B-Day: Due Mon., Dec 6
A-Day: Due Tues., Dec 7

2010 PreAP Momentum 1

Variable	Units	Variable Name	Notes:
p (small)	kgm/s	momentum	How hard it is to stop something. Can be neg or 0.
I	kgm/s or Nsec	Impulse	Causes a change of p.

$p = mv$
$I = Ft$
$p_{net} = p_1 + p_2...$

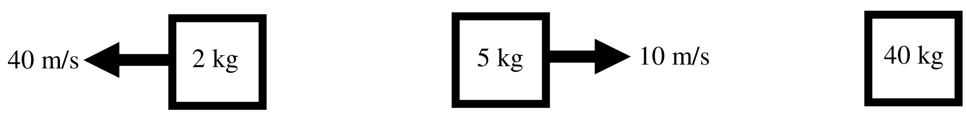
1) * A 35 kg object has –450 kgm/s of momentum. Calculate its velocity.

2) An object has 5000 kgm/s of momentum when it is moving 25 m/s. Calculate its mass.

3) Which has more momentum? (*choose one for each*)
A. A car when going fast or slow? B. A heavy or light object going 10 m/s?

4) Which of the following has the most inertia?
A. * A car when going fast or slow? B. A heavy or light object going 10 m/s?

5) Find the momentum of each of the following objects:



A. ________________ B. _________________ C. _________________

6) Which of the objects in #5 has the momentum with the greatest **magnitude** (*disregarding direction*)?

7) Which of the objects in #5 has the most **inertia**?

6) * Find the net momentum (total) of all of the objects in #5 above (*find Σp*).

7) A 10 kg object is 5 m/s moving to the left while a 3 kg object is going 4 m/s to the right.
(Remember that left is negative.)
A) Find the momentum of the 10 kg object (we'll call this momentum 1 or "p_1"):

B) Find the momentum of the 3 kg object (p_2):

C) Find the net momentum of both objects (Σp).

8) * A 25 kg object moving 3 m/s to the right while a 30 kg object is moving 4 m/s to the right (yes, same direction). Calculate p_{net}.

9) A 2 kg object initially going 4 m/s to the right is later going 8 m/s. Find Δv. (*Remember that Δ = final – initial.*)

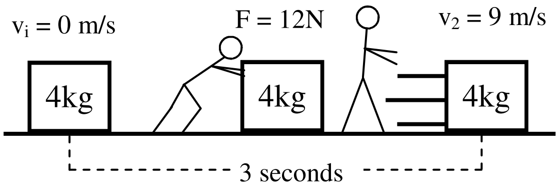
10) * A 3 kg object going 6 m/s to the right ends up going 3 m/s to the left. Being careful of negatives and positives, find the change of momentum of the object.

Impulse (in kgm/sec) → **I = Ft** ← Force (in N), Time (in sec)

I = Δp

Lecture time*: In the last chapter Work caused a change of energy because the units for work are the same as for energy: joules.*

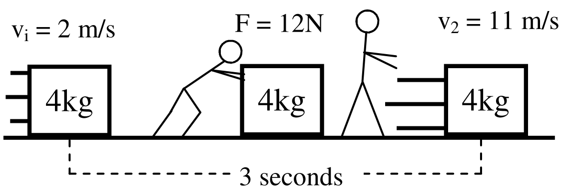
It turns out that Ft (force times time) has the same units as momentum. Therefore: an impulse causes a change of momentum.



p_{before} = I = p_{after} =

11) Slim Jim pushes on a 4 kg box for 3 seconds.
  A. Under the diagram, calculate the momentum before and after and the impulse Jim gave to the box.

  B. * What does the impulse equal?

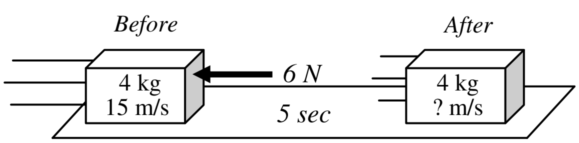


p_{before} = I = p_{after} =

12) This time Slim Jim pushes on an object that was already moving.
  A. Under the diagram, calculate the momentum before and after and the impulse Jim gave to the box.

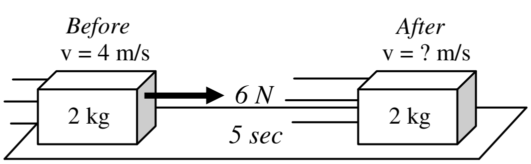
  B. What does the impulse equal?

So, this is our equation: $\Sigma p_{before} \pm I = \Sigma p_{before}$. *Again, this is the same as in energy, where:* $\Sigma E_{before} \pm W = \Sigma E_{before}$.

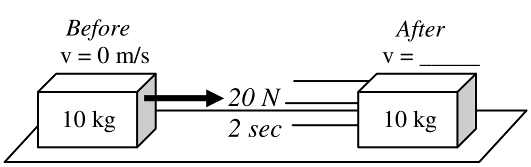


Σp_{before} ± I = Σp_{before}

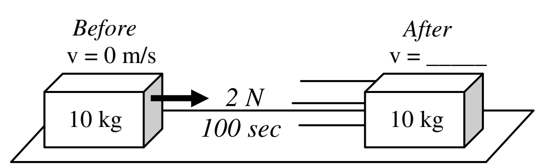
13) A 4 kg object is moving 15 m/s. A force is applied to the left.
  A. Is the impulse positive or negative?
  B. Will the object gain or lose momentum?
  C. * Fill in the information under the diagram and solve for the final velocity.



14) A 2kg object at moving 4m/s. A 6N force pushes for 5 sec. Using the same method as above, calculate the final speed of the object.



p_{before} = I = p_{after} =

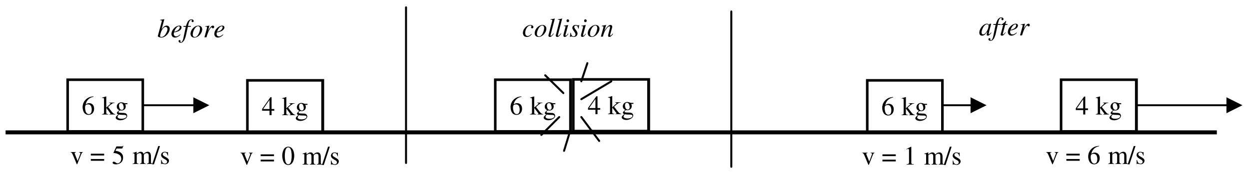


p_{before} = I = p_{after} =

15) Two identical 10 kg objects begin at rest, as shown above.
  A. On the diagram, calculate and label the initial momentums and impulses for each object.
  B. Calculate the final momentum of each.
  C. Calculate the final velocity of each object.
  D. Which force gave the bigger impulse?
  E. Which object (left or right) had the bigger final velocity?

16) So, do you have to use a big force to make a big impulse?

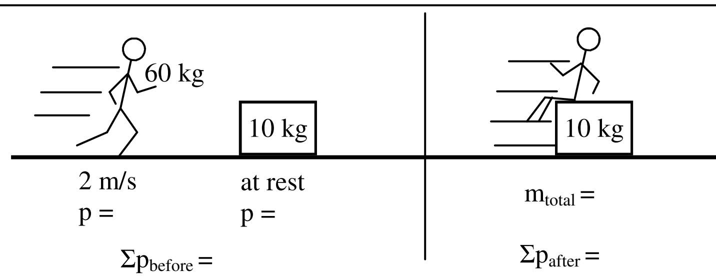
17) Force A is 75N. Force B is 3N. Which one gives the bigger impulse?



$\Sigma p_{before} =$ $\Sigma p_{after} =$

18) The diagram above shows two objects before and after they collide.
A. On the diagram above calculate and label the net momentum before and after.

B. How does the net momentum before compare with the net momentum after?
(*This is ALWAYS the case when objects collide: momentum is conserved:* $\Sigma p_{before} = \Sigma p_{after}$. *And a collision is also when two objects hit and connect. Momentum is also conserved when objects split apart.)*



19) Slim Jim is running 2 m/s towards a box that is at rest. Jim then jumps onto the box and the two slide together
A. On the diagram, calculate the net momentum before.

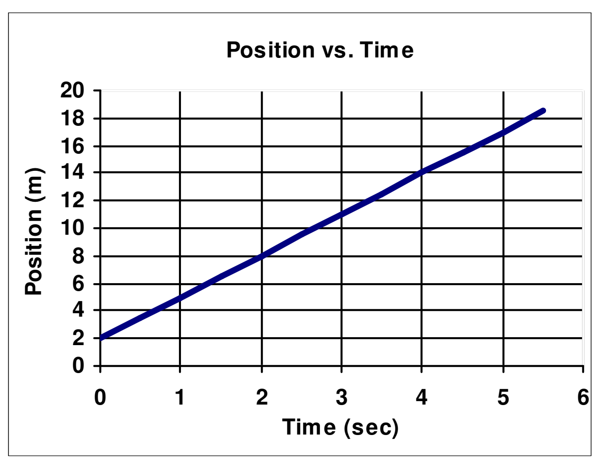
B. What is the total mass of Jim and the box afterwards?

C. Since momentum is always conserved, how much net momentum is there afterwards?

D. * Calculate the final velocity of Jim and the box.

20) The graph at the right shows an the motion of a 6 kg object.
A. Calculate the speed of the object from the graph.

B. Calculate the momentum of the object.



Q1: -12.9 m/s Q4A: inertia is only about mass, so "same"
Q6: −30kgm/s (add 'em up). Q8: 195 kgm/s Q10: −27kgm/s = $p_{final} - p_{initial}$
Q11B: I = p_{final} Q13C: 7.5 m/s Q19D: 1.7 m/s