

PHYSICS
NEWTON'S LAWS OF MOTION
FORM 5

Newton's 1st Law : This states that a body continues at rest or in uniform motion (constant velocity, constant speed in the same direction) unless otherwise acted upon by an unbalanced force.

An unbalanced force is the force applied to an object in which there is no counteracting force in the opposite direction.



Unbalanced Force = 2N \longrightarrow (7N - 5N = 2N)

According to the first law an object will be stationary unless acted upon by an unbalanced force.

An object will continue moving in uniform motion unless acted upon by an unbalanced force.

All objects obey Newton's first law of motion.

Practical Examples:

For a rocket ship to travel 600mph in outer space the rocket ship needs to accelerate to achieve that speed and then switch off the engines. The rocket ship will then continue to move at 600mph.

The moon has a circular pathway (orbit). Since the moon is not at rest or travelling in uniform motion (straight line) it then means there is an unbalanced force acting on the moon. This unbalanced force is the earth's gravitational pull.

Newton's 2nd Law : *Force* = *Mass* \times *Acceleration*

$$N = kg \times m/s^2$$

This states that for an object to accelerate, a force must be applied.

From the first law, the presence of an unbalanced force results in a change in the motion, speed or direction of an object. This means that an unbalanced force will cause an object to have an acceleration. $F = ma$.

When a force is applied to an object, the object will have an acceleration which may be in the form either in the change in direction or change in speed of an object.

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Newton's 3rd Law : This law can be expressed in one of the following 3 forms:

1. Action and reaction are equal and opposite for a given pair of bodies.
2. For every action there is an equal and opposite reaction.
3. If body A exerts a force on body B then body B will exert an equal and opposite force on body A.

This law refers to the relationship between two objects, eg, an object resting on a table. The object applies a force on the table, ie, its weight, the table applies a force on the object in return. The force of the table on the object is equal and opposite to the force of the object on the table. Since there is no unbalanced force, the object does not move.

Practical examples:

The launching of a rocket ship into outer space follows Newton's 3rd law. After ignition, combustion of fuel occurs. This results in large quantities of hot gases at high velocities to be expelled downwards. An equal and opposite force is created, this force therefore acts upwards causing the rocket to launch.

Further reading:

<http://csep10.phys.utk.edu/astr161/lect/history/newton3laws.html>

<http://newtonvsaristotle.wikispaces.com/BATTLE+OF+THE+AGES+-+Newton+vs.+Aristotle>

<http://www.youtube.com/watch?v=rOtWO94ld3o>