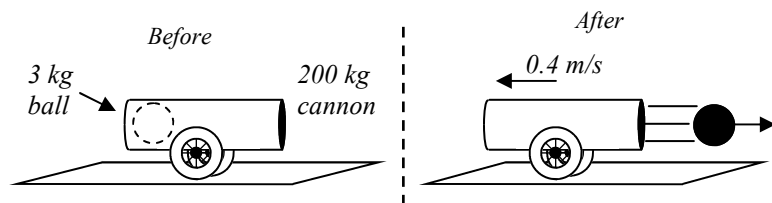


# PreAP Momentum 3

With some Energy 11

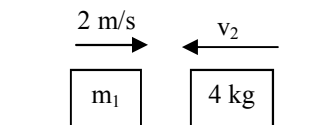
- 1) \* A 6 kg object speeds up from 5 m/s to 20 m/s. Find  $\Delta p$ .
- 2) A 10 kg object slows down from 25 m/s to 5 m/s. Find  $\Delta p$ .
- 3) \* What is the impulse for Q1 above:                      What is the impulse for Q2 above:
- 4) Can an object ever have a negative kinetic energy?                      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.
 

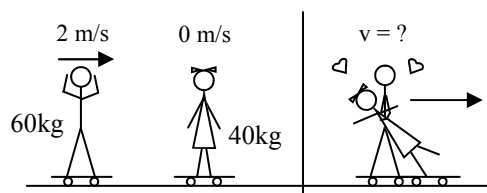
A. ___ * Two objects at rest push off from each other.	A) $p_B + J = p_A$	D) $p_{1+2B} = p_{1A} + p_{2A}$
B. ___ * Two people in moving bumper cars collide and bounce off.	B) $p_{1B} + p_{2B} = p_{1A} + p_{2A}$	E) $p_{1B} + p_{2B} = 0$
C. ___ * A skateboarder is moving and throws something.	C) $p_{1B} + p_{2B} = p_{1+2A}$	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.

From “PreAP Energy 11” (Problems 3–7)

- A spring has a spring constant of 50 N/m. How much work must be done to stretch the spring 0.25 m?
- A 45 N object is accelerated from rest to 12 m/s. How much work was done on the object?
- \* How much energy does a 60 W light bulb use in 3 minutes?
- To overcome friction, a force of 16 N must be applied to keep an object moving at a constant speed of 3 m/s. How much power was generated by the force?
- \* A 120 W motor pulls on a rope. The rope is connected to a 2 kg object. How fast is the mass going after 10 seconds?

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

Q3: 90 kgm/s = Impulse =  $\Delta p$       Q7A: F;    Q7B: B;    Q7C: D

Q8: No—internal impulses cancel out (= opp. forces). To  $\Delta$  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

15: 10,800 J      17: 34.6 m/s