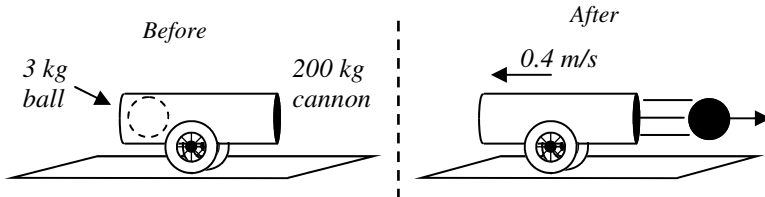


2011 PreAP Momentum 3

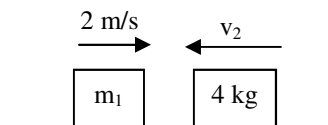
- 1) * A 6 kg object speeds up from 5 m/s to 20 m/s. Find Δp .
- 2) A 10 kg object slows down from 25 m/s to 5 m/s. Find Δp .
- 3) * What is the impulse for Q1 above: What is the impulse for Q2 above:
- 4) Can an object ever have a negative kinetic energy? Why or why not?
- 5) Can an object ever have a negative momentum? Why or why not?
- 6) If an object's kinetic energy is zero, what is its momentum?
- 7) Use the equations at the right to answer the following questions. Note: p_{1+2} means a the combination of objects 1 and 2.

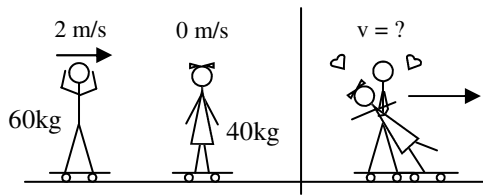
A. ____ * Two objects at rest push off from each other.	A) $p_B + I = p_A$	D) $p_{1+2B} = p_{1A} + p_{2A}$
B. ____ * Two people in moving bumper cars collide and bounce off.	B) $p_{1B} + p_{2B} = p_{1A} + p_{2A}$	E) $p_{1B} + p_{2B} = 0$
C. ____ * A skateboarder is moving and throws something.	C) $p_{1B} + p_{2B} = p_{1+2A}$	F) $0 = p_{1A} + p_{2A}$
D. ____ A person pushes on a car that is already rolling.		
E. ____ A football player catches a football.		
F. ____ Two moving objects collide, stick together, and stop.		
- 8) * If the net momentum before equals the net momentum after, is there an external impulse?
- 9) A 2 kg object going 30 m/s feels a -4 N force for 8 seconds, find the object's final velocity.
Conservation of Momentum Equation: Solve:



- 10) A 3 kg cannonball is shot from a 200 kg cannon. The cannon recoils backwards at 0.4 m/s backwards. What is the velocity of the ball after it is shot?
 - A. Since the ball is sitting in the cannon, beforehand, what is the initial velocity of the cannon and ball?
 - B. What is the net momentum before?
 - C. Since momentum MUST be conserved, how much total momentum must there be afterwards?
 - E. Is the final velocity of the cannon + or -?
 - F. * Under the diagram, solve for the final velocity of the ball.
 - G. Calculate the final kinetic energies of each object.
 - H. Which one had the greater velocity?
 - I. Which one had the greater kinetic energy?

- 11) * What is the net momentum of the two objects shown?
 (Your answer will have variables in it.)





- 12) Slim Jim decides to learn to skate board. Though he is learning very fast, he is distracted by a beautiful girl and “meets” Slim Kim. We know Jim is 60 kg. Kim is only 40 kg.
- * How much total momentum is there before?
 - How much momentum must there be after?
 - As a combined object, is their combined mass greater or less?
 - So their velocity must go up or down?
 - * Under the diagram, calculate the final velocity of the two.

Q1: $\Delta p = p_f - p_i = 6(20) - 6(5) = 120 - 30 = 90 \text{ kg m/s}$

Q3: 90 kgm/s = Impulse = Δp Q7A: F; Q7B: B; Q7C: D

Q8: No—internal impulses cancel out (= opp. forces). To Δ the net momentum it must come from outside the system: external impulse

10F: 26.7 m/s; Equation: $0 = 200(-4) + 3v$

11: $2m_1 + 4v_2$ (generic) or $2m_1 - 4v_2$ (since right object is moving to the left)

12A: 120 kgm/s 12E: 1.2 m/s