

Newton's Third Law

Scott N. Walck

October 11, 2024

Forces on objects are produced by other objects

Force	force acts on	force produced by
Jodi pushing sled	sled	Jodi
gravity	object	Earth
normal force	object	surface

- ▶ Any object, living or non-living, can produce a force.
- ▶ For one object to exert a force on another, they usually need to be touching (gravity is the one exception).
- ▶ Forces come in pairs.

Newton's Third Law

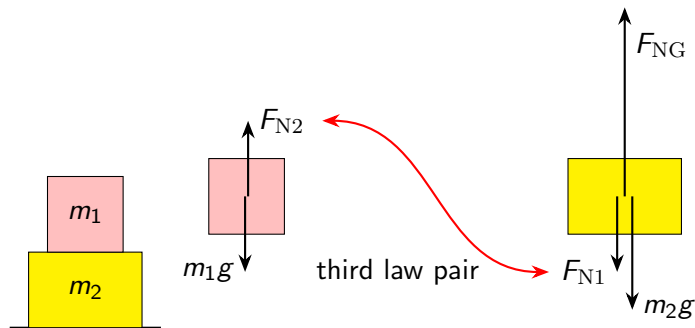
Newton's Third Law, Newton's words

To any action there is always an opposite and equal reaction; in other words, the actions of two bodies upon each other are always equal and always opposite in direction.

Newton's Third Law, modern version

If object A exerts a force on object B, then object B exerts a force on object A. This second force is equal in magnitude to the first force, but opposite in direction.

Third Law Pair of Forces



- ▶ F_{NG} is the normal force on m_2 from the ground
- ▶ F_{N2} is the normal force on m_1 from m_2
- ▶ F_{N1} is the normal force on m_2 from m_1

Comparison of 2nd and 3rd laws

- ▶ Newton's second law applies to an object.
- ▶ Newton's third law applies to an interaction between two objects.

Multiple objects

- ▶ Newton's Third Law
The force that object B exerts on object A is equal and opposite to the force that object A exerts on object B.
- ▶ Light Rope Rule
For a rope with negligible mass, the tension at one end is the same as the tension at the other end.
- ▶ Different objects can use different coordinate systems.
- ▶ Sometimes, the accelerations of different objects are linked.

Newton's laws

Law	Says something about
1st	an object, if no forces act on it
2nd	an object and the forces that act on it
3rd	the forces between objects

- ▶ These three laws form the core of Newtonian mechanics.