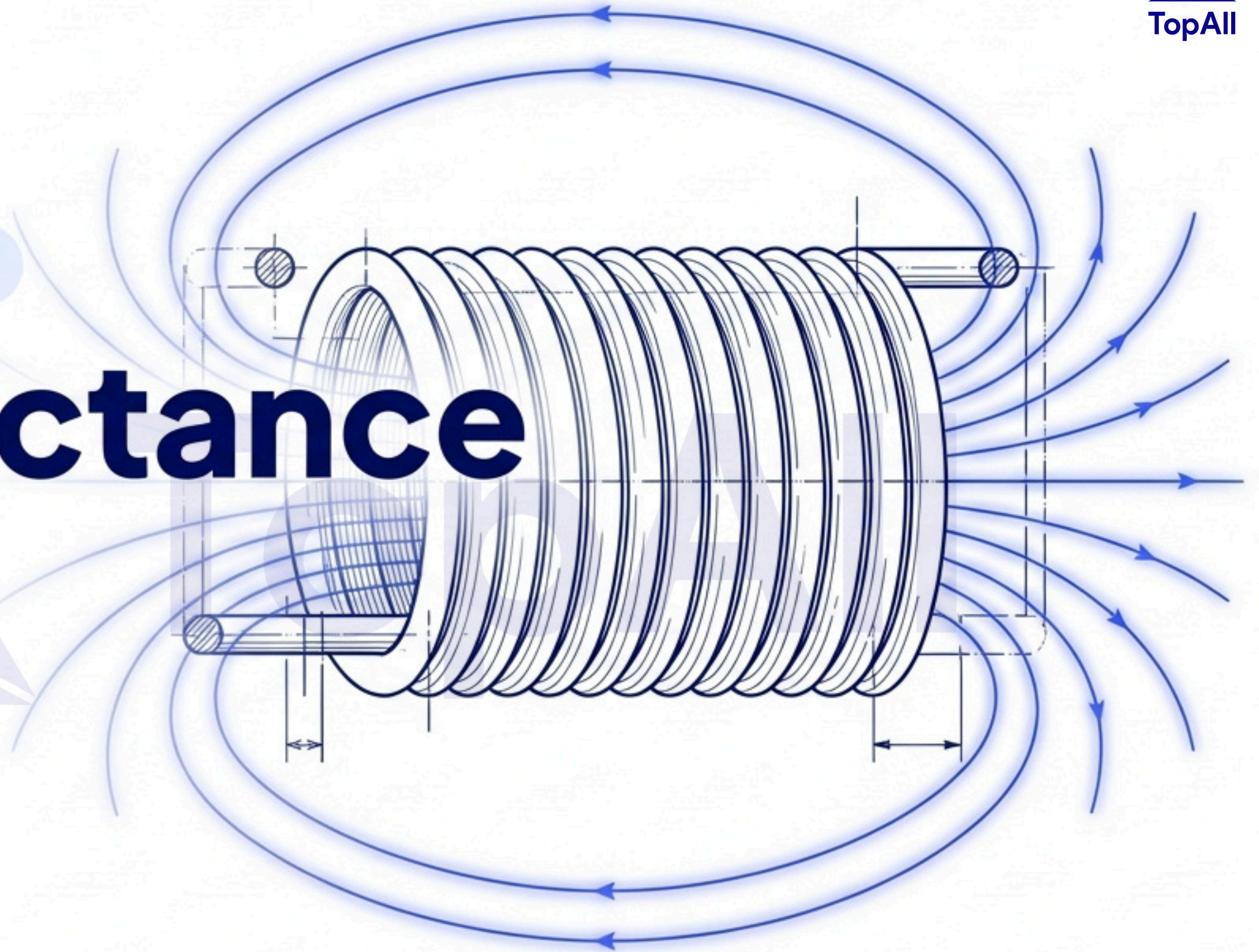


CLASS 12 PHYSICS | SECTION 6.7.2

Self-Inductance

The Blueprint of
Electrical Inertia

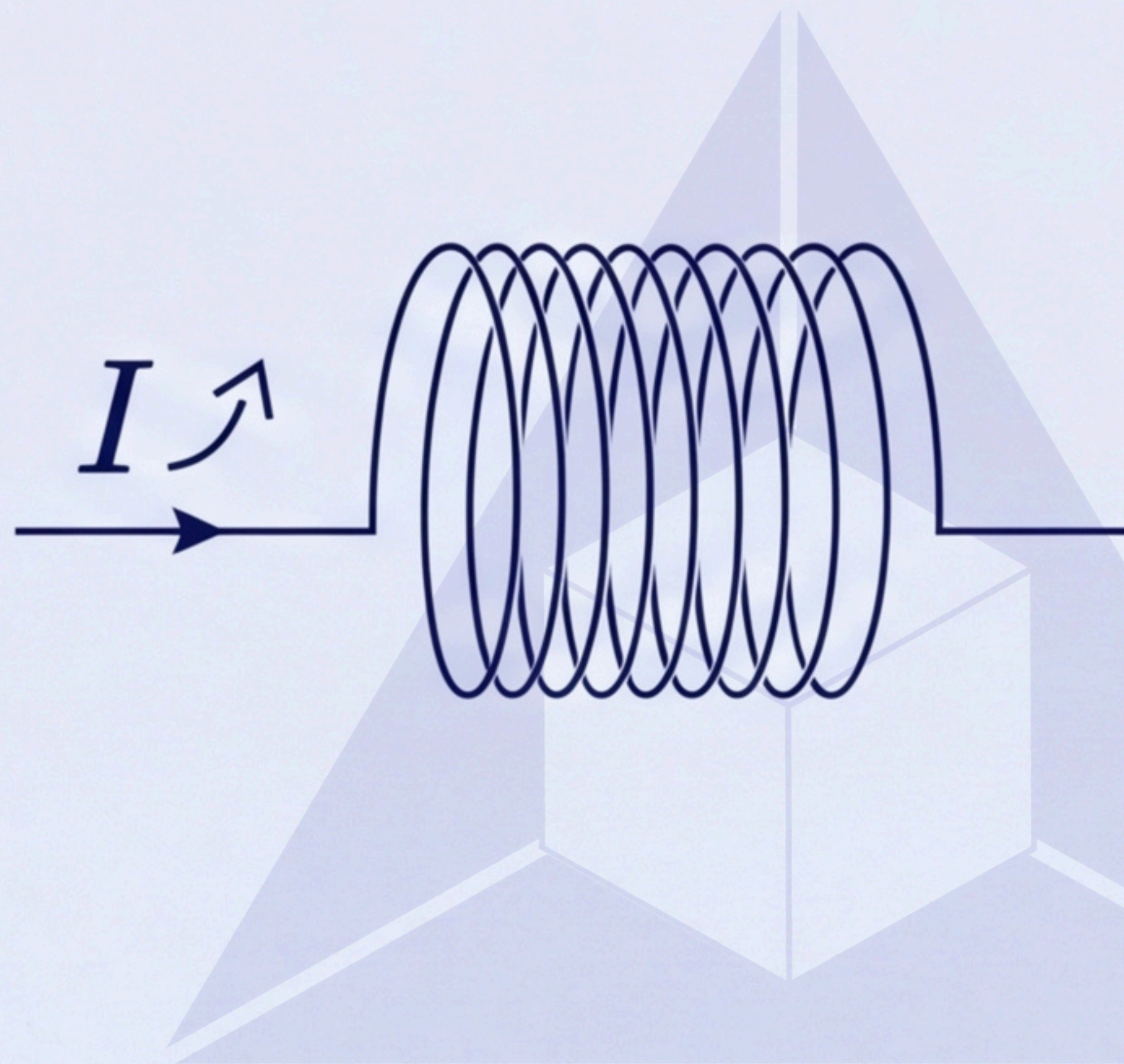
NEET / JEE Core Concept Prep



A Coil Reacting to Its Own Current

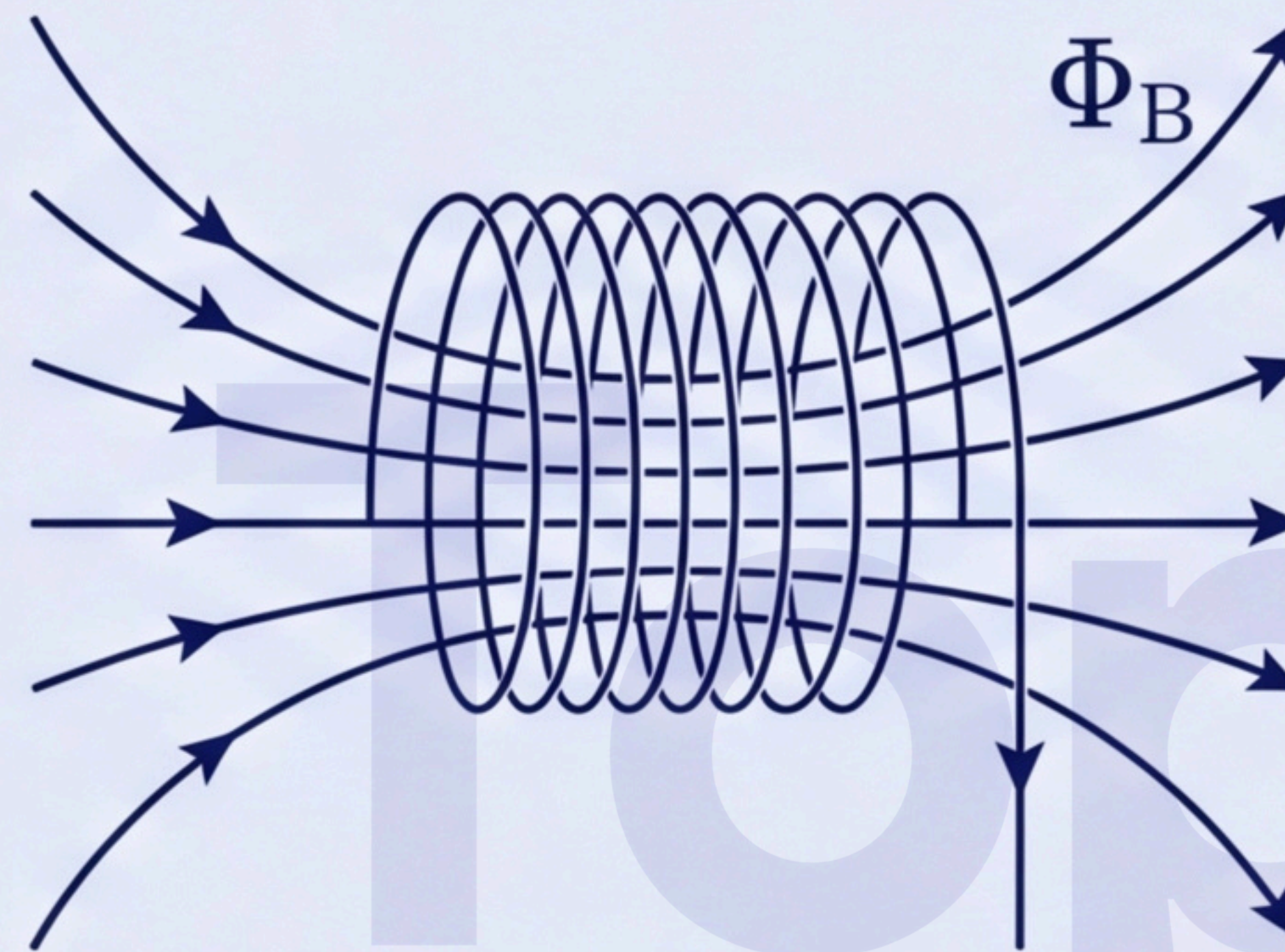
Electrical Inertia

1. Changing Current



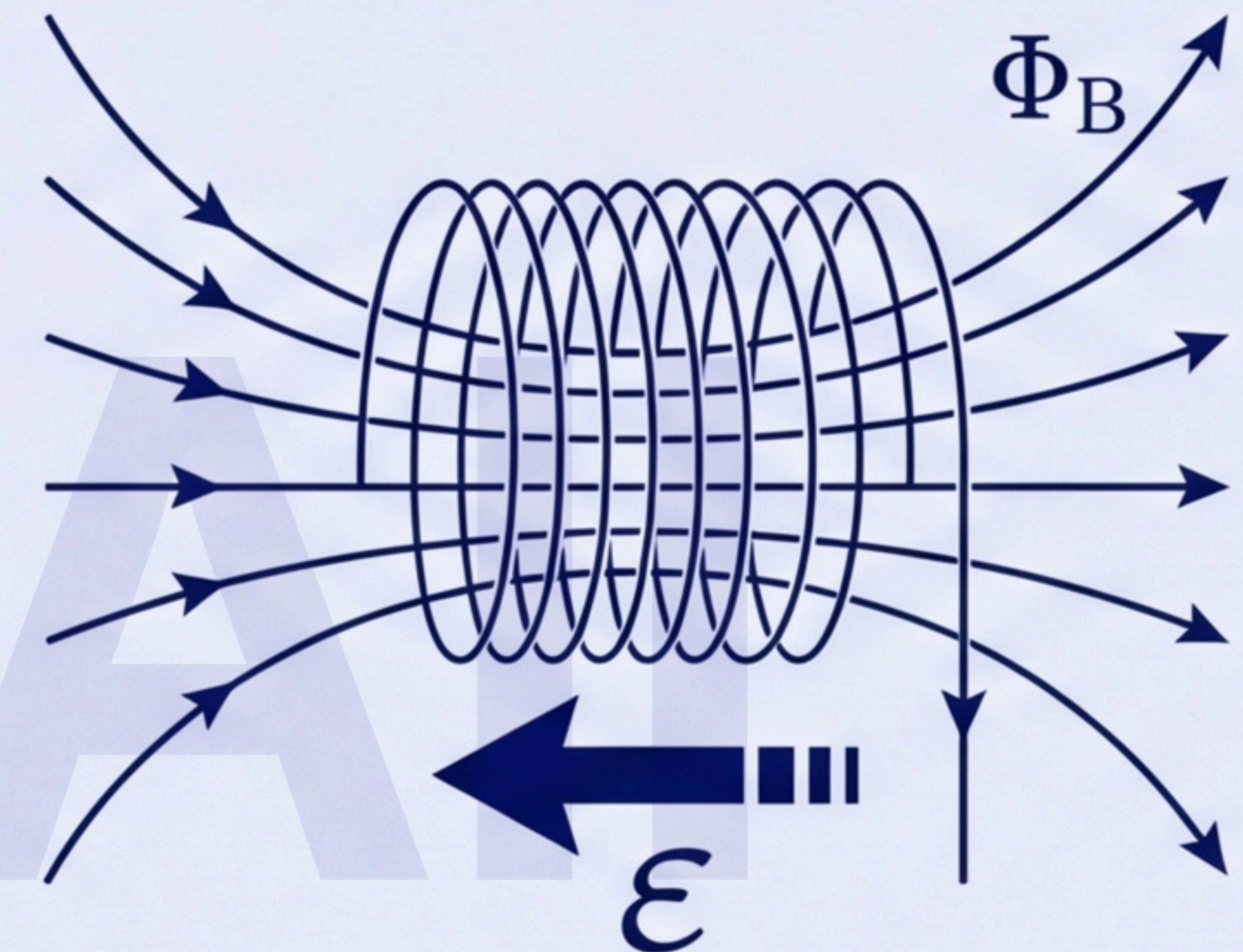
The current I through an isolated coil varies with time.

2. Changing Flux



This alters the magnetic flux Φ_B linking the coil itself.

3. Self-Induction



An induced emf is generated, strictly opposing the change in current.

The Flux-Linkage Relation

For a closely wound coil of N turns, the total flux linkage is directly proportional to the current I .

$$N\Phi_B = LI$$

Total Flux Linkage
(Weber, Wb)

Self-Inductance
(Constant of Proportionality)

Current
(Ampere, A)



Exam Tip: The SI unit of inductance L is the Henry (H).



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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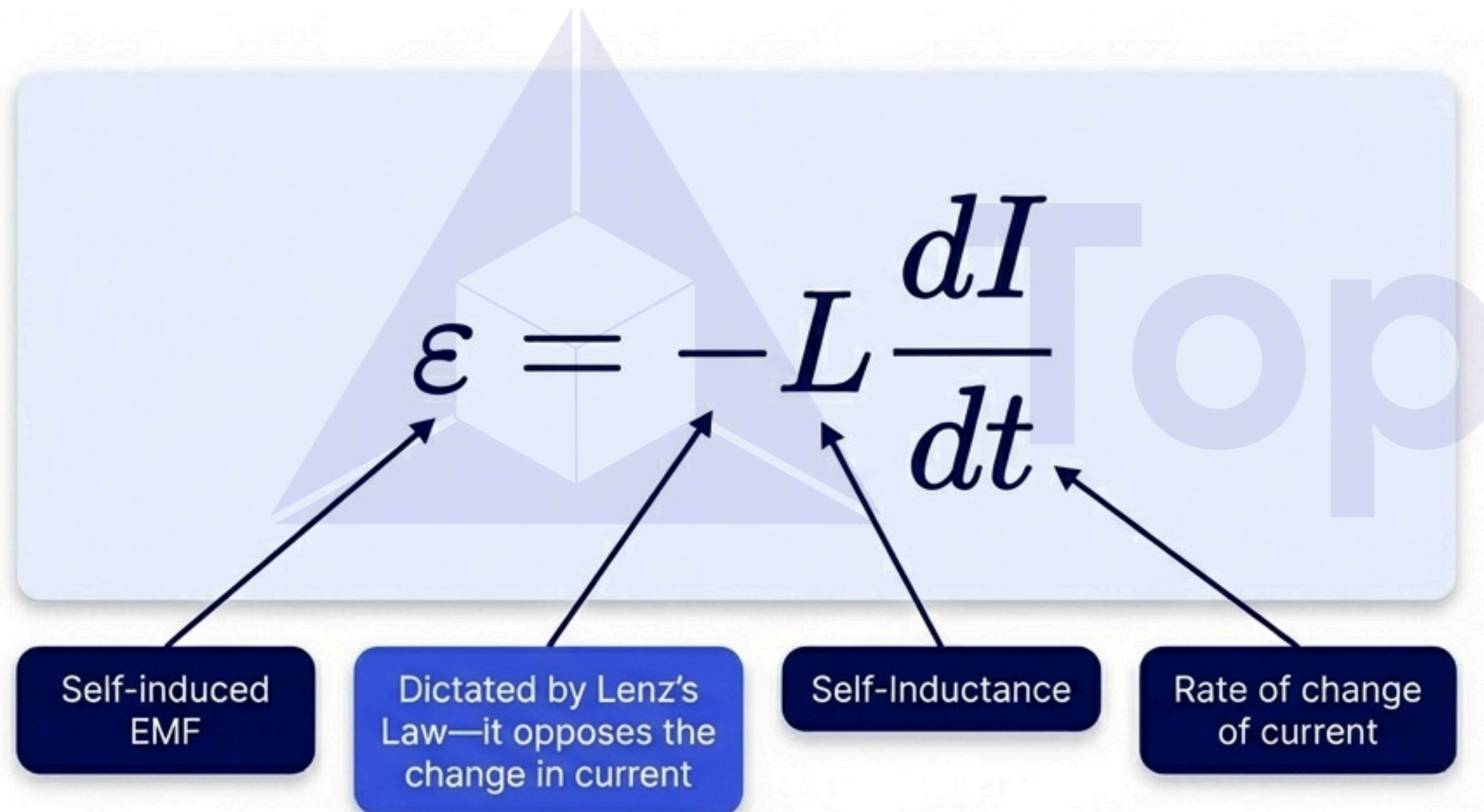
Key Highlights

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- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



The Rule of Dynamic Opposition

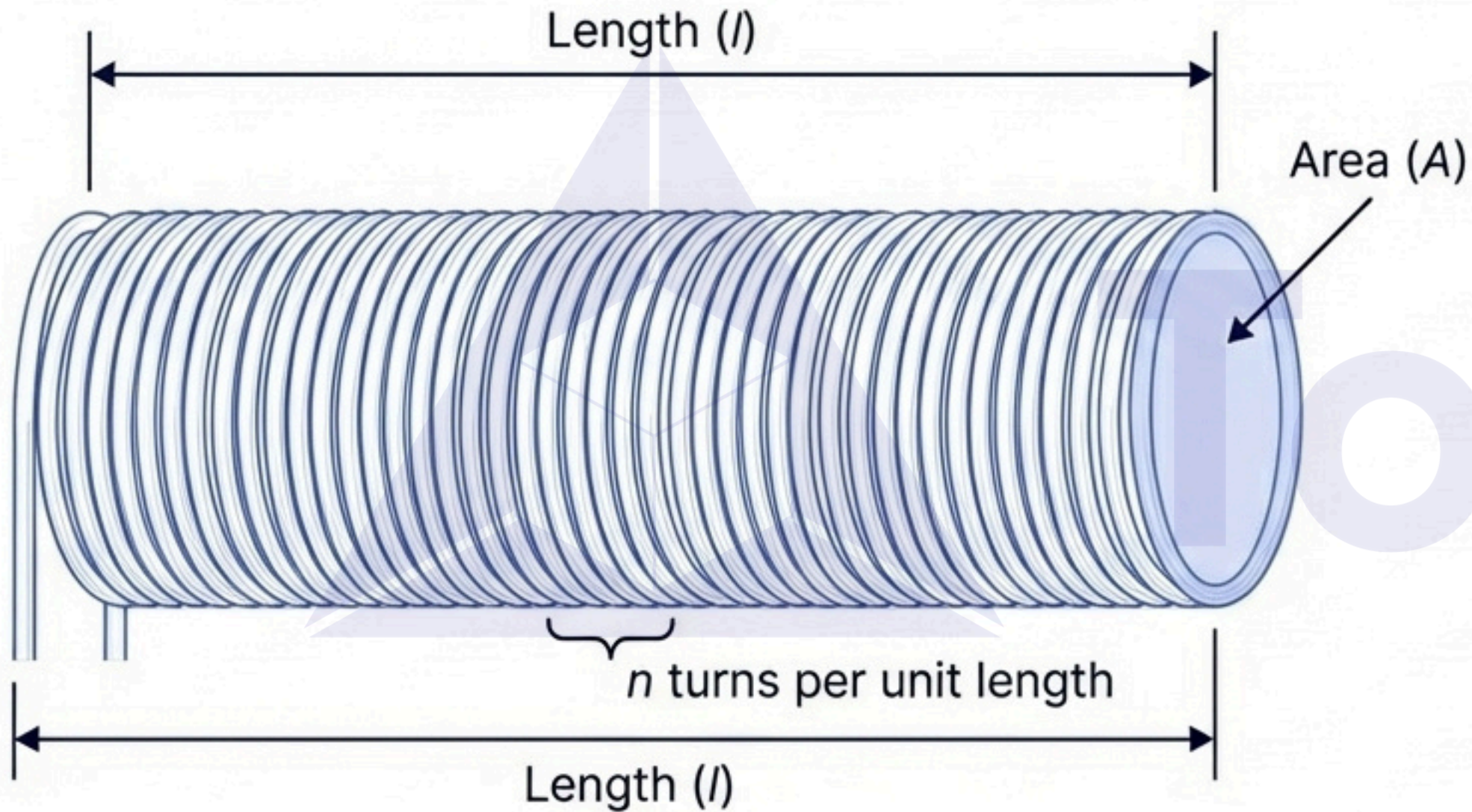
When current varies with time, the changing flux induces an emf that acts as a back emf.



BACK EMF

Opposes any increase or decrease in current, establishing the coil's electrical inertia.

Anatomy of a Solenoid's Inductance



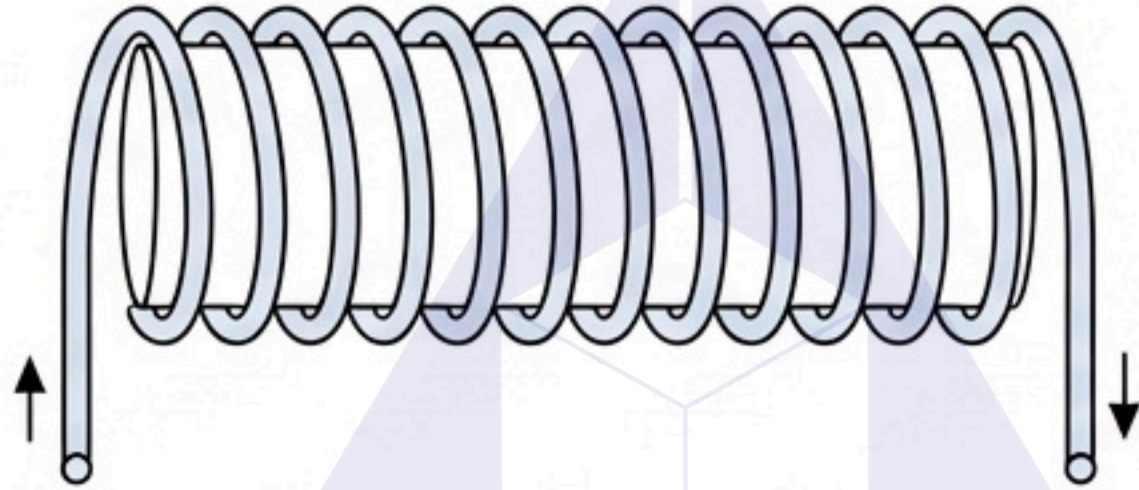
Total turns $N = nl$

$$L = \mu_0 n^2 A l$$

- Inductance depends only on the geometry of the coil, not on the current.
- Derived from the magnetic field $B = \mu_0 n l$ inside a long solenoid.

The Impact of a Magnetic Core

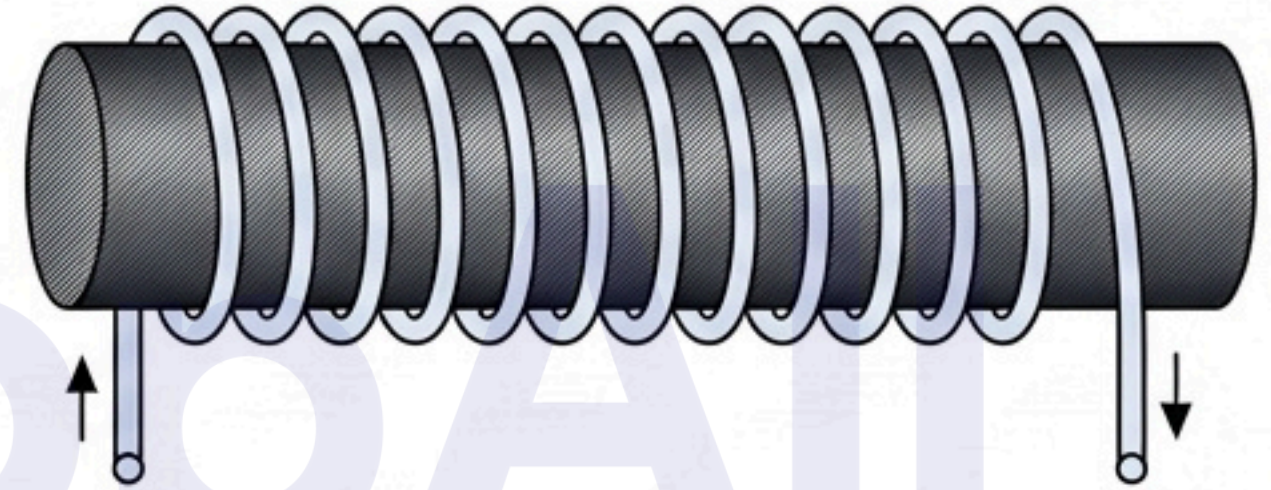
Air-Core Solenoid



Permeability: μ_0 (Free space)

Formula: $L_0 = \mu_0 n^2 A l$

Magnetic-Core Solenoid



Permeability: $\mu = \mu_r \mu_0$

Formula: $L = \mu_r \mu_0 n^2 A l$



Exam Tip: Inserting a high-permeability material (like soft iron, $\mu_r \gg 1$) acts as a multiplier, drastically increasing self-inductance.

Key Takeaways: Self-Inductance

Success

- ✓ **Concept:** Self-induction is "electrical inertia." A coil opposes any change to its own current via a back-emf.
- ✓ **Core Equations:** Flux linkage is $N\Phi_B = LI$, and induced emf is $\varepsilon = -L (dI/dt)$.
- ✓ **Dependencies:** L depends exclusively on the coil's geometry (A , l , n) and the core material's permeability (μ_r).

Try Chapter MCQs Next →



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