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Period 5

Physics In Motion Notes – Part 2

- Newton's Three Laws of Motion
- Momentum and Impulse
- Conservation of Energy

Theories → an idea that is based on some evidence.

→ it is not proven to be be 100% true or accurate.

Laws → an idea proven to be correct, ~~repeatedly~~ (repeatedly)

Sir Isaac Newton: (1642 – 1727)

"Newton's Laws of Motion"

"push" or "pull"

- Wrote his ideas about force and motion in his book, *Principia*.
- Developed his "three laws of motion", involving the concept of force. Therefore the unit of force has been named the Newton (N).
- His first law challenged the Aristotelian idea of what is "natural", since states that both the state of rest, and the state of uniform, unaccelerated motion, are both "natural".

Newton's Three Laws of Motion

★ Newton's First Law of Motion

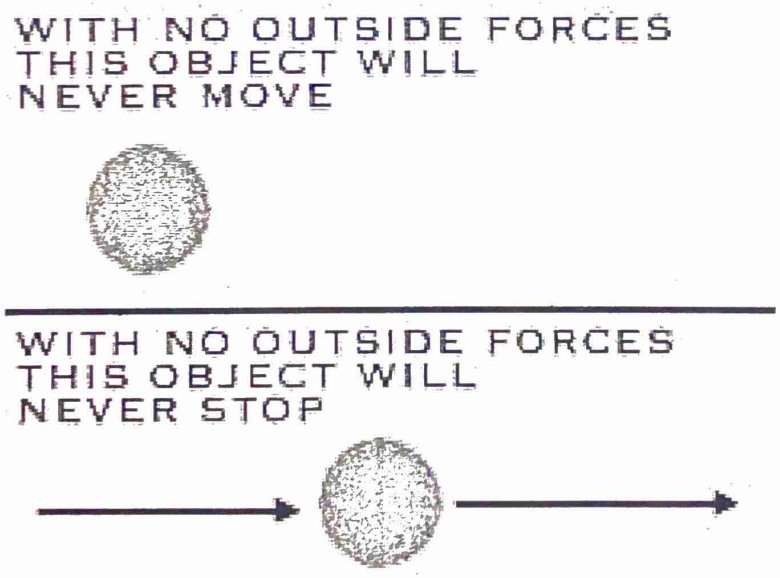
Isaac Newton described acceleration as an imbalance in forces.

For example, if there is force acting on your right side but there is a stronger force acting on your left side, you will be moved to the right.

Newton devised a law of physics that is still accepted today.

An object at rest stays at rest, and an object in motion stays in motion, unless the object is acted upon by an external and unbalanced force.

***NOTE**: This law is sometimes called the **"law of inertia"**.



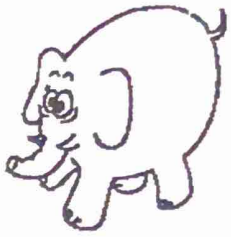
Example:

- Using seatbelts is very important when in a car, otherwise a passenger would continue traveling forward, when car is stopped suddenly.
- Objects with greater inertia have a greater resistance to change their motion.
  - It is more difficult to start a train or a ship and to bring it up to speed than to keep it going once it is moving at the desired speed.

Greater mass = greater inertia
lesser mass = lesser inertia

Newton's Law Practice - Again

NEWTON'S FIRST LAW



1. If an elephant were chasing you, its enormous mass would be most threatening. But if you zigzagged, its mass would be to your advantage. Why?

2. Two closed containers look the same, but one is packed with lead and the other with a few feathers. How could you determine which has more mass if you and the containers were orbiting in a weightless condition in outer space?

NEWTON'S SECOND LAW

1. If the force exerted on a 2-kg object is 30 N, what is object's acceleration?

2. Suppose a cart is being pushed by a certain net force. If the net force is doubled, by how much does the acceleration change?

3. Suppose a cart is being moved by a certain net force. If a box is dumped into the cart, so its mass is doubled, by how much does the acceleration change?

NEWTON'S THIRD LAW

1. When a hammer exerts a force on a nail, how does the amount of force compare to that of the nail on the hammer?

2. Why does a cannon recoil when it fires a cannonball?

3. Why is it easier to walk on a carpeted floor than on a smooth, polished floor?

4. When a rifle is fired, how does the size of the force of the rifle on the bullet compare to the force of the bullet on the rifle?

5. If a bicycle and a massive truck have a head-on collision, upon which vehicle is the impact force greater?

Two people of equal mass attempt a tug-of-war with a 12-meter rope while standing on frictionless ice. When they pull on the rope, they each slide toward each other. How far does each person slide before they meet?