kg, change the mass of the bullet to kilograms.
B. What is the mass of the ***combined object***?
C. What is the initial momentum of the bullet?

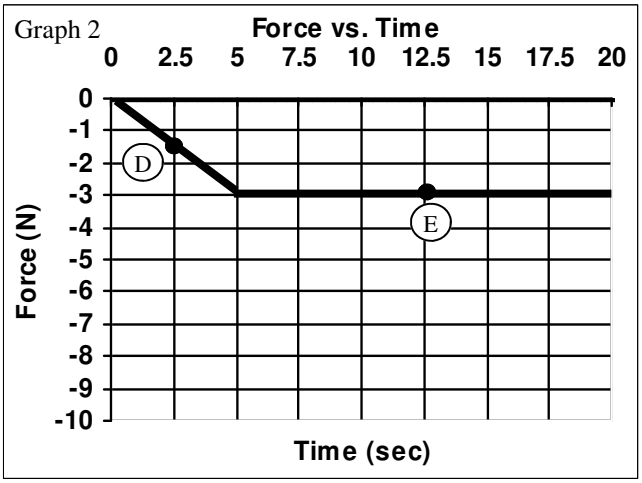
D. How much momentum does the combined object have afterwards?
E. Under the diagram, calculate the final speed of the combined object.

F. What kind of collision is this?
G. The numbers given are realistic for a bullet and a person. In movies, a bullet causes a person to be thrown backwards violently. How likely is the movie scenario? Explain.

Graph 1



Graph 2



Use the graphs above to answer the following questions.

17. Graph 1 or Graph 2?

A. ____ Shows an object with a positive acceleration
B. ____ Could be an object moving to the right and slowing down.
C. ____ Shows a negative change of speed.
D. ____ Shows a force pushing to the left.

18. Force A, B, C, D, or E (*could be more than one*)?

A. _____ Is the strongest positive force.
B. _____ Is the greatest negative force.
C. _____ Is the weakest positive force.
D. _____ Will cause the fastest negative acceleration.
E. _____ Is the strongest force pulling left.
F. _____ Shows negative acceleration.

19. Find the impulse of Graph 1.

20. A 2 kg object is moving 6 m/s. What would be its final velocity after the impulse of Graph 1?

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Period: _____

Momentum In Class Review

A. $p_{1+2B} = p_{1A} + p_{2A}$ 4

B. $p_B - I = 0$ 6

C. $0 = p_{1A} + p_{2A}$ 5

D. $p_B + I = p_A$ 1

E. $p_{1B} + p_{2B} = p_{1A} + p_{2A}$ 3

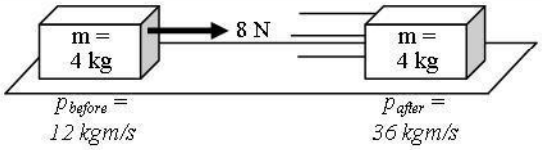
F. $p_{1B} + p_{2B} = p_{1+2A}$ 2

1. D A car speeds up.
2. F A person running catches a football.
3. E Two moving cars hit and bounce off.
4. A A moving airplane drops a bomb.
5. C A rocket at rest turns on its engine: hot gases go back; the rocket goes forward.
6. B A moving car uses its brakes to stop.

7. Which has more momentum?
   A. A fast baseball or a slow baseball?
   B. A bowling ball or a baseball going 2 m/s?
   C. A slow ping pong ball or a house? v=0 p=0
8. What does an impulse equal?
   $= Ft$ or $= \Delta p$

9. Does a large force always cause a large impulse? Explain.
   No, if the large force only pushes for a short time.

10. 15 N acts for 8 seconds. How much momentum was gained?
    $\Delta p = I = Ft = 15(8) = 30(4) = 120$ kgm/s



11. A. How much momentum was gained by the 4 kg object?
    $36 - 12 = 24$ kgm/s
    B. How big was the impulse acting on the object?
    $I = \Delta p = 24$ kgm/s
    C. Calculate the time the force acted.
    $I = Ft$, $24 = 8t$, $t = 3$ sec
    D. Calculate the acceleration of the object.
    $F = ma$, $8 = 4a$, $a = 2$ m/s²
    E. What is the final velocity of the object?
    $p_f = mv_f$, $36 = 4v_f$, $v_f = 9$ m/s

12. Elastic, Inelastic, or Perfectly Inelastic (could be more than one)?
    A. I, PI $\Sigma p_{before} = \Sigma p_{after}$, $\Sigma E_{kbefore} \neq \Sigma E_{kafter}$
    B. E $\Sigma p_{before} = \Sigma p_{after}$, $\Sigma E_{kbefore} = \Sigma E_{kafter}$
    C. PI $\Sigma p_{before} = \Sigma p_{after}$, and $m_{after} = m_{1+2}$ (combine)
    D. E There is little or no sound.
    E. I, PI There is a lot of noise.
    F. I, PI The objects are mangled, or crushed.

13. Two objects collide. They don't stick together.
    A. What happens to the momentum of the 4 kg object? increases
    B. What happens to the momentum of the 6 kg object? decreases
    C. What happens to the total momentum of the system? constant (stays same)

6(1.5) = 9 kgm/s 0 kgm/s 9 kgm/s 0 kgm/s

14. Two identical carts moving 6 m/s stop. The Cart 1 hits a spring. The Cart 2 just hits a wall.
    A. Calculate the initial momentum of the carts. 9 kgm/s
    B. Calculate the change of momentum of the carts. −9 kgm/s
    C. Which cart experienced the bigger change of momentum? same
    D. Which cart felt the bigger impulse? same $I = \Delta p$ E. Which cart felt the bigger force? cart 2
    F. Calculate the force on each cart.
    $I = \Delta p = Ft$, $-9 = F(.5)$, $F = -9/.5 = -18$ N
    $-9 = F(.1)$, $F = \frac{-9}{.1} = -90$ N ← Big force small t
    G. So, to give the same Δp you have two choices: Big F, small t OR small F, big t

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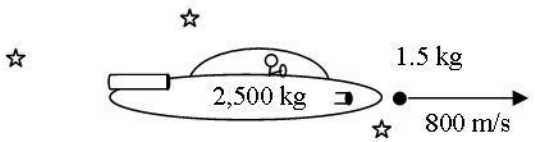
on earth
$F_w = 25{,}000$ N
(x10)



15. Slim Jim is also an astronaut. His space ship "*Galactic Cruiser*" is at rest when he shoots his space cannon.

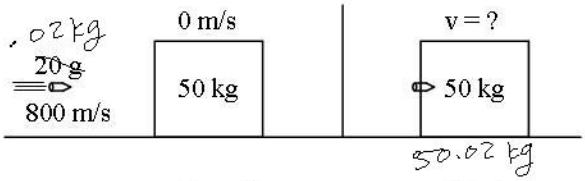
A. What is the mass of the ship? 2500 kg
B. What is the weight of the ship? 0 N (in space)
C. Calculate the final velocity of the ship.

$0 = 2500v + 1.5(800)$

$-1200 = 2{,}500v$ $\quad v = \frac{12}{25} = -.48$ m/s

D. Which has more momentum afterwards: the ship or the projectile? same, but 1 is neg.

16. A 20 g bullet is shot 800 m/s into a 50 kg object that is at rest.



A. If 1000 g = 1 kg, change the mass of the bullet to kilograms.
B. What is the mass of the ***combined object***? 50.02 kg
C. What is the initial momentum of the bullet?
$.02(800) = 16$ kg m/s
D. How much momentum does the combined object have afterwards? 16 kg m/s
E. Under the diagram, calculate the final speed of the combined object.

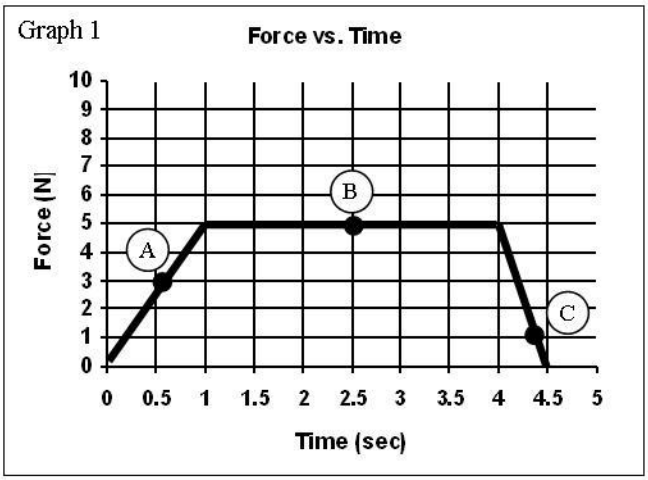
$.02(800) + 0 = 50.02v$

$16 = 50.02v$

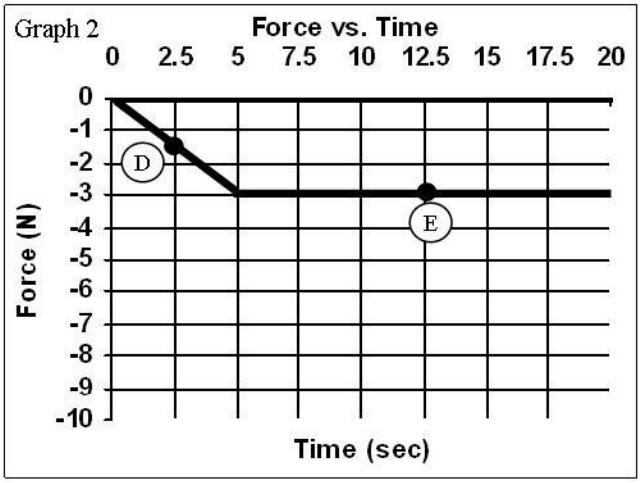
$.32 \text{ m/s} = v$

F. What kind of collision is this? perfectly inelastic
G. The numbers given are realistic for a bullet and a person. In movies, a bullet causes a person to be thrown backwards violently. How likely is the movie scenario? Explain.
Not possible. The bullet doesn't have enough momentum.

Graph 1



Graph 2



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B. 2 Could be an object moving to the right and slowing down. F is neg.
C. 2 Shows a negative change of speed.
D. 2 Shows a force pushing to the left.

18. Force A, B, C, D, or E (*could be more than one*)?

A. B Is the strongest positive force.
B. E Is the greatest negative force.
C. C Is the weakest positive force.
D. E Will cause the fastest negative acceleration.
E. E Is the strongest force pulling left.
F. D, E Shows negative acceleration.

19. Find the impulse of Graph 1.

$= \frac{1}{2}(1)(5) + 3(5) + \frac{1}{2}(5)(.5)$

$= 2.5 + 15 + 1.25$

$= 18.75$ kg m/s

20. A 2 kg object is moving 6 m/s. What would be its final velocity after the impulse of Graph 1?

$p_B + I = p_A$

$2(6) + 18.75 = 2(v)$

$30.75 = 2v$

$v = 15.375$ m/s