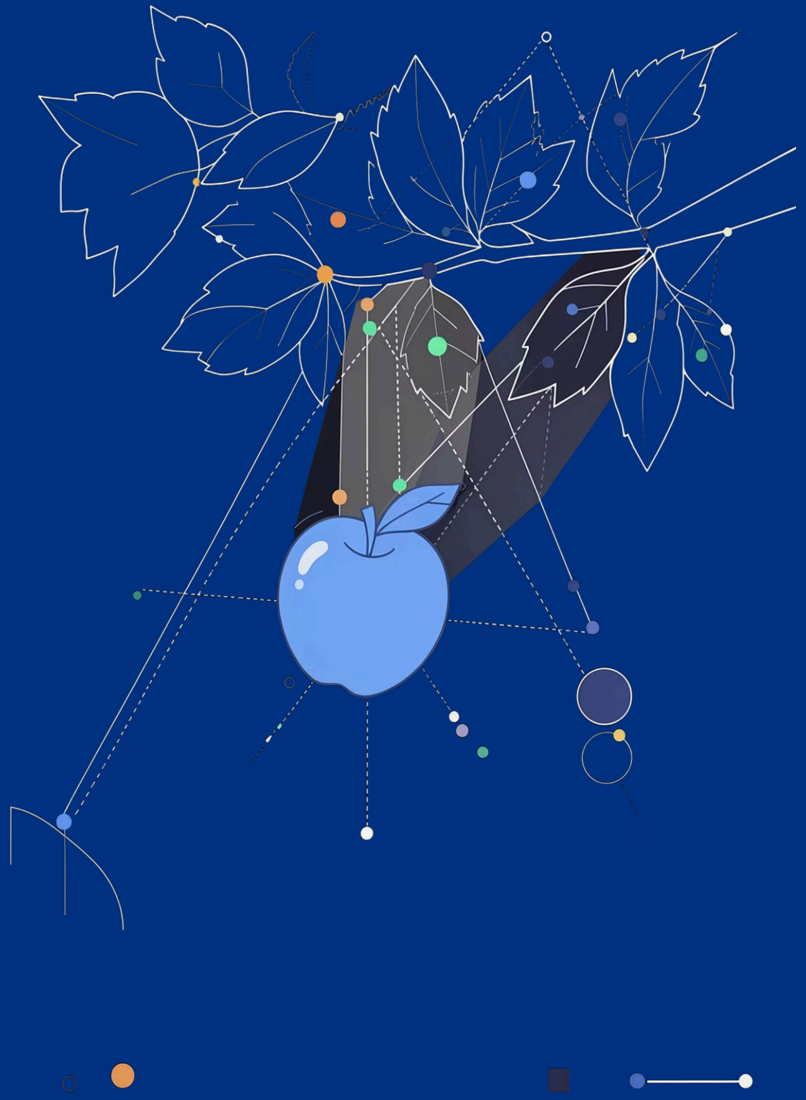


Newton's Laws of Motion

Three elegant principles that govern everything — from a falling apple to the orbit of planets. Discover the pillars that hold up classical physics.

CLASSICAL MECHANICS

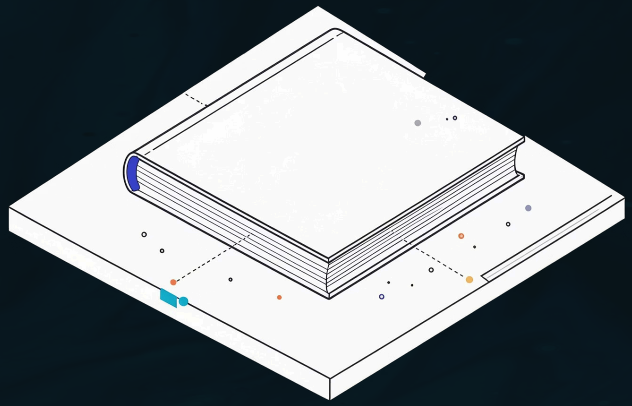
ISAAC NEWTON · 1687

CHAPTER 1

The Law of Inertia

Why does a book stay on a table until you move it? Why do you lurch forward when a bus brakes suddenly? The answer lies in one of nature's most stubborn tendencies — **inertia**.

Newton's First Law: An Object at Rest Stays at Rest...



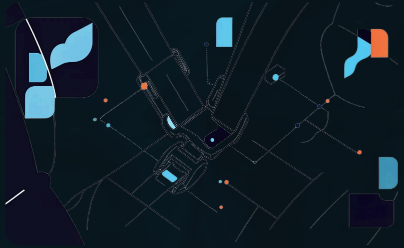
The Law Stated

Every object continues in its state of rest, or of uniform motion in a straight line, **unless compelled to change that state by an external force.**

What is Inertia?

Inertia is the natural resistance of any object to a change in its state of motion. The greater the mass, the greater the inertia. It is not a force — it is a **property of matter.**

Inertia in Action: Everyday Examples

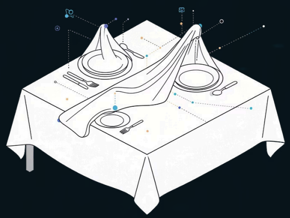


Seatbelts Save Lives

When a car stops suddenly, your body's inertia keeps it moving forward. The seatbelt applies an external force to counteract this — preventing you from flying through the windshield.

Turning a Car

When a car turns, you feel pushed outward. This is your body's inertia resisting the change in direction — it wants to keep moving in a straight line.



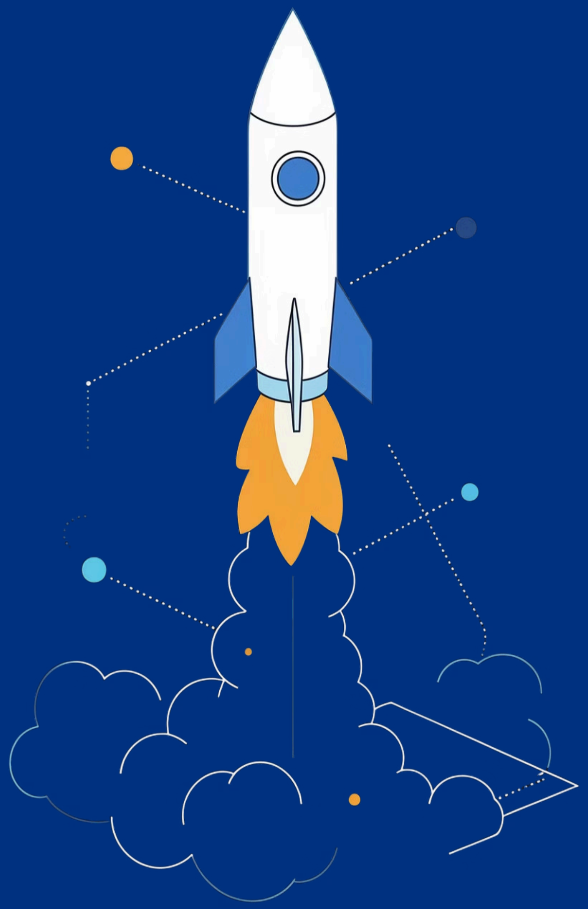
The Tablecloth Trick

Pull a tablecloth quickly and dishes stay put. Their inertia resists the sudden motion — a classic demonstration of Newton's First Law in action.

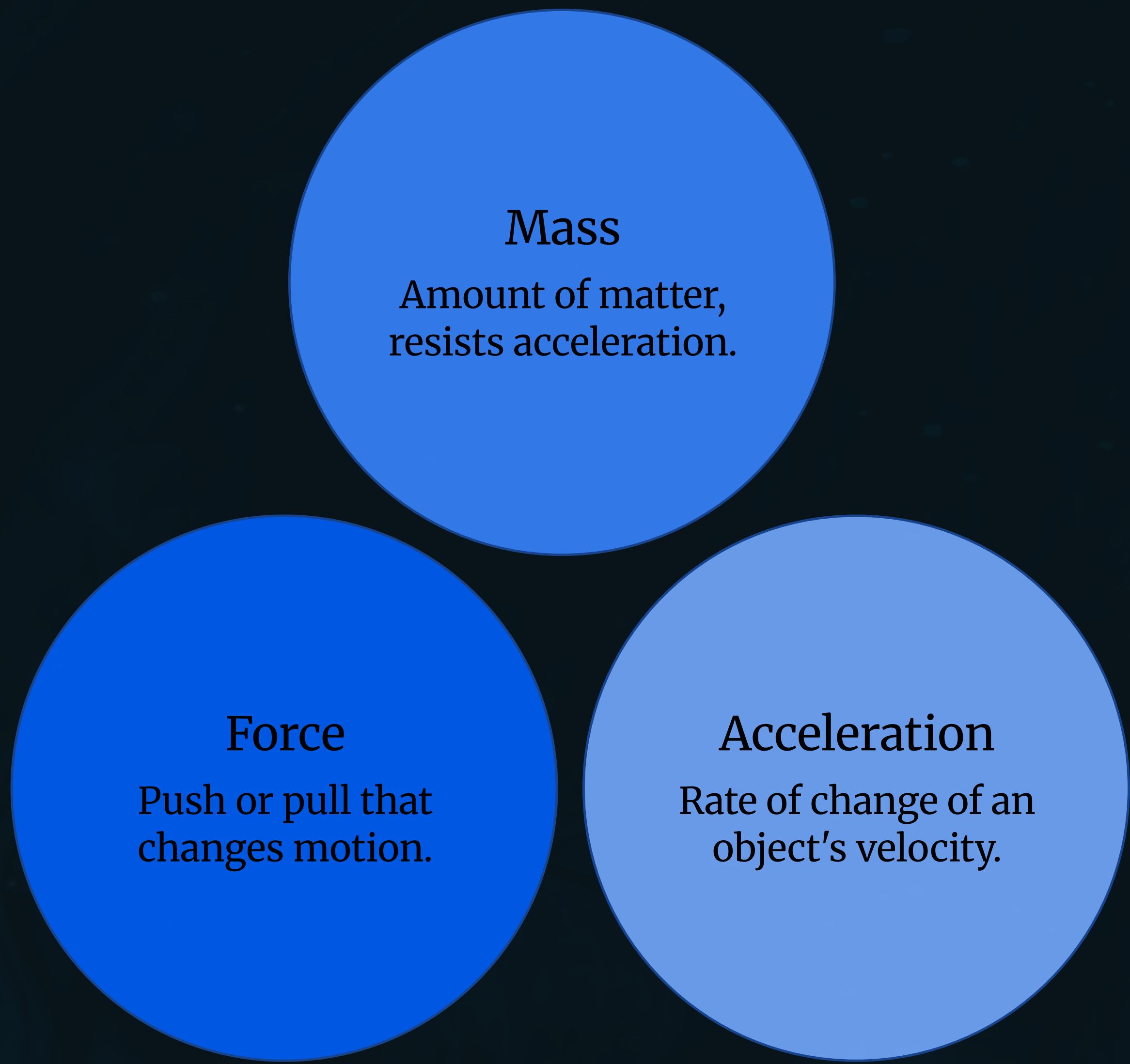
CHAPTER 2

The Law of Acceleration

Force and motion are not just related — they are mathematically bound. Newton's Second Law reveals the precise dance between **force, mass, and acceleration**.



Newton's Second Law: Force = Mass × Acceleration



These three quantities are linked by a single elegant equation: **F = ma**.

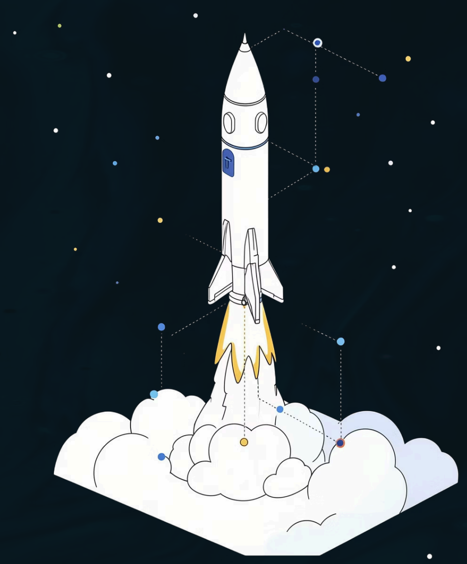
More Force → More Acceleration

Double the force on an object and you double its acceleration — assuming mass stays constant. Kick a ball harder, and it flies faster.

More Mass → Less Acceleration

Apply the same force to a bowling ball and a tennis ball — the lighter ball accelerates more. Mass is the measure of an object's resistance to acceleration.

Real-World Application: Rocket Science



How Rockets Defy Gravity

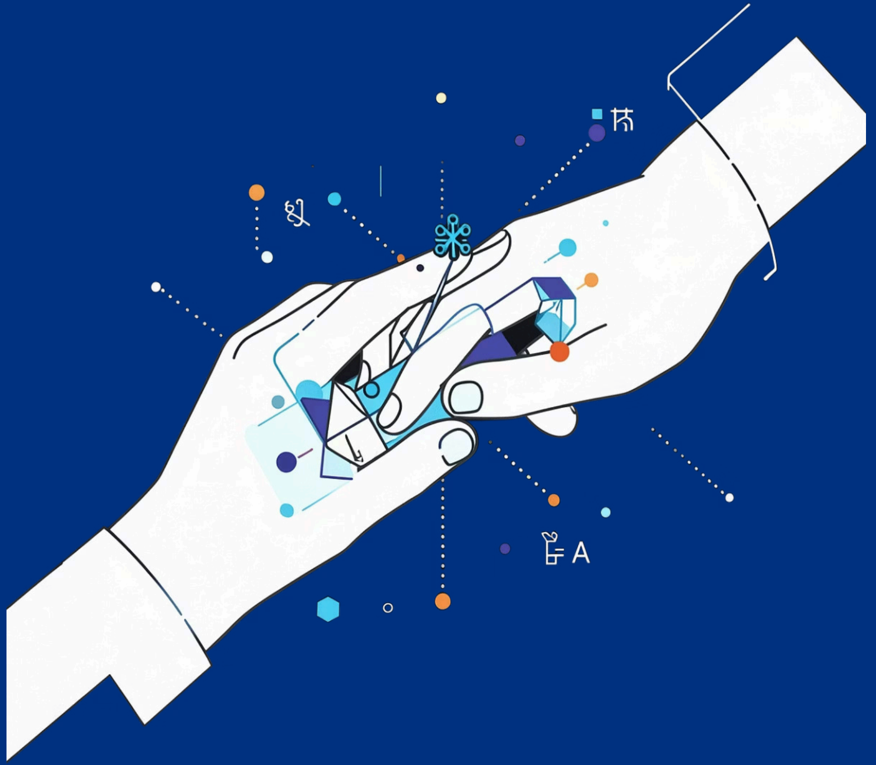
Rockets expel hot gas **downwards** with immense force. By Newton's Second Law, this enormous force — acting on the rocket's mass — produces tremendous upward acceleration.

A rocket's mass decreases as fuel burns, meaning the same thrust produces **increasing acceleration** over time — a direct application of F = ma.

CHAPTER 3

The Law of Action-Reaction

Every force is a conversation, not a monologue. Newton's Third Law tells us that forces always come in pairs — equal in magnitude, opposite in direction, and acting on **different objects.**



Newton's Third Law: For Every Action, There is an Equal and Opposite Reaction

Pushing a Wall

When you push a wall, the wall pushes back on you with **equal force**. You feel this reaction in your hands — forces always act in pairs.

Walking on Earth

Your foot pushes the ground **backwards**; the ground pushes your foot **forwards** with equal force. That forward reaction is what propels you ahead.

Bird in Flight

A bird's wings push air **downwards**; the air pushes the bird **upwards** with equal force. This reaction force is what keeps it airborne.

The Grand Finale: Understanding Our Universe

From a falling apple to the motion of galaxies, Newton's three laws form the **bedrock of classical mechanics** — a framework that has guided science and engineering for over 300 years.

First Law

Inertia — objects resist change in motion

Second Law

F = ma — force, mass, and acceleration linked

Third Law

Action-Reaction — forces always occur in pairs