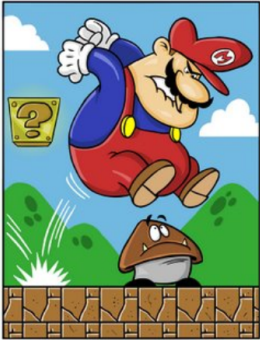


Physics 30 Unit A - Momentum and Impulse

Collisions in 2D



Feb 18-10:37 AM

POS Checklist

explain, quantitatively, that momentum is conserved in one- and two-dimensional interactions in an isolated system

Jan 26-12:04 PM

Diploma Question Alert!

1. Which of the following quantities are scalar quantities?

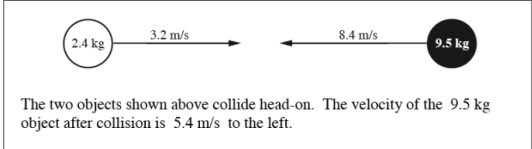
- A. Kinetic energy and potential energy
- B. Kinetic energy and momentum
- C. Potential energy and force
- D. Momentum and force

Ans:

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Diploma Question Alert!

Use the following information to answer the first question.



The two objects shown above collide head-on. The velocity of the 9.5 kg object after collision is 5.4 m/s to the left.

1. The velocity of the 2.4 kg object after collision is

- A. 15 m/s to the right
- B. 8.7 m/s to the left
- C. 8.0 m/s to the right
- D. 6.2 m/s to the left

Ans:

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Numerical Response

1. A 1 575 kg car, initially travelling at 10.0 m/s, collides with a stationary 2 250 kg car. The bumpers of the two cars become locked together. The speed of the combined cars immediately after impact is _____ m/s.


(Record your three-digit answer in the numerical-response section on the answer sheet.)

Ans:

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Non-linear Conservation of Momentum

Just as momentum is conserved in one dimension,



(the sum of the momentums in all diagrams is the same)

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it is also conserved in other, non-linear directions.

(the sum of the momentums in all diagrams is the same)

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In situations where objects are moving in two dimensions (i.e. the x and y direction), we need to break the momentum vectors into components.

The components in the x direction will be conserved and the components in the y direction will be conserved.

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ex) A 4.0 kg cat is traveling South at 2.8 m/s when it collides with a 6.0 kg bat traveling East at 3.0 m/s. The objects stick together upon collision. What is the velocity of the cat-bat system?

Step 1: Draw a diagram.

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Step 2: Write separate conservation statements for x and y directions.

x-direction y-direction

Step 3: Find final momentum in x and y direction

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Step 4: Find the resultant momentum using vectors. Solve for velocity.

Ans:

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Let's take a look at a "glancing collision".

ex) A 4.0 kg bicycle is moving East at an unknown velocity when it hits a stationary 6.1 kg tricycle. After collision, the bicycle moves at 2.8 m/s 32° N of E and the tricycle moves at 1.5 m/s at 41° S of E. What is the initial velocity of the bicycle?

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Step 1: Draw a diagram.

Step 2: Break vectors into components.

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Step 3: Write conservation statements for the x and y.

Step 4: Solve for the unknown variable.

Step 4: Using the found momentum, determine the missing momentum and solve for velocity.

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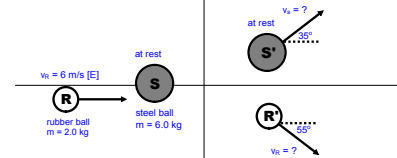
Diploma Question Alert!

3. A 115 g arrow travelling east at 20 m/s imbeds itself in a 57 g tennis ball moving north at 42 m/s. The direction of the ball-and-arrow combination after impact is
- A. 46° N of E
 - B. 46° E of N
 - C. 25° E of N
 - D. 25° N of E

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Momentum Handout Problems:

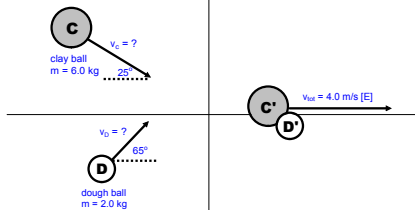
**Hit and Bounce 90°:
1-triangle type**



	Before			After		
	R	S	Total	R'	S'	Total'
p_x						
p_y						

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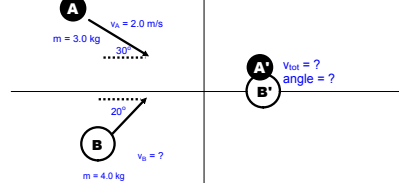
**Hit and Stick 90°:
1-triangle type**



	Before			After		
	C	D	Total	C' and D'	Total'	
p_x						
p_y						

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**Hit and Stick (putty balls)
3-triangle type**



	Before			After		
	A	B	Total	A' and B'	Total'	
p_x						
p_y						

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Hit and Bounce (rubber balls)
2-triangle type

	Before			After		
	A	B	Total	A'	B'	Total'
p_x						
p_y						

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Hit and Bounce (rubber balls)
4-triangle type

	Before			After		
	E	F	Total	E'	F'	Total'
p_x						
p_y						

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Explosion: 3-triangle type

	Before				After			
	I	J	K	Total	I'	J'	K'	Total'
p_x								
p_y								

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HW - Finish WS

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