

What makes a CO2 car go faster? Sir Isaac Newton provides some important insight with his three laws of motion. These principles, or "laws" apply to all forms of moving objects and can be used to design a better car. Let's take a look.

Newton's Laws of Motion

First Law: Law of Inertia

It states that an object at rest remains at rest, while an object in motion remains moving at a constant velocity unless acted on by an unbalanced force.

Inertia

-the tendency of an object to resist changes in its state of motion



marble
(low mass,
small inertia)



soccer ball
(high mass,
large inertia)

a soccer ball initially at rest



the ball tends to remain at rest due to inertia

a player kicks the ball and makes it move



the kick represents the unbalanced force

a soccer ball moving in the air



the ball tends to continue moving at constant velocity

a soccer ball stops moving when it encounters the net



the opposing force from the net represents the unbalanced force

Newton's Laws of Motion

Second Law: $F=ma$

This law tells us that an object's acceleration is proportional to a net force acting on it, and inversely proportional to the object's mass. So, if we want to increase acceleration, we can either increase the net force acting on the car or reduce its mass (or both).

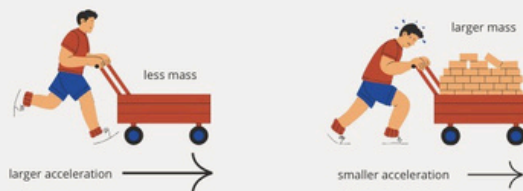
- Also known as the “law of acceleration”
- Describes how force and mass affect acceleration

Expression

$$a = \frac{F}{m} \quad \text{OR} \quad F = ma$$

force ↑
acceleration ↓ mass ↓

Mass and Acceleration



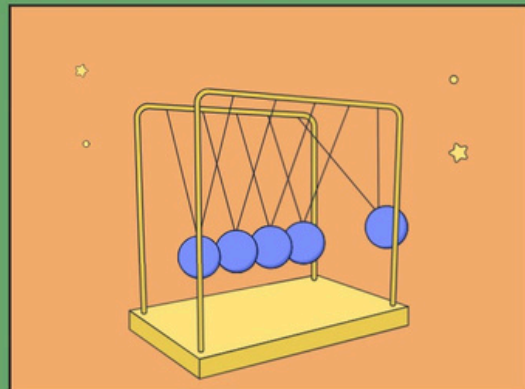
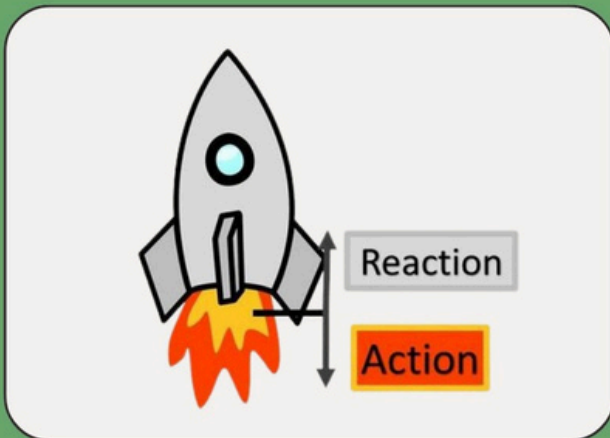
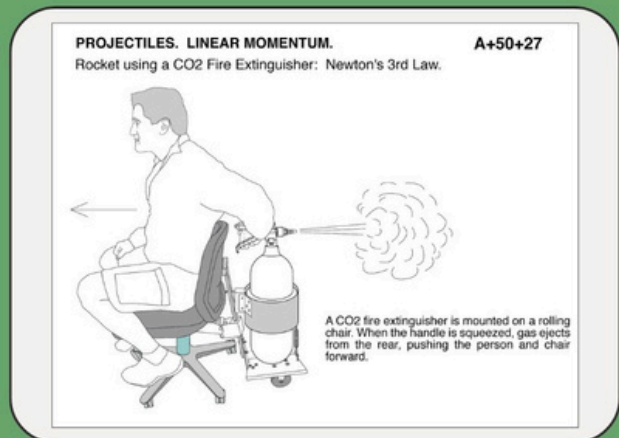
At constant force, acceleration decreases as mass increases.

While each of these laws applies to a CO2 dragster, Newton's second law provides the most insight into the design decisions that can most effectively improve your car.

Newton's Laws of Motion

Third Law:

For every action there is an equal and opposite reaction



Leaning against the wall is an example of Newton's Third Law. **As you lean against a wall, you exert a force against the wall.** At the same time, the wall exerts an equal but opposite force on you which prevents you from falling. This is evident on a dragster when the vehicle moves off the starting line. When CO2 gas is rapidly expelled from the rear of the cartridge, the cartridge reacts by pushing back in the opposite direction. This reaction force propels the car forward.