Name_____

NEWTON'S FIRST & SECOND LAWS

Directions: Read the information below.

Newton's First Law of Motion

An object at rest will stay at rest and an object in motion will stay in motion until acted upon by an outside force. The first law of motion is all about inertia. This may seem complex, but it's actually pretty easy to understand. If you're sitting in your seat, you don't expect to start moving across the classroom. Nothing is making you move, right? You set your homework paper down on your bed and decide to go outside. When you come back in those papers should still be there. These objects (you in the chair and your homework on the bed) are at rest, meaning they are not moving. They're still. They will continue to be at rest unless something makes them move – in other words, they're acted upon by an outside force. If the wind were to blow through a window in your room, that would be a force that could move your papers. Likewise, if somebody bumped into your seat you would expect it to begin moving. No object at rest will ever being moving on its own without the help of an outside force.

Objects that are in motion will also stay in motion unless a force compels them to stop. A roller coaster may be gliding along a track, but when it reaches a hill it will slow down because the force of gravity wants to pull it back down. A football player who throws a football hopes that it will fly through the air as far as possible. However, a variety of factors including gravity and wind will act against that motion and cause the football to eventually fall. A quarterback who throws for a touchdown hopes that the football does not get acted up by the outside force of an interception, preventing it from continuing to travel down the field. A car can coast along a road, but will eventually slow down if the accelerator is not applied because of the force of friction.

Physicists like to say that objects which have a net force of 0 will have no change in motion. As you stand on the ground you exert a force on the ground, but the ground also pushes back up onto you. The two forces are equal which means there is no net force, thus the object (you) stays still. If you pushed on the ground with a greater force, then the ground would cave in downward. If the ground pushed back up on you with a greater force, then you would rise upward.

Newton's Second Law of Motion

This law states that force is equal to mass times acceleration.

Force = mass x acceleration

In other words, we know that if an object's acceleration or mass changes so will its force. It may not seem clear, but this is actually very logical. Imagine a student walking down the hall to class. Hands are empty, backpack is on. If you run into that student it would probably hurt, but not much. Now, assume that student is carrying a heavy load of books. It now requires more effort (force) for that student to maintain the same speed (acceleration) walking down the hall. That's because the mass has increased from the addition of the books. If that student was walking down the hall with empty hands again and increased his or her speed by walking faster, it would hurt more to run into them. This time it's because the acceleration increased.

If Newton's first law of motion explains how objects do not change their total net force, the second law explains how they do change their total force.

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Directions: Answer the questions below.

1. If a hockey puck is traveling across the ice, it will continue moving at the same speed forever unless acted upon by an outside force. If no humans or hockey sticks touch the puck, what force might slow it down?
2. If a large and small player collide, will one or both players have a force exerted upon them? Explain your answer using Newton's Second Law of Motion.
3. The amount of force an object has is a product of what two factors?

4. A magician pretends to be able to allow an object, let's say a rabbit, float in the air with the wave of a wand. This is impossible because of Newton's laws. Use information from the text to explain what is really going on. Show your answer in words and an illustration.

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