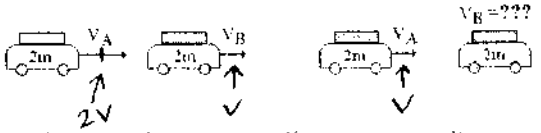
Momentum and Collisions — Sublevel 5

For Practice Mode

MC5 Momentum Conservation

In a Physics lab, two carts of varying mass collide on a low-friction track in such a manner that the system can be considered as an isolated system. The before- and after-collision velocities of the carts are represented by vector arrows. Which vector represents the after-collision velocity of cart B? THIS IS JUST LIKE OUR COLLISION LAB! (TOTAL VM before must equal TOTAL VM after!)

Before Collision | After Collision



a. V_B → b. V_B → c. V_B → d. V_B →

e. V_B ← f. V_B ← g. V_B ← h. V_B ←

Answer: B

Check Answer

Number Possible: 10

Number Correct: 3

Number Wrong: 0

? Questions

Hints & Help

Before

$2v2m + V2m$

$4vm + 2vm$

$\Downarrow$

$6vm$

After

$v2m + (?v)2m$

must equal $6vm$!

$\Downarrow$

?v must equal 2V

$(2vm + (2v)2m)$

$6vm$

Sublevel 5

Momentum and Collisions

MC5 Momentum Conservation

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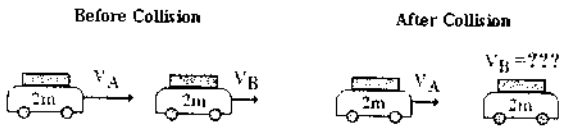
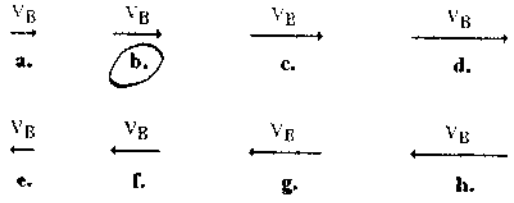




Answer: B

Check Answer

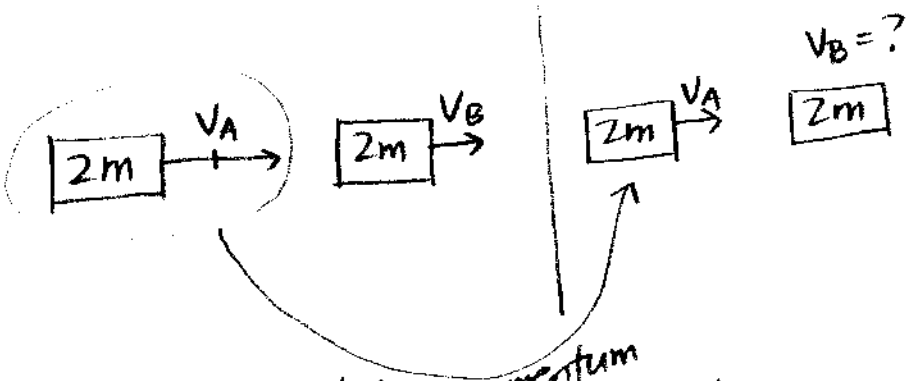
Progress Health

10 % 100 %

Questions

Hints & Help

You can solve this like the previous problem, however, since the masses are the same it's easy to do conceptually.



A lost momentum because v decreased by $\frac{1}{2}$

⇓

That means B gained it

⇓

B's velocity doubles

⇓

answer is: V_B → b.

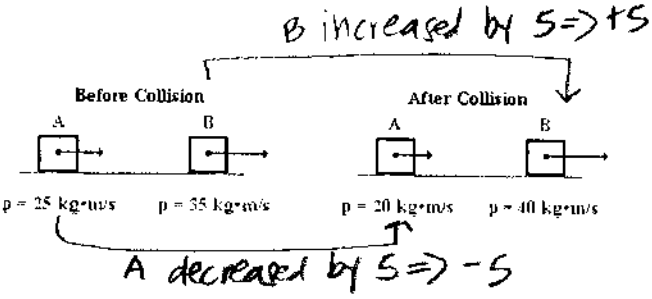
sublevel 5

Momentum and Collisions

MC5 Momentum Conservation

The magnitude of the before- and after-collision momentum of two colliding objects are shown in the diagram below. The direction of the momentum is indicated by the arrows. The change in momentum of object A is ____ kg x m/s. The change in momentum of object B is ____ kg x m/s. Enter the letters of the two answers in their respective order with no commas or spaces between letters. (Assign a negative value to all leftward momentum values.)

a. -15 b. -5 c. 5 d. 10
e. 15 f. 45 g. 60 h. 75
i. None of these choices appropriately fill in this blank.



Answer: B C

Check Answer

Progress Health

20 % 100 %

Questions

Hints & Help

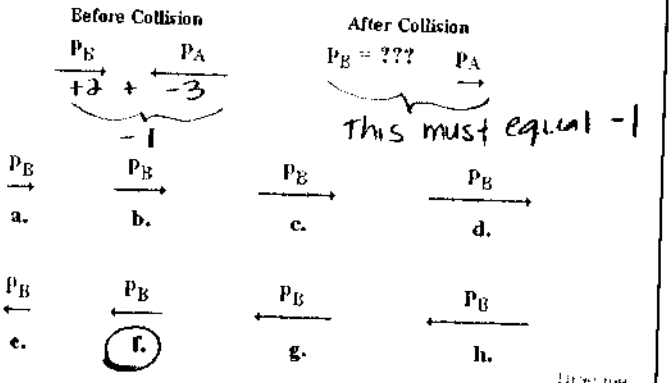
This makes sense. Since momentum is conserved, whatever A loses must be gained by B.

Momentum and Collisions sublevel 5

MC5 Momentum Conservation

Object A and object B undergo a collision in an isolated system. The vector arrows shown in the diagram below represent the before- and after-collision momentum of object A and object B. Which vector best represents the magnitude and direction of the momentum of object B after the collision?

$P_{before} = P_{after}$



Answer: F

Check Answer

Progress Health

60 % 100 %

Questions

Hints & Help

sublevel 7

Momentum and Collisions

MC2 Momentum Conservation

In a Physics lab, a 1.8-kg brick is dropped from rest upon a 4.6-kg cart moving east with a speed of 2.1 m/s. After the collision, the brick and cart are observed to move east with a speed of 1.5 m/s. Fill in the momentum table and determine if momentum is conserved (within 1 percent). (Use the notation that east is the positive direction and west is the negative direction.)

Check Answer

Progress Health

0 % 100 %

Questions

Hints & Help

#.##!

	Momentum in kg • m/s	
	Before Collision	After Collision
Dropped Brick	0	2.7
Cart	9.66	6.9
Total for System	9.66	9.6

Is momentum conserved? 1

Enter 1 for Yes and 0 for No.

almost identical

momentum

0 BRICK ⟹

.1 m/s (4.6 kg) CART ⟹

9.66 kg·m/s

Before

1.8kg 0 V

+2.1 m/s

4.6 kg

After

+1.5m/s

1.8kg

4.6 kg

momentum

BRICK ⟸ (1.5 m/s)(1.8 kg)

2.7 kg·m/s

CART ⟸ (1.5 m/s)(4.6 kg)

6.9 kg·m/s

sublevel 8

Momentum and Collisions

MC8 Problem Solving - Inelastic Collisions

In a physics lab, a 0.750-kg cart (A) moving east at 53.0 cm/s collides with a 1.250-kg cart (B) which is moving east at 18.0 cm/s. The two carts are equipped with Velcro strips which allow them to move together after the collision. Assuming the system is isolated, fill in the momentum table and determine the final velocity of the carts. Use the notation that east is the positive direction and west is the negative direction.

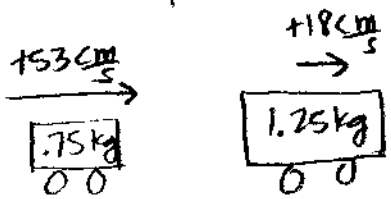
##.##!

	Momentum in kg • cm/s	
	Before Collision	After Collision
Cart A	3975	23.34
Cart B	22.5	38.91
Total for System	62.25	62.25

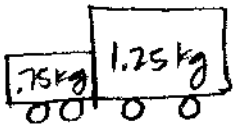
Enter the final velocity in m/s.

0.31

Before



After



Prediction: + & less than 53 cm/s but greater than 18 cm/s

$(53\frac{cm}{s})(.75\,kg) + (18\frac{cm}{s})(1.25\,kg) = \vec{V}(2\,kg)$

$39.75\,kg\cdot\frac{cm}{s}$ $\quad 22.5\,kg\cdot\frac{cm}{s}$

$62.25\,kg\cdot\frac{cm}{s} = V(2\,kg)$

$\vec{V} = +31.125\,\frac{cm}{s}$

$.31125\ m/s$

NOW, CALCULATE Vm for each cart after:

$(31.125\frac{cm}{s})(0.75\,kg)$ & $(31.125\frac{cm}{s})(1.25\,kg)$

$23.34\,kg\cdot\frac{cm}{s}$ $\quad 38.91\,kg\cdot\frac{cm}{s}$

Momentum and Collisions

sublevel 9

MC9 Problem Solving - Elastic Collisions

In a physics lab, a 0.500-kg cart (A) moving east at 38.0 cm/s collides with a 0.750-kg cart (B) which is moving west at 64.0 cm/s. After the collision, Cart A moves west at 84.0 cm/s. Assume the system is isolated. Fill in the momentum table and determine the final velocity of Cart B. Use the notation that east is the positive direction and west is the negative direction.

#.##!

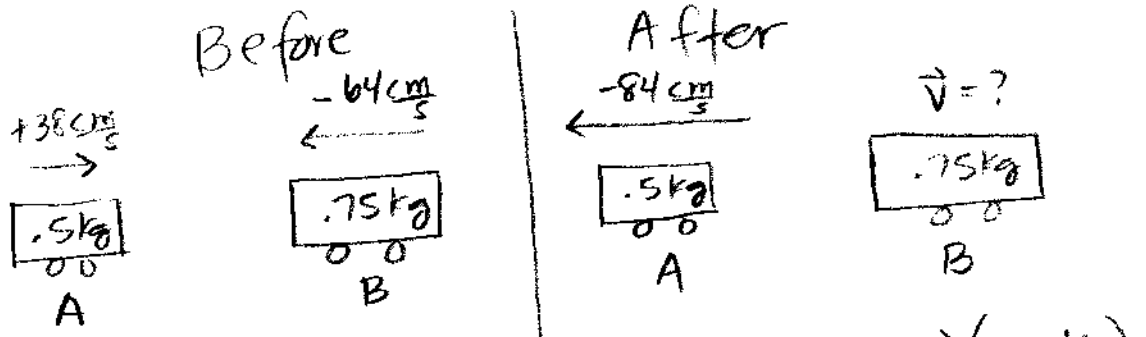
	Momentum in kg • cm/s	
	Before Collision	After Collision
Cart A	19	-42
Cart B	-48	+13
Total for System	-29	-29

must be equal

Enter the final velocity in cm/s.

17.33

If it's -29 √ THEN B must be +13



$$\left(38\tfrac{cm}{s}\right)(.5\,kg) + \left(-64\tfrac{cm}{s}\right)(.75\,kg) = \left(-84\tfrac{cm}{s}\right)(.5\,kg) + \vec{V}(.75\,kg)$$

$19\ kg\cdot\tfrac{cm}{s}$ $\quad -48\ kg\cdot\tfrac{cm}{s}$ $\quad -42\ kg\cdot\tfrac{cm}{s}$

$$-29\ kg\cdot\tfrac{cm}{s} = -42\ kg\cdot\tfrac{cm}{s} + \vec{V}(.75\,kg)$$

$$13\ kg\cdot\tfrac{cm}{s} = \vec{V}(.75\,kg)$$

$$\boxed{\vec{V} = +17.33\ \tfrac{cm}{s}}$$

momentum of B can now be calculated:

$$\left(17.33\tfrac{cm}{s}\right)(.75\,kg) = \boxed{+13\ kg\cdot\tfrac{cm}{s}}$$

this is similar to #8 from the conservation of momentum worksheet

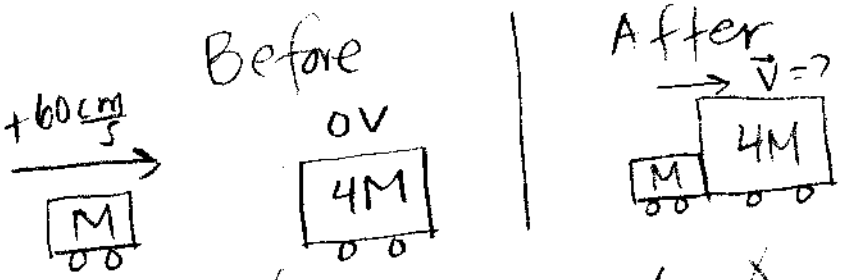
Momentum and Collisions

sublevel 10

MC10 Momentum and Proportional Reasoning

In a Physics lab, a cart with a mass of 'M' is moving with a speed of 60 cm/s. It collides with a stationary cart with a mass of '4M'. After the collision, the two carts stick together and move with a speed of ____ cm/s. Enter a numerical answer.

##.##!



$$\left(60\ \frac{cm}{s}\right)M + 0 = \vec{V}(5M)$$

M cancels out since it is in both terms

$$60 = \vec{V}(5)$$

$$\boxed{\vec{V} = 12\ \frac{cm}{s}}$$