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Newton's Laws

Science Literacy Article

Isaac Newton (January 4, 1643 – March 31, 1727) was an English scientist, mathematician, and astronomer. He is known as one of the most influential scientists that ever lived. During his lifetime he made many discoveries. He constructed a reflecting telescope to help study light and color. He also helped to discover and develop many important theories in the field of calculus. However, his most important work was contained in his book, Principia. This book outlined his discoveries in physics which included his 3 laws of motion.

The 1st Law of Motion is also referred to as the Law of Inertia. Inertia is an object's tendency to resist a change in motion. The 1st Law of Motion states that an object at rest will remain at rest unless acted upon by an unbalanced force. If a person leaves a book on the table, the book will remain on the table. There are no unbalanced forces acting on the book, so it will stay in the same place. The 1st Law of Motion also states that an object in motion will remain in motion with a constant velocity unless acted upon by an unbalanced force. If a person rolls a ball across the floor, the ball will continue to roll until gravity, friction, and possibly other forces (i.e. hitting a wall) cause it to stop rolling.

The 2nd Law of Motion is also referred to as the Law of Acceleration. The 2nd Law of Motion states that the force of an object is equal to its mass multiplied by its acceleration. It is represented by this formula: Force = Mass X Acceleration. Therefore, force, mass, and acceleration are all related. Newton's 2nd Law of Motion explains why it requires more force to accelerate a full grocery cart (more mass) than an empty cart (less mass).

The 3rd Law of Motion is also referred to as the Law of Action & Reaction. The 3rd Law of Motion states that for every action there is an equal and opposite reaction. Forces occur in pairs when acting on two interacting objects. The size of the force on one object is equal to the size of the force on the second object. Newton's 3rd Law of Motion is observed when a balloon flies around the room as air is released. Air rushes out of the balloon in one direction, which propels the balloon in the opposite direction.

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Newton's Laws Question Companion

For 1-5, choose the best answer.

1. Which of the following is the tendency for an object to resist a change in motion?
    a. Inertia
    b. Friction
    c. Gravity
    d. Air resistance

2. In a car, when you slam on the brakes, the car will stop but your body will keep moving. What law of motion does this demonstrate?
    a. This demonstrates Newton's First Law.
    b. Newton did not have cars in his time so he was not able to observe this kind of motion.
    c. This demonstrates Newton's Second Law.
    d. This demonstrates Newton's Third Law.

3. When rockets launch they use thrusters which apply a fore against the ground. This force then pushes the rocket up into space. What law does this demonstrate?
    a. This demonstrates Newton's First Law.
    b. Newton did not have rockets in his time so he was not able to observe this kind of motion.
    c. This demonstrates Newton's Second Law.
    d. This demonstrates Newton's Third Law.

4. If you wanted to calculate the force behind an object, what formula would you use according to Newton's Second Law of Motion?
    a. F = M/V
    b. F = M x A
    c. F = M/A
    d. F = M x d

5. True or False: When an object does not move it is because there are unbalanced forces acting on it.
    a. True
    b. False

Fill in the blank(s) with the correct answer for 6-9.

6. For every action there is an _____ and _____ reaction.

7. An object at rest will remain at rest and an object in _____ will remain in _____ unless acted upon by an _____ force.

8. The force of an object is its _____ multiplied by its _____.

9. Forces always act in _____.

10. Draw pictures below to represent each law of motion.

Newton's 1st Law	Newton's 2nd Law	Newton's 3rd Law

Newton's Laws

Reading: Read the passage below, then answer the questions on your answer pages.

Isaac Newton lived in the 1600s. The Scientific Revolution was just beginning: Galileo had just seen the moons of Jupiter for the first time, and doctors had determined that blood circulated around the body. But, there was still so much they didn't know. Things we consider common sense now were not understood back then.

Isaac Newton spent a lot of time studying the world around him and coming up with his three laws of motion. His discoveries still are important centuries later!

Newton's first law of motion states that an object in motion stays in motion or an object at rest stays at rest until an unbalanced force acts on it. This means that the pencil on your desk will stay there until you push it, or a soccer ball on flat ground won't move until it is kicked. A bowling ball rolling on the ground will continue to roll until a force (friction or the pins) acts on it. This law is also called the law of inertia. Inertia is the tendency of an object to resist a change in motion. Inertia is the reason it takes more effort to start a bike moving forward than it does to keep it going!

1. What is another example you can think of that demonstrates Newton's first law?

Newton's second law of motion tells us how acceleration (speeding up or slowing down) is affected by the mass of an object and the force acting on it. Think about pushing a baseball or a bowling ball. The bowling ball would be much heavier. Therefore, a small push will accelerate the baseball more than it would the bowling ball.

If you are pushing two baseballs with different amounts of force, the one with more force applied to it will accelerate more than the one with less force applied. This law is represented by: **force = mass x acceleration, or *f=ma***

2. Which will have a greater acceleration if they are both thrown with the same force, a 50 g potato or a 400 g potato?

Newton's third law is known as the law of Action/Reaction. It states that for every action (a force) there is an equal and opposite reaction (a opposite force). When the wheel of a bicycle turns, it pushes against the ground. But the ground doesn't just let the tire fall through it! The ground pushes back against the tire with equal and opposite force, so the bike moves forward.

3. If you pedal harder so the bike tires push against the ground with more force, what will happen to the bike?

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Newton's Laws of Motion

1. Describe an example of Newton's 1st Law of Motion.

2. Describe an example of Newton's 2nd Law of Motion.

3. Describe an example of Newton's 3rd Law of Motion.

4. Describe Newton's 1st Law in your own words.

5. What is another name for Newton's 1st Law?

6. Describe Newton's 2nd Law in your own words.

7. What is another name for Newton's 2nd Law?

8. Describe Newton's 3rd Law in your own words.

9. What is another name for Newton's 3rd Law?

10. What is inertia. List an example.

Read the scenarios below. Mark "1" for Newton's 1st Law, "2" for Newton's 2nd Law, or "3" for Newton's 3rd Law.

11. _____ A fireman turns on a hose and is knocked backwards.

12. _____ A motorcycle will accelerate faster than a large truck.

13. _____ It requires more force to pull a wagon with someone in it than an empty wagon.

14. _____ A soccer ball will not move until it is kicked.

15. _____ A bird pushes down on the air with its wings in order to fly.

16. _____ A person's body is thrown outward around a curve on a rollercoaster.

17. _____ The air is let out of a balloon and it flies around the room.

18. _____ A baseball continues to roll until friction, gravity, and air resistance stop it.

19. _____ Pushing a child on a swing requires less force than pushing an adult.

20. Fill in the boxes to the table shown below. Describe how each of Newton's Laws of Motion are seen on a daily basis at school, home, and outdoors.

	Newton's 1st Law	**Newton's 2nd Law**	**Newton's 3rd Law**
School			
Home			
Outdoors			

Create an icon for each of Newton's Laws of Motion. An icon is a picture or sketch that represents a concept.

21. Newton's 1st Law	22. Newton's 2nd Law	23. Newton's 3rd Law

Read the following questions and circle the correct answer choice.

24. Which of the following best represents inertia?
a. An object at rest remains at rest
b. An object in motion remains in motion
c. Flying forward when a car suddenly stops
d. All of the above

25. Which of the following is an example of Newton's 1st Law?
a. Using a force to push a box
b. Pulling back an arrow to shoot it forward
c. A table remains motionless in a classroom
d. None of the above

26. Which of the following is an example of Newton's 2nd Law?
a. A bowling ball requires more force to roll than a tennis ball
b. Sitting in a chair
c. A rocket blasting off
d. All of the above

27. Which of the following is an example of Newton's 3rd Law?
a. A full grocery cart requires more force to push than an empty cart
b. Pushing backward in order to move forward while ice skating
c. A cookie sitting on a plate
d. None of the above