Chp 6: Lect 6: Newton's Laws of Motion: First & Third Laws

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Does this have anything to do with cookies? Nope, not fig newtons… Sir Isaac Newton. A little bit stuffy, bad hair, but quite an intelligent guy. He was a genius mathematician & physician in the 1700's. During his work, he came up with the three basic ideas that are applied to the physics of most motion. The ideas have been tested and proved so many times over the years that are now called Newton's _____ Laws of _____.

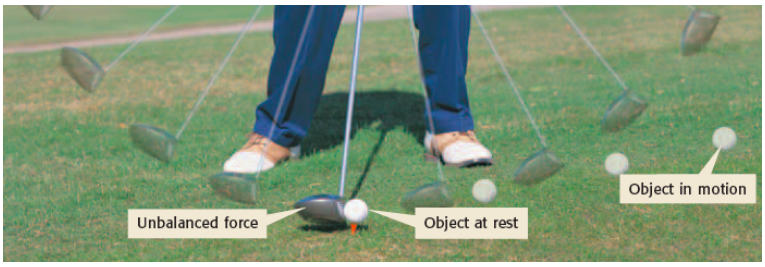
Newton's Law #1

Newton's First Law
An object at rest remains at rest, and an object in motion remains in motion with the same velocity unless acted on by an unbalanced force.

What does this mean? If nothing is happening to you and nothing does happen you will never go anywhere. If you're going in a specific direction, unless something happens to you, you will always go in that direction. Forever. Things don't move unless a force is applied to them.

A golf ball on a tee will remain on the tee until the club, the unbalanced force, makes contact with it.

Think again of astronauts in space. Have you ever noticed that their tools float? They can just place them in space and they stay in one place. There are very few forces acting on objects in space. When you put something in one place, it will only move very slowly when gravity pulls it.



Why don't things keep on moving forever? So, if an object in motion remains in motion unless acted upon by another force and I pushed my desk across the room, would it keep moving forever? Of course not. It stops moving because an unbalanced force acts on it. This unbalanced force is_____. This force is everywhere & affects our daily life constantly.

Law #1 = Law of Inertia: Newton's first law is also called the "law of inertia". Inertia sounds like "in-er-shuh". Inertia is the property of an object to _____. It is because of inertia that objects like to remain at rest or why objects like to keep moving. To understand inertia, imagine trying to move a bowling ball and a golf ball. Which needs more force? Of course, the bowling ball needs more force to get it moving at the same speed as the golf ball. The bowling ball also needs more force to stop. A bowling ball has _____ inertia than a golf ball. The greater an object's inertia, the greater the _____ needed to change its motion.

Inertia & Mass: Inertia comes from mass. Objects with more mass have more inertia and are more resistant to changes in their motion.

Have you ever observed the behavior of your mom's coffee in a coffee cup filled to the rim while starting a car from rest or while bringing a car to rest from a state of motion? Coffee tends to "keep on doing what it is doing." Coffee in motion tends to stay in motion.	Have you ever played the "Blob" game in the car? Why is it that when the car turns right, your body goes to the left and when the car turns left, you blob to the right? You blob in the direction of the car's _____. Your body wants to keep going straight, even as the car is turning.

You should now be able to explain why the following occurs:

- blood rushes from your head to your feet while quickly stopping when riding on a descending elevator.
- to dislodge ketchup from the bottom of a ketchup bottle, the bottle is often turned upside down, thrust downward at a high speed and then abruptly halted.
- headrests are placed in cars to prevent whiplash injuries during rear-end collisions.
- while riding a skateboard, you fly forward off the board when hitting a curb, a rock or another object which abruptly halts the motion of the skateboard.

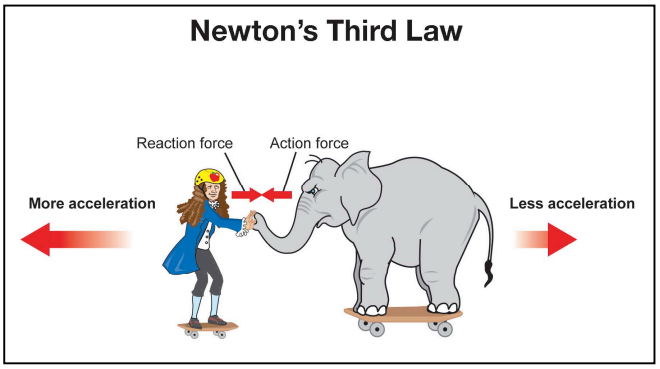
Water-Lab Review

Newton's Law #3

We're going to skip ahead to Newton's 3rd law. We'll come back to Law #2 tomorrow. Newton's first law only applies to single objects. This third law deals with pairs of objects. This is because _____ _____ _____.

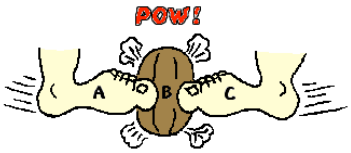
Newton's Third Law
For every action, there is an equal and opposite reaction

Newton versus the Elephant: Imagine a skateboard contest between Newton & an elephant. They can only push against each other, not against the ground. The fastest one wins. The elephant knows it is much stronger & pushes off Newton with a huge force, thinking he will win. But will he? The result of the giant push from the elephant is that Newton flies away with a greater speed & the puzzled elephant moves backwards with a smaller speed. Newton wins - and will always win, no matter how hard the elephant pushes. In fact, Newton doesn't have to push at all & he still wins. Why? Newton wins because forces always come in pairs. The elephant pushes against Newton & that _____ pushes Newton away. The elephant's force against Newton creates a _____ force against the elephant. These forces are _____ in strength. BUT, these two are different in mass - Newton has a lot less mass & inertia, so he moves more easily.

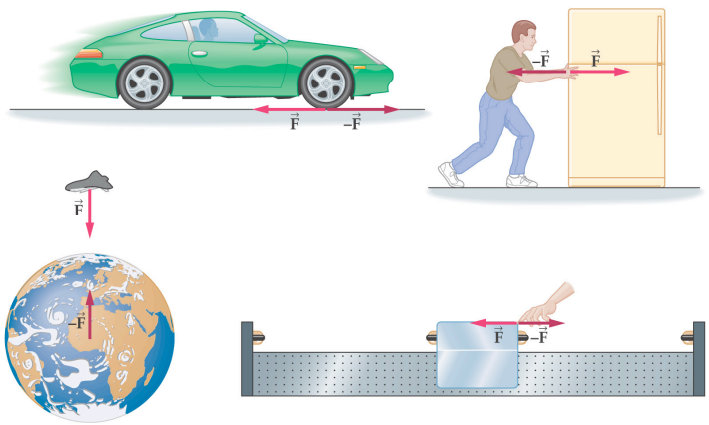


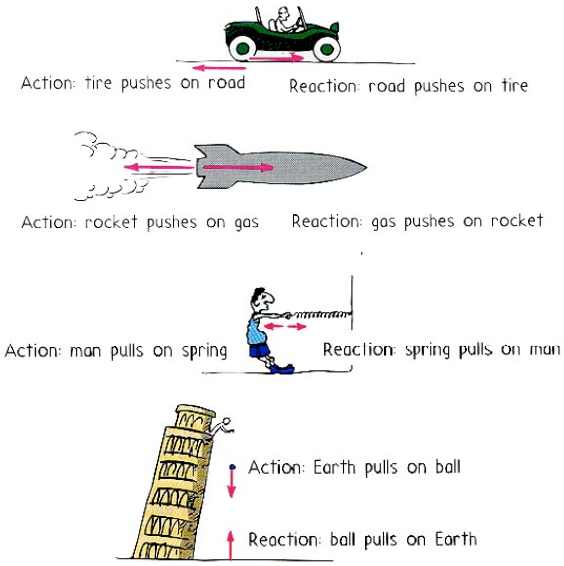
We've talked about this before. When you sit in your chair, your body exerts a downward force on the chair and the chair exerts an upward force on your body. There are _____ resulting from this interaction — a force on the chair and a force on your body. It's a pair of forces! _____ and _____!

Think of how birds fly. The wings of a bird push air downwards. In turn, the air reacts by pushing the bird upwards. For every action, there is an equal (in size) and opposite (in direction) reaction. Action-reaction force pairs make it possible for birds to fly.	When you swim…your hands and feet push on the water - this is the _____ force. The _____ force is the water pushing equally (and in an opposite direction) on your hands and feet. The reaction forces causes forward motion.



Why don't the forces cancel? The reason is action & reaction forces act on _____ objects. If the two forces canceled each other out, there would be no motion. Think about throwing a ball. You apply the action to the ball, creating the ball's acceleration. The reaction is the ball pushing back on your hand. You can only cancel forces acting on the same object (like each foot acting on the football).





Brainpop: Laws of Motion. Complete the questions from your handout Log in: mms308 password: marshall