

Name: _____

Momentum Guided Notes

Momentum:

Momentum is the product of _____ and _____. It is a _____ quantity because it has magnitude and direction. The equation is momentum = mass times velocity and looks like this: $p = mv$ (p is used for _____). Momentum is a measure of how difficult it is to stop a moving object; essentially it is _____ in action. If mass doubles and velocity stays the same, momentum doubles. If velocity doubles, and mass stays the same, momentum _____. If an object is _____ moving, its momentum is _____. The SI unit for momentum is $\text{kg}\cdot\text{m/s}$.

Momentum Problems:

1. What is the momentum of a 5 kg bowling ball that is rolling at 2 m/s?
2. A. What is the momentum of a 2000 kg truck that is moving at 10 m/s? B. What would the momentum be if the velocity doubled? C. What if the mass were cut in half?

Impulse:

Impulse is the product of force and the _____ interval during which a force acts. If a force acts on an object, its velocity changes, which is also known as acceleration, and ultimately changes the object's momentum. An object with a lot of momentum is hard to stop (semi vs. car or bowling ball vs. a ping pong ball or a bullet vs. a paper airplane). The greater the _____ that you can apply a force, the greater the change in momentum. Impulse = impact force x impact time (J is used for _____). $J = F\Delta t$ Units are $\text{N}\cdot\text{s}$

Why is a dish dropped on carpet more likely to survive a fall than one dropped on a hard floor? Consider impact force and impact time. Since the carpet has more "give" it increases the impact time which results in a smaller impact force. The shorter impact time on the hard floor due to less "give" means a greater impact force and the dish is more likely to break.

If a boxer moves into a punch, they decrease the _____ of the impact and _____ the force of the impact.

If a baseball player catching a ball moves their glove closer to their body as they catch the ball, they increase the time of impact between the ball and glove and decrease the _____ of the impact.

Why are air bags, padded dashboards and crush panels used in automobiles? What do they do for the impact time and impact force?

Conservation of Momentum:

If two objects collide in an isolated system (meaning not impacted by any outside forces), the total momentum before and after the collision is the same.

For instance, two objects collide. The total momentum of the two objects before the collision is the same as the total momentum of the two objects after the _____. Momentum lost by one object striking another is _____ to the momentum _____ by the second object.

Therefore, momentum is the same before and after a collision in a system if no outside forces act on the system!

Formula: $(m_1v_1) + (m_2v_2) = (m_1v_1) + (m_2v_2)$

Collisions:

Elastic Collisions: objects _____ without being permanently deformed or generating heat. The objects bounce apart with no energy _____. Momentum is conserved!

If object 1 and object 2 are moving in _____ directions then we have to give one object a positive velocity and the other one a _____ velocity.

Inelastic Collisions: objects collide and some mechanical energy is transformed into _____. In the real world, friction or _____ are external _____ that act on a system but for our purposes are negligible during a collision so momentum is conserved. Be advised though, that the reason a ball doesn't bounce as high after it is dropped is because some heat is generated between the ball and the floor. A ball rolled across the floor will not roll forever due to friction. These are external forces acting on the system!

