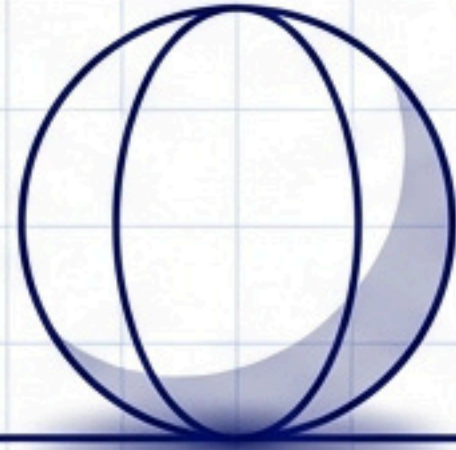




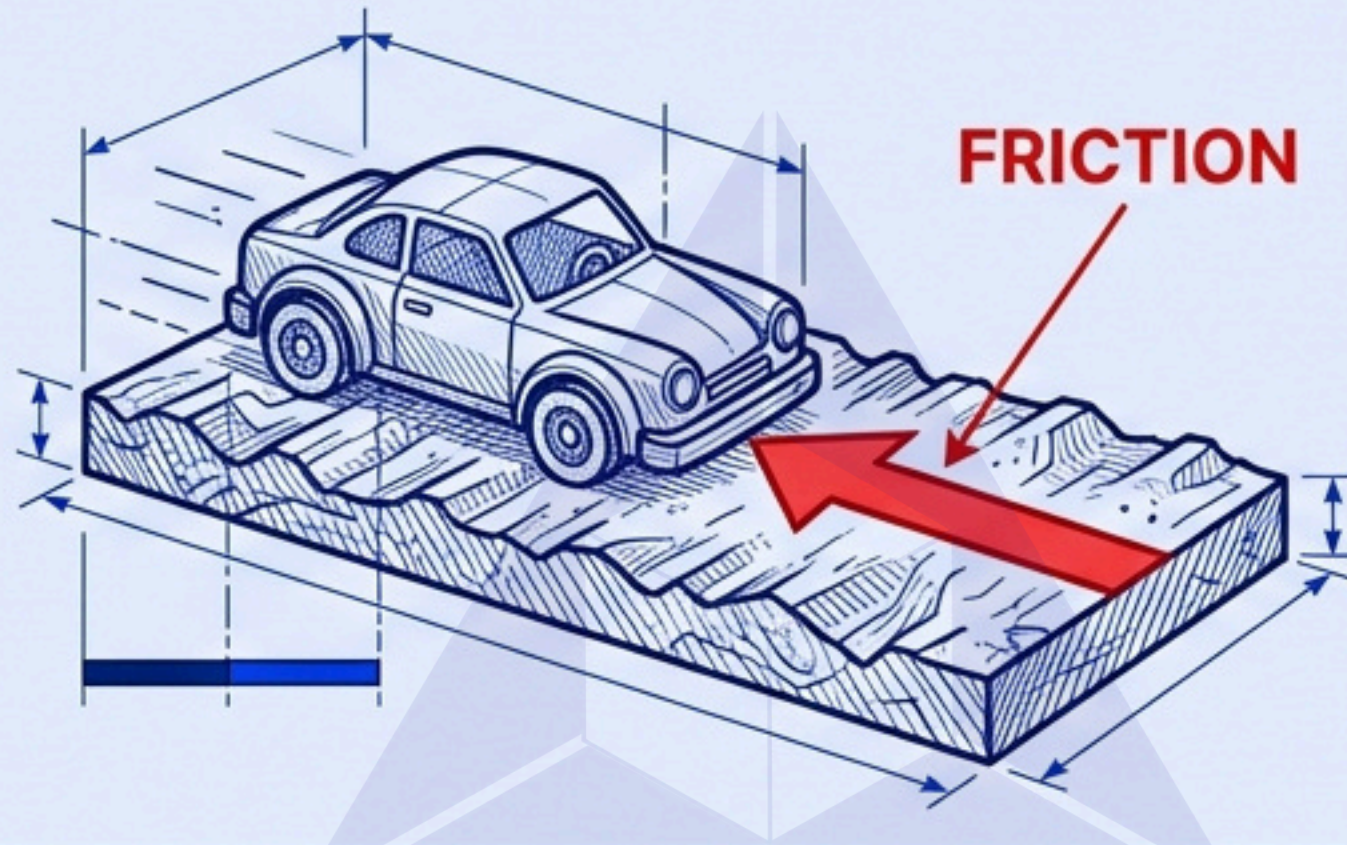
CHAPTER 4 • LAWS OF MOTION

4.3 The Law Of Inertia

Galileo's revolutionary thought experiment and the foundation of modern mechanics.

Class 11 Physics | Concept Explainer

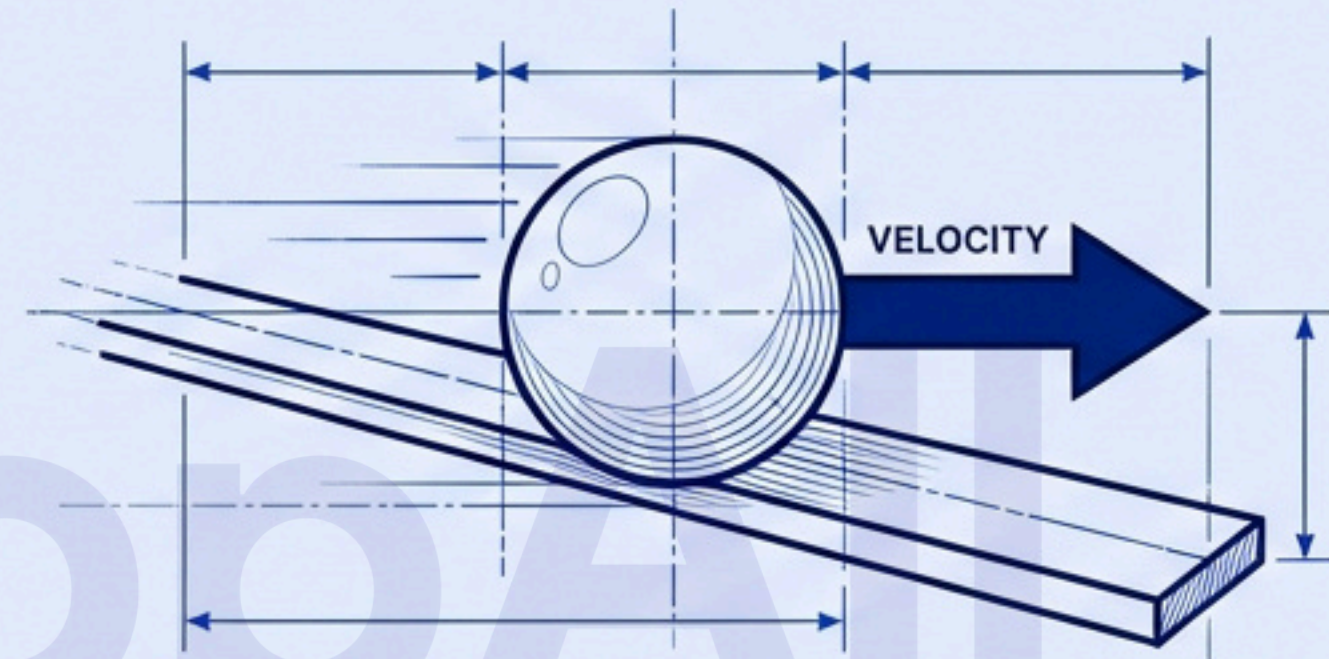
[H2]: The Flaw in Everyday Experience: Why do moving objects stop?



[H4]: The Everyday Illusion

In the real world, a moving toy car comes to rest because friction opposes its motion.

Conclusion: We mistakenly think force is needed just to keep an object moving.



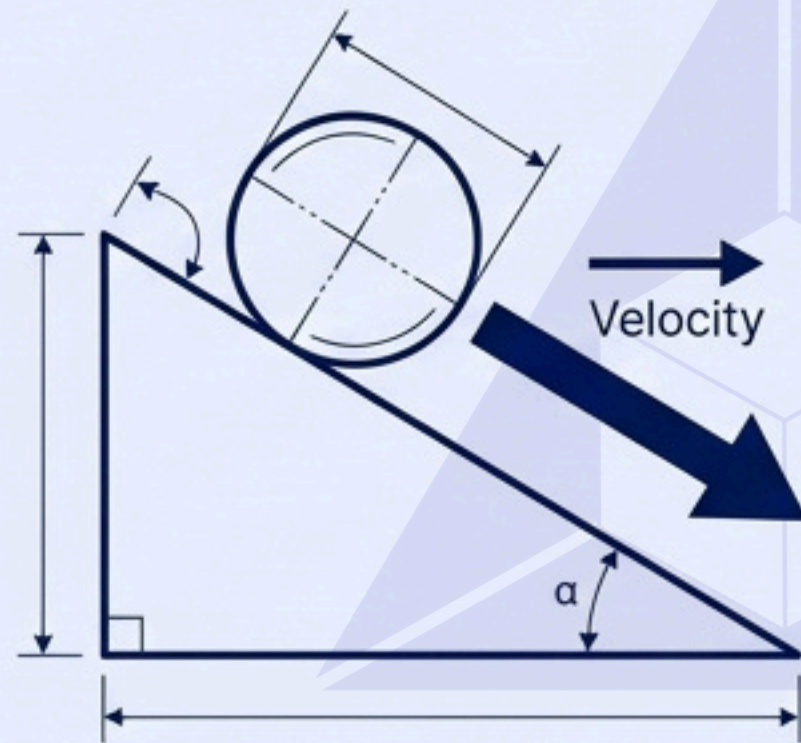
[H4]: Galileo's Insight

To find the true laws of nature, we must imagine a world with no opposing frictional forces.

Conclusion: Without friction, no external force is required to maintain uniform motion.

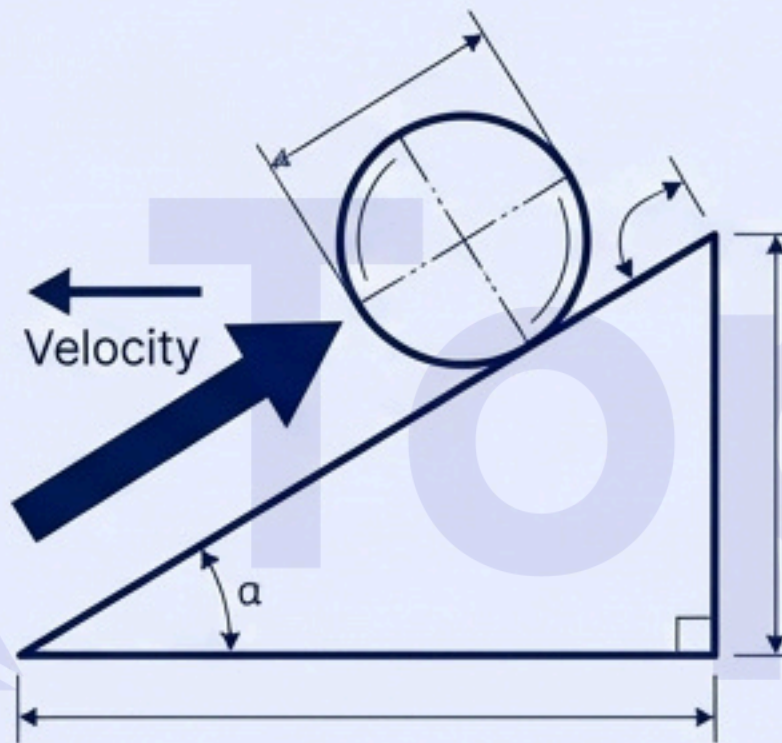
[H2]: Galileo's Observations of a Sphere

[OVERLINE LABEL]: **ACCELERATES**



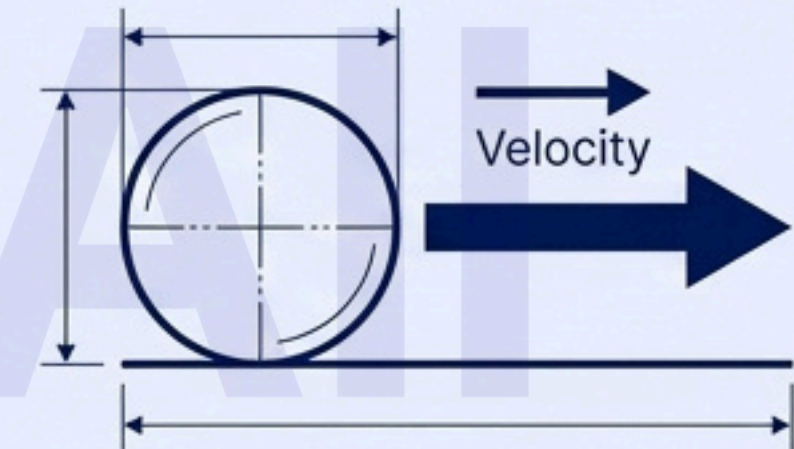
Velocity increases as it moves down the incline.

[OVERLINE LABEL]: **RETARDS**



Velocity decreases as it climbs against the incline.

[OVERLINE LABEL]: **CONSTANT VELOCITY**



The intermediate case. It neither accelerates nor retards.



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Let's Test Them Now.**

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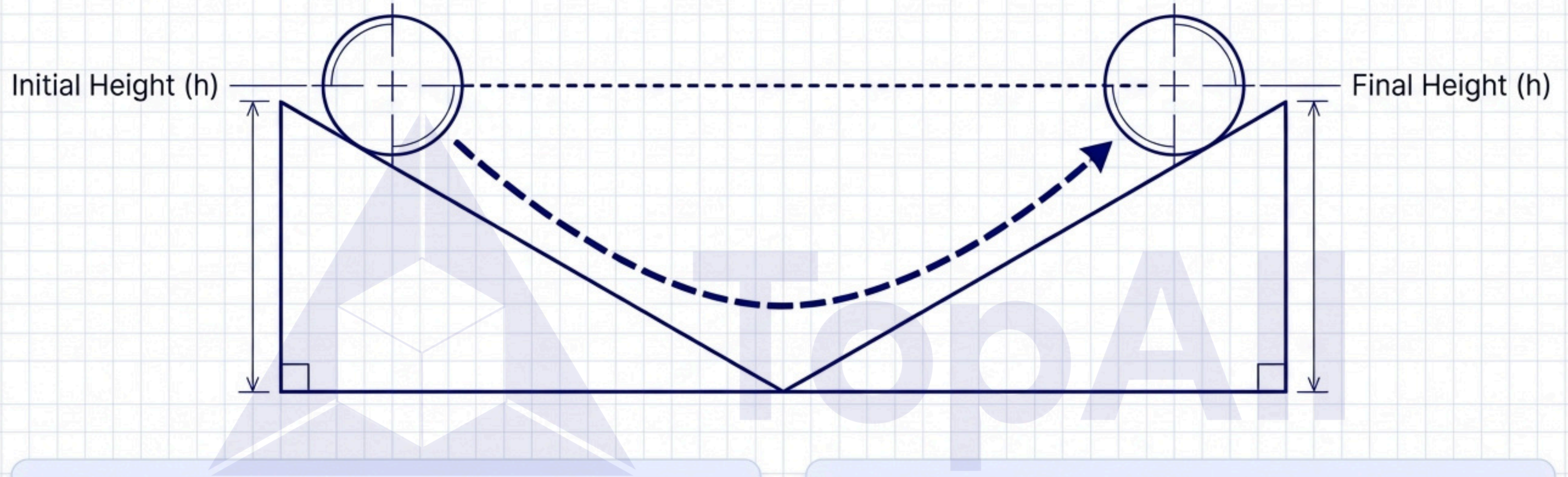
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- » Track Your Performance Smarter



[H2]: The Double Inclined Plane Experiment



[H4]: The Setup

A ball is released from rest on a frictionless inclined plane. It rolls down and climbs up an opposing plane.

[H4]: The Result

The ball always reaches a final height exactly equal to its initial height. This happens regardless of the distance traveled along the slope.

[H2]: The Limiting Case: Zero Slope

[CHIP]: Reference: Fig. 4.1(b)



[CHIP]: 1. Decreasing the slope:

The ball must travel a longer distance to reach its required initial height.



[CHIP]: 2. The Limiting Case (Slope = 0):

The second plane is lowered until it is perfectly horizontal.



[CHIP]: 3. The Result:

The ball must travel an infinite distance trying to reach its initial height. Its motion never ceases.

[H2]: Defining “Resistance to Change”



INERTIA: The inherent property of a body to resist any change in its state of rest or uniform motion.

[H4]: State of Rest

Velocity (v) = 0
Acceleration (a) = 0

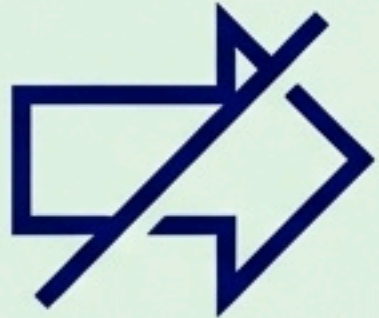
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[H4]: Uniform Linear Motion

Velocity (v) = Constant
Acceleration (a) = 0

In both states, the net external force is ZERO.

[H2]: Key Takeaways



Friction hides the truth: Objects stop due to opposing forces (friction), not because they naturally 'want' to come to rest.



Zero net force = Zero acceleration: To maintain uniform motion in the real world, applied force only needs to exactly cancel out friction.



Inertia is fundamental: A body does not change its state of rest or uniform motion unless compelled by a net external force.



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