

Momentum: Summative Assessment

You may find the following equations helpful in completing the following assessment:

Momentum:	Elastic Collision:	Inelastic Collision:
$p = mv$	$m_1v_1 + m_2v_2 = m_1v_3 + m_2v_4$	$m_1v_1 + m_2v_2 = (m_1 + m_2)v_{\text{after}}$

Multiple Choice, True/False, and Fill in the Blank

- Linear momentum is the product of an object's _____ and its velocity in a straight line.
- T/F: If they are going the same speed, a baseball will have less momentum than a bowling ball.
- Which of the following objects has the largest momentum?
 - A 500 kg car traveling at 2 m/s
 - A 70 kg person traveling at 5 m/s
 - A 0.5 kg soccer ball traveling at 1 m/s
 - A 5000 kg elephant standing still
- A 70 kg football player is running with a speed of 5 m/s. Another football player, with a mass of 80 kg, is running towards him with a velocity of -4 m/s. What is the total momentum of the system of both football players?
 - 30 kg*m/s
 - 30 m/s
 - 670 kg*m/s
 - 670 kg
- T/F: The law of conservation of momentum states that the momentum before a collision will always be greater than the momentum after a collision.
- T/F: If they are not moving, an elephant has a larger linear momentum than a tiger.
- A bullet is fired at a block of wood. The bullet becomes lodged in the block of wood, which moves backward after the collision. This an example of a(n) _____ collision.
- An astronaut is doing a spacewalk when he becomes detached and begins floating away from the space shuttle. He is holding a large toolbox. What can he do to move back to the space shuttle?
 - Swing the toolbox in circles
 - Throw the toolbox towards the space shuttle so that he will follow it
 - Throw the toolbox away from the space shuttle so that he will move the opposite way
 - Swing the toolbox back and forth
- Linear momentum is _____, meaning that it does not change unless there is an outside force.
- T/F: The units for momentum are kg/m/s.
- When comparing the momentum of two moving objects, which of the following is correct?
 - The object with the higher velocity will have less momentum if the masses are equal.
 - The more massive object will have less momentum if its velocity is greater.
 - The less massive object will have less momentum if the velocities are the same.
 - The more massive object will have less momentum if the velocities are the same.
- A child with a mass of 23 kg rides a bike with a mass of 5.5 kg at a velocity of 4.5 m/s to the south. Compare the momentum of the child with the momentum of the bike.
 - Both the child and the bike have the same momentum.
 - The bike has a greater momentum than the child.
 - The child has a greater momentum than the bike.
 - Neither the child nor the bike has momentum.

13. T/F: If a 70 kg human is walking at 2 m/s, her momentum is 140 kg*m/s.
14. In which of the following situations would it be possible for a bumblebee and a grizzly bear to have the same momentum?
- The bumblebee is moving very quickly and the grizzly bear is moving very slowly
 - The bumblebee is moving very slowly and the grizzly bear is moving very quickly
 - The bumblebee and grizzly bear are moving with the same nonzero velocity
 - The bumblebee and the grizzly bear are both at rest.
- i only
 - i and iv only
 - iv only
 - i, ii, and iv only
 - The bumblebee and grizzly bear have the same momentum in all of these situations.
15. T/F: It is possible for a small car to have the same momentum as a large truck.
16. A pool player hits the cue ball. It hits the 8 ball. Both balls roll into the pocket, with the cue ball falling into the pocket a few seconds after the 8 ball. This would be an example of:
- An elastic collision
 - An inelastic collision
 - Momentum being gained in a collision
 - A violation of Newton's Second Law
17. T/F: If an object is not moving, it has nonzero momentum because it still has mass.
18. A large 700 kg truck is driving with a speed of 20 m/s when it collides with a 300 kg car which is not moving. The two stick together. After the collision, the car and truck will have a speed:
- Greater than 20 m/s
 - Less than 20 m/s
 - Exactly equal to 20 m/s

Calculations:

Momentum:	Elastic Collision:	Inelastic Collision:
$p = mv$	$m_1v_1 + m_2v_2 = m_1v_3 + m_2v_4$	$m_1v_1 + m_2v_2 = (m_1 + m_2)v_{\text{after}}$

19. A 400 kg tiger is chasing after a gazelle at a speed of 20 m/s. What is the momentum of the tiger?
20. A bowler rolls a ball down the lane with a momentum of 40 kg*m/s. It has a mass of 5 kg. What is the speed of the bowling ball?
21. A child is running with a speed of 5 m/s. His momentum is 200 kg*m/s. What is the mass of the child?
22. An 80 kg student is running with a speed of 4 m/s. He tackles another student who is not moving and also has a mass of 80 kg. The two stay together after the collision. What will their speed be after the collision?
23. A small 200 kg sports car collides with a large 800 kg truck. Before the collision, the sports car was traveling at 25 m/s and the large truck was traveling at 10 m/s in the same direction. What was the total momentum of the car and truck?
24. In the collision from #23, if the car and truck stick together, what will be their speed after the collision?