Name:	Block:

PHYSICS: ELASTIC AND INELASTIC COLLISIONS DETERMINING MOMENTUM, KE, AND VELOCITIES OF COLLIDING OBJECTS

Elastic Collisions: Objects collide and rebound off of each other without damage and without loss of kinetic energy.

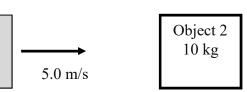
$$\begin{split} \left(p_1+p_2\right)_{before} &= \left(p_1+p_2\right)_{after} \\ \left(m_1\cdot v_1\right)_{before} &+ \left(m_2\cdot v_2\right)_{before} &= \left(m_1\cdot v_1\right)_{after} + \left(m_2\cdot v_2\right)_{after} \end{split}$$

Collision A. Elastic Collision: Moving object impacts a stationary object. Both objects have the same mass.

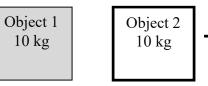
BEFORE COLLISION

Object 1

10 kg



AFTER COLLISION



0 m/s

0 m/s

	BEFORE COLLISION		
	Object 1	Object 2	
Mass (kg)	10 kg	10 kg	
Velocity (m/s)	5.0 m/s	0 m/s	
Momentum (kgm/s)	50 kg·m/s →	0 kg·m/s	
Kinetic energy (J)	125 J -	– 0 J	

AFTER COLLISION					
Object 1	Object 2				
10 kg	10 kg				
0 m/s					
0 kg·m/s	+				
0 Ј -	+				

 V_2

Which object had more momentum before	ore the collision?
Which object had less momentum before	e the collision?
Object transferred momentum to	Object (look at the "after collision" evidence)
Object #1 moved	after the collision than it did before the collision.
Object #2 moves	after the collision than it did before the collision.
What is special about this collision?	

What happened to the momentums and to the velocities of the objects?

Collision B. Elastic Collision. Two objects experience a head-on collision. Both objects have the same mass.

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AFTER COLLISION

			•			1
Object 1	→	Object 2	←	Object 1	Object 2	
10 kg	5.0 m/s -2.0 m/s	10 kg	-2.0 m/s	10 kg	10 kg	V2
	2.0 1113		200 112 5			· 2

	BEFORE COLLISION				
	Object 1	Object 2			
Mass (kg)					
Velocity (m/s)					
Momentum (kgm/s)	+		=		
Kinetic energy (J)		+			

AFTER CO	AFTER COLLISION					
Object 1	Object 2					
	+					
	+					

Which object had more momentum before	ore the collision?
Which object had less momentum before	re the collision?
Object transferred momentum t	o Object (look at the "after collision" evidence).
Object #1 moved	after the collision than it did before the collision.
Object #2 moves	after the collision than it did before the collision.
What is special about this collision?	

What happened to the momentums and to the velocities of the objects?

Collision C. Elastic Collision. Moving object collides with stationary object. The objects have different masses.

		BEFORE COI	LLISION		AFTER	COL	LISION	
10 k	kg		20 kg	-1.667	10 kg		20 kg	${\longrightarrow}$ V_2
		5.0 m/s	0 m/s	•				l

	BEFORE COLLISION			AFTER
	Object 1	Object 2		Object 1
Mass (kg)				
Velocity (m/s)				
Momentum (kgm/s)		+	=	
Kinetic energy (J)		+	_ =	

AFTER CO	AFTER COLLISION					
Object 1	Object 2					
	+					
	+					

Which object had more momentum before	ore the collision?
Which object had less momentum befor	e the collision?
Object transferred momentum to	Object (look at the "after collision" evidence).
Object #1 moved	after the collision than it did before the collision.
Object #2 moves	after the collision than it did before the collision.
The objects did not exchange momentur	n and velocities in this collision because

Collision D. Elastic Collision. Moving object collides with stationary object. The objects have different masses.

BEFORE COLLISION				AFTER COLLISION			
10 kg 5.0 m/s	20 kg	2.0 m/s	10 kg	1.0 m/s) kg V2		
	BEFORE C	COLLISION		AFTER C	OLLISION		
	Object 1	Object 2		Object 1	Object 2		
Mass (kg)							
Velocity (m/s)							
Momentum (kgm/s)		+	_ =		+		
Kinetic energy (J)		+	=		+		
Which object had more	momentum before t	he collision?					

Which object had less momentum before the collision?

Which object had less momentum before the collision?

Object _____ transferred momentum to Object _____ (look at the "after collision" evidence).

Object #1 moved _____ after the collision than it did before the collision.

Object #2 moves _____ after the collision than it did before the collision.

The objects did not exchange momentum and velocities in this collision because...

GUIDED PRACTICE: INELASTIC COLLISIONS

Inelastic Collisions: Objects collide and are damaged, fuse together, or experience energy loss through friction. Momentum is conserved, but KE is not conserved. There is a loss of KE.

$$(p_1 + p_2)_{before} = (p_{12})_{after}$$

$$(m_1 \cdot v_1)_{before} + (m_2 \cdot v_2)_{before} = (m_{12} \cdot v_{21})_{after}$$

Collision A. Inelastic Collision: Moving object impacts a stationary object.

BEFORE COLLISION AFTER COLLISION Object 1 Object 1 Object 2 Object 2 10 kg 10 kg 10 kg 10 kg V_{12} 5.0 m/s0 m/s**BEFORE COLLISION** AFTER COLLISION Object 12 Object 1 Object 2 20 kg Mass (kg) 10 kg 10 kg 5.0 m/s0 m/sVelocity (m/s) $+ 0 \text{ kg} \cdot \overline{\text{m/s}}$ $50 \text{ kg} \cdot \text{m/s}$ Momentum (kgm/s) 125 J 0 J Kinetic energy (J) >

Which object had more momentum before the collision?
Which object had less momentum before the collision?
Which direction did the fused object move after the collision?
Why did the object move in that direction?

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Object 1 10 kg	5.0 m/s	-2.0 m/s	Object 2 10 kg
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Object 1 10 kg	Object 2 10 kg	V ₁₂
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AFTER COLLISION

	BEFORE	BEFORE COLLISION		
	Object 1	Object 2		
Mass (kg)				
Velocity (m/s)				
Momentum (kgm/s)		+	=	
Kinetic energy (J)		+	>	

AFTER COLLISION
Object 12

Which object had more momentum before the collision?	
Which object had less momentum before the collision?	
Which direction did the fused object move after the collision?	
Why did the object move in that direction?	

Collision C. Inelastic Collision. Two objects experience a head-on collision.

Velocity (m/s)

Momentum (kgm/s)

Kinetic energy (J)

BEFORE COLLISION 10 kg 5.0 m/s -5 m/s 20 kg V2 10 kg 20 kg AFTER COLLISION 10 kg 20 kg AFTER COLLISION Object 1 Object 2 Mass (kg)

Which object had more momentum before the collision?	
Which object had less momentum before the collision?	
Which direction did the fused object move after the collision?	
Why did the object move in that direction?	

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Collision D. Inelastic Collision. Two moving objects are moving the same direction. The faster moving object collides and merges with the slower moving object.

BEFORE	COLLISION			AFTER C	OLLISION	
10 kg 5.0 m/s	20 kg	2.0 m/s		10 kg	20 kg	V_2
		COLLISION			COLLISIO)N
Mass (kg)	Object 1	Object 2		0	bject 12	
Velocity (m/s)						
Momentum (kgm/s)		+	=			
Kinetic energy (J)		+	>			
Which object had more	momentum before	the collision?				
Which object had less r	nomentum before th	ne collision?			_	
Which direction did the	fused object move	after the collision? _				_
Why did the object mov	ve in that direction?					