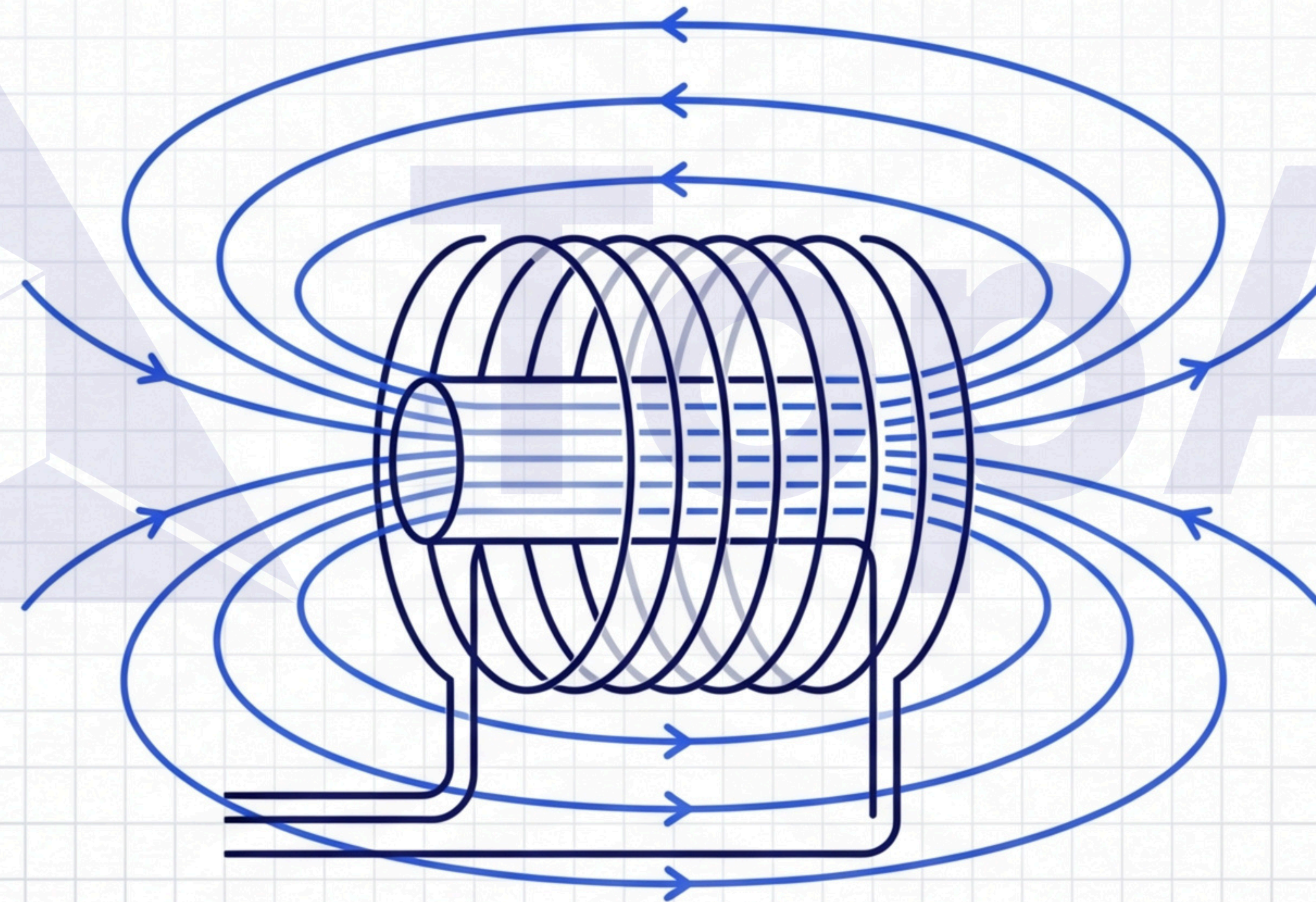


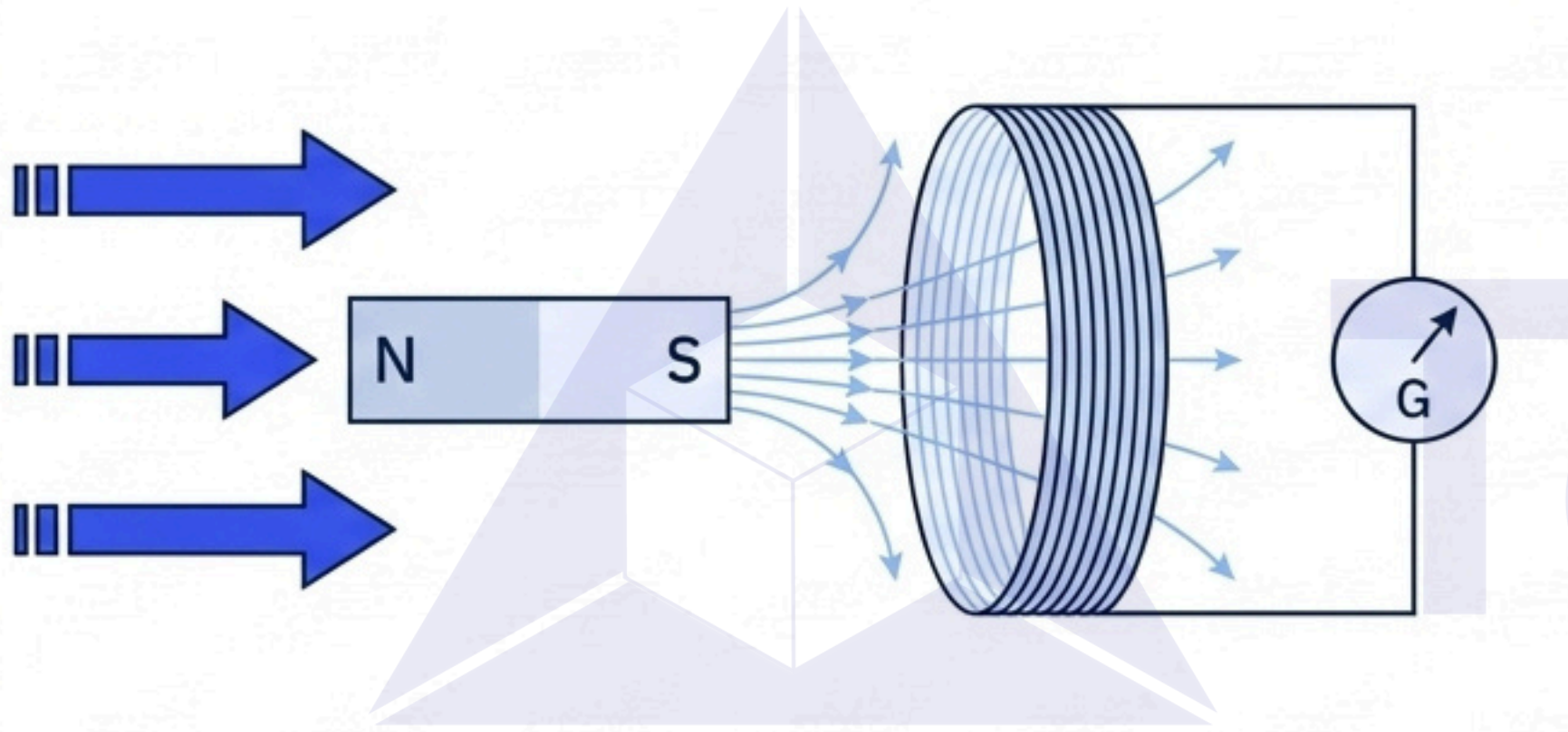
Faraday's Law Of Induction

Section 6.4 • Class 12 Physics (NEET / JEE Prep)



[FROM EXPERIMENT TO LAW]

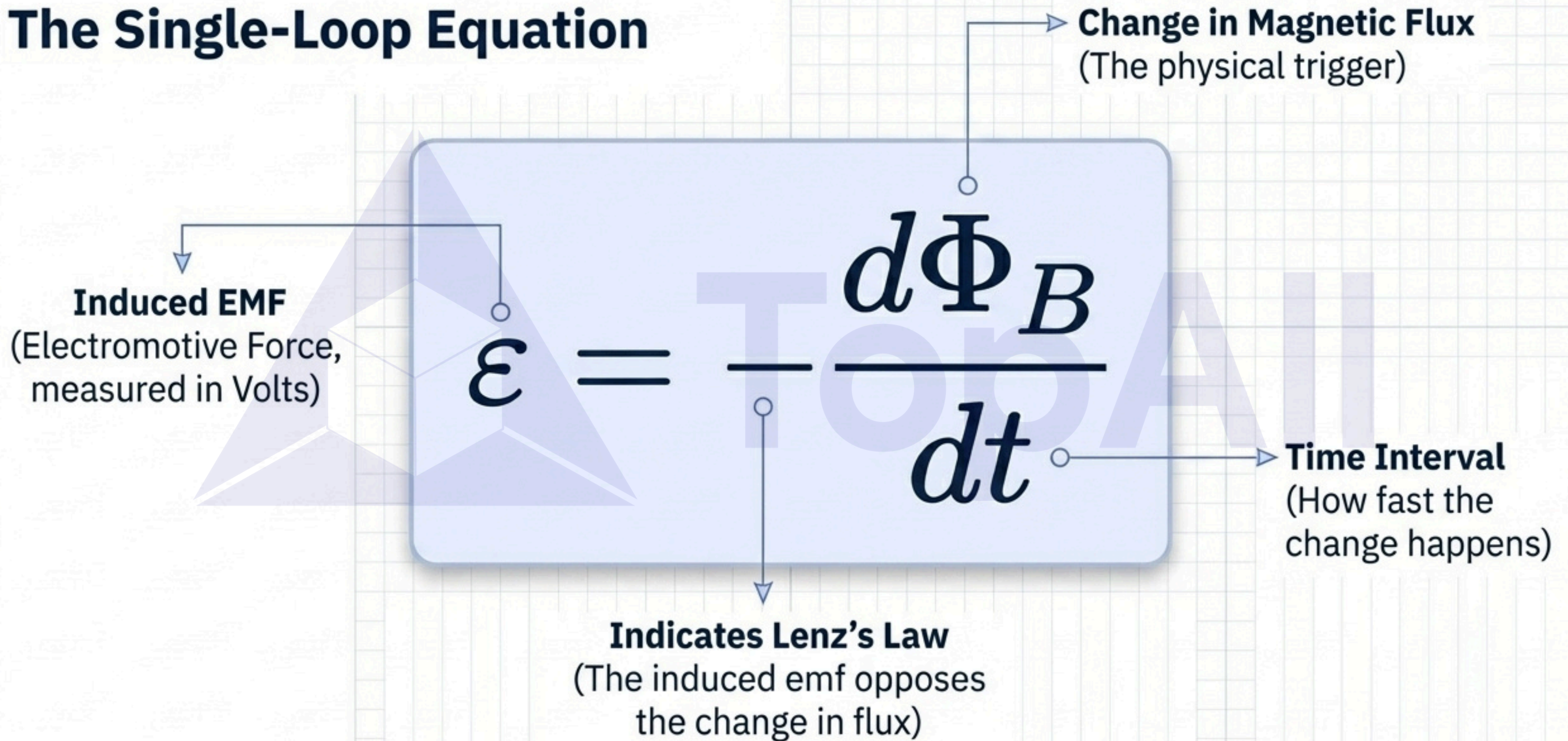
Translating Motion into Principle



- Relative motion between a magnet and a coil induces an electric current.
- The magnetic flux through the coil is changing.

“The magnitude of the induced emf in a circuit is equal to the time rate of change of magnetic flux through the circuit.”

The Single-Loop Equation



The diagram shows the equation $\mathcal{E} = -\frac{d\Phi_B}{dt}$ centered on a light blue rectangular background. Four arrows point from descriptive text to parts of the equation: one from the left to the $\mathcal{E}$, one from the top right to the $d\Phi_B$ term, one from the bottom center to the minus sign, and one from the bottom right to the dt term.

Induced EMF
(Electromotive Force,
measured in Volts)

Change in Magnetic Flux
(The physical trigger)

Indicates Lenz's Law
(The induced emf opposes
the change in flux)

Time Interval
(How fast the
change happens)

$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$



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$$E=mc^2$$



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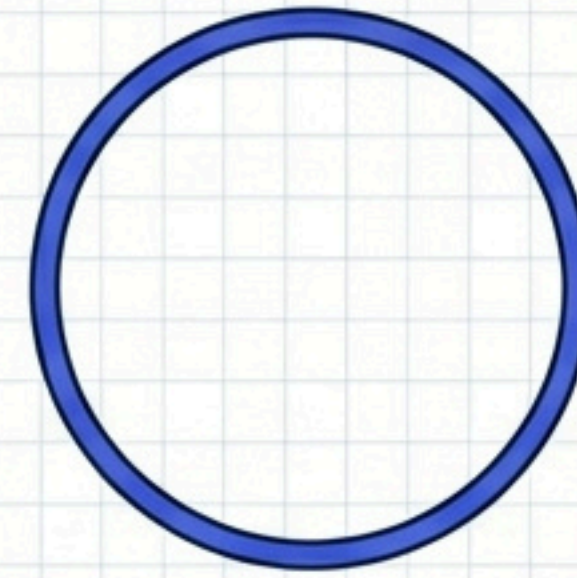
Key Highlights

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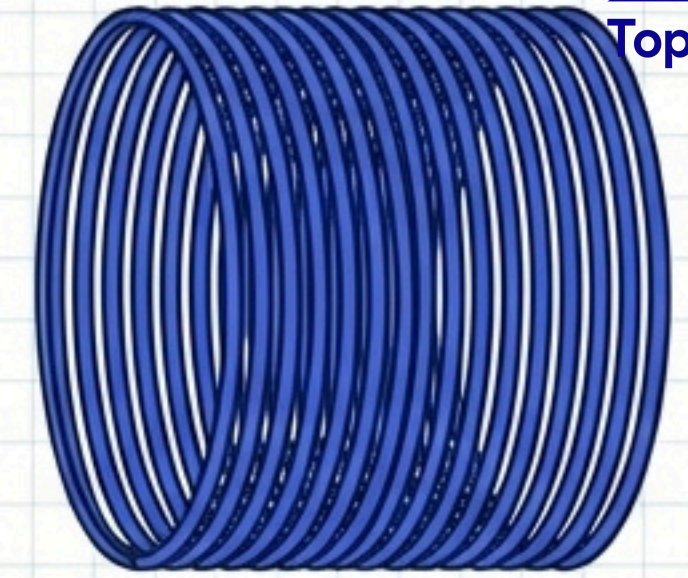


[SCALED FORMULA: EQ 6.4]

The N-Turn Coil Multiplier



1 Turn = Base EMF



N Turns = $N \times$ Base EMF

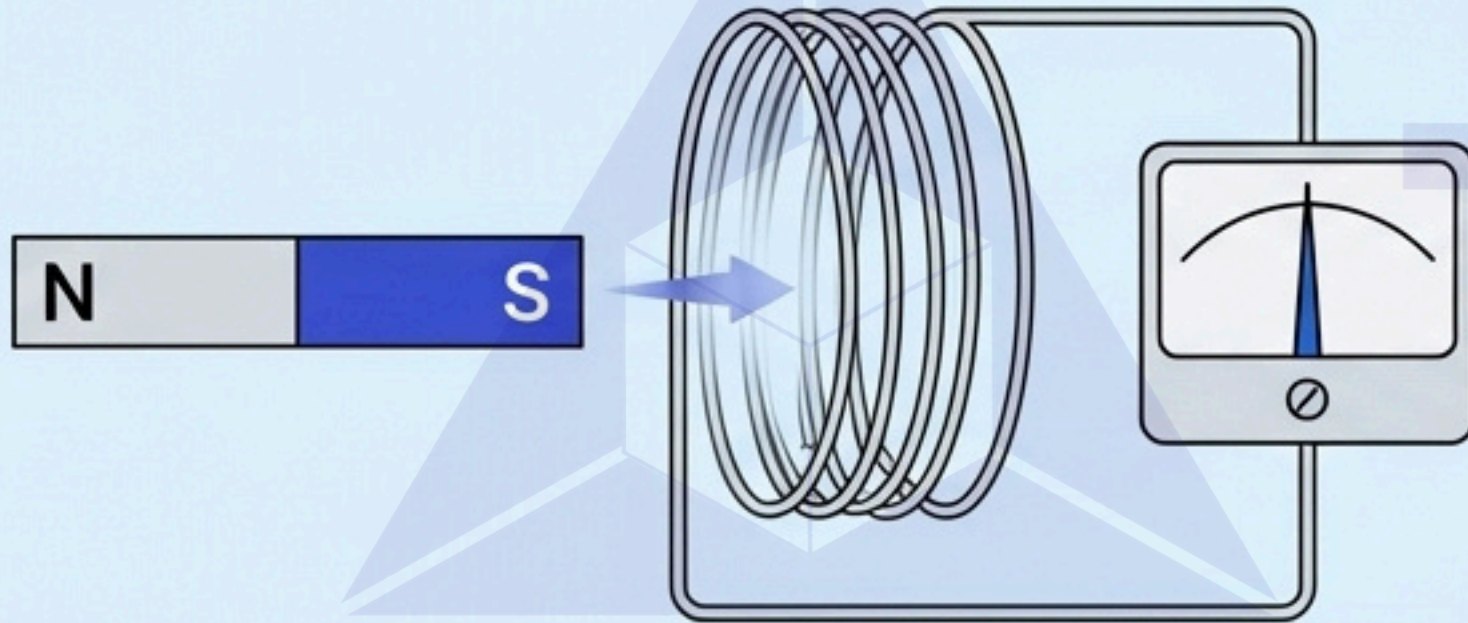
For a closely wound coil, the flux change links to each turn equally.

$$\mathcal{E} = -N \frac{d\Phi_B}{dt}$$

Number of Turns
(Acts as a linear multiplier to increase the induced emf)

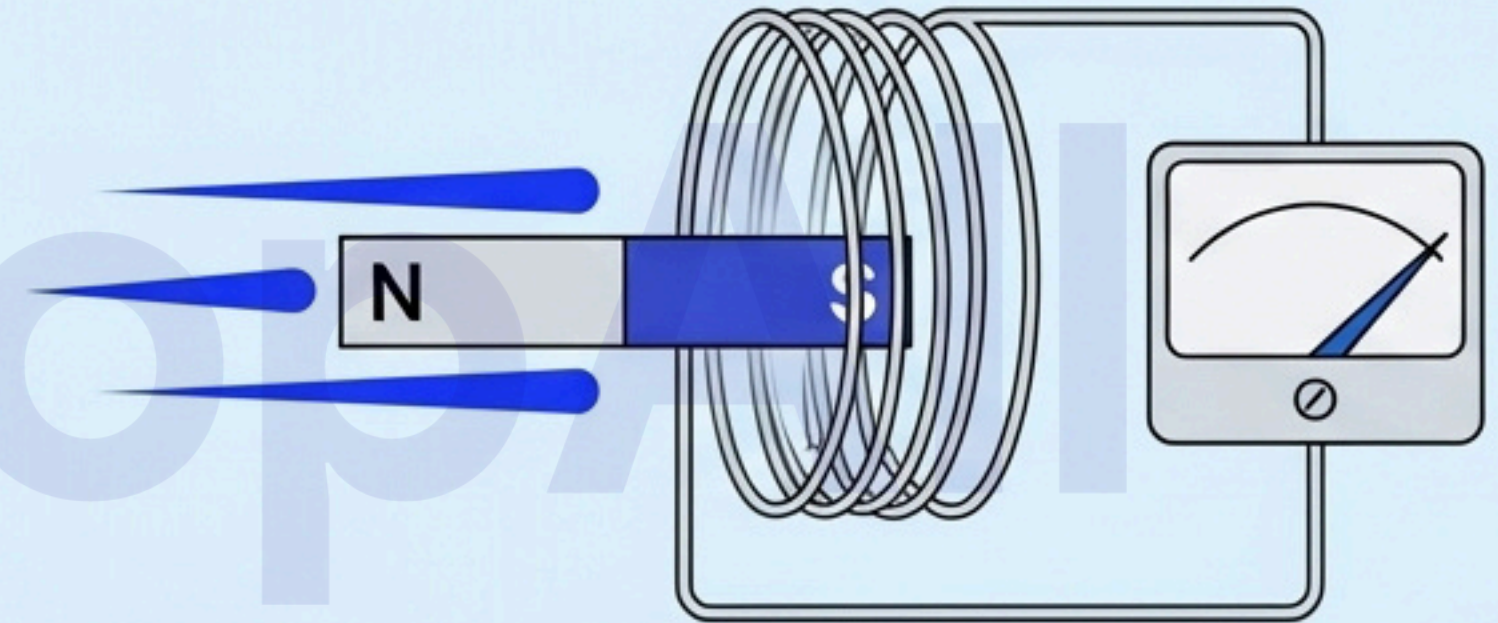
Why 'Rate of Change' Matters

Slow Flux Change (Large dt)



Small Induced EMF (ϵ)

Fast Flux Change (Small dt)



Large Induced EMF (ϵ)

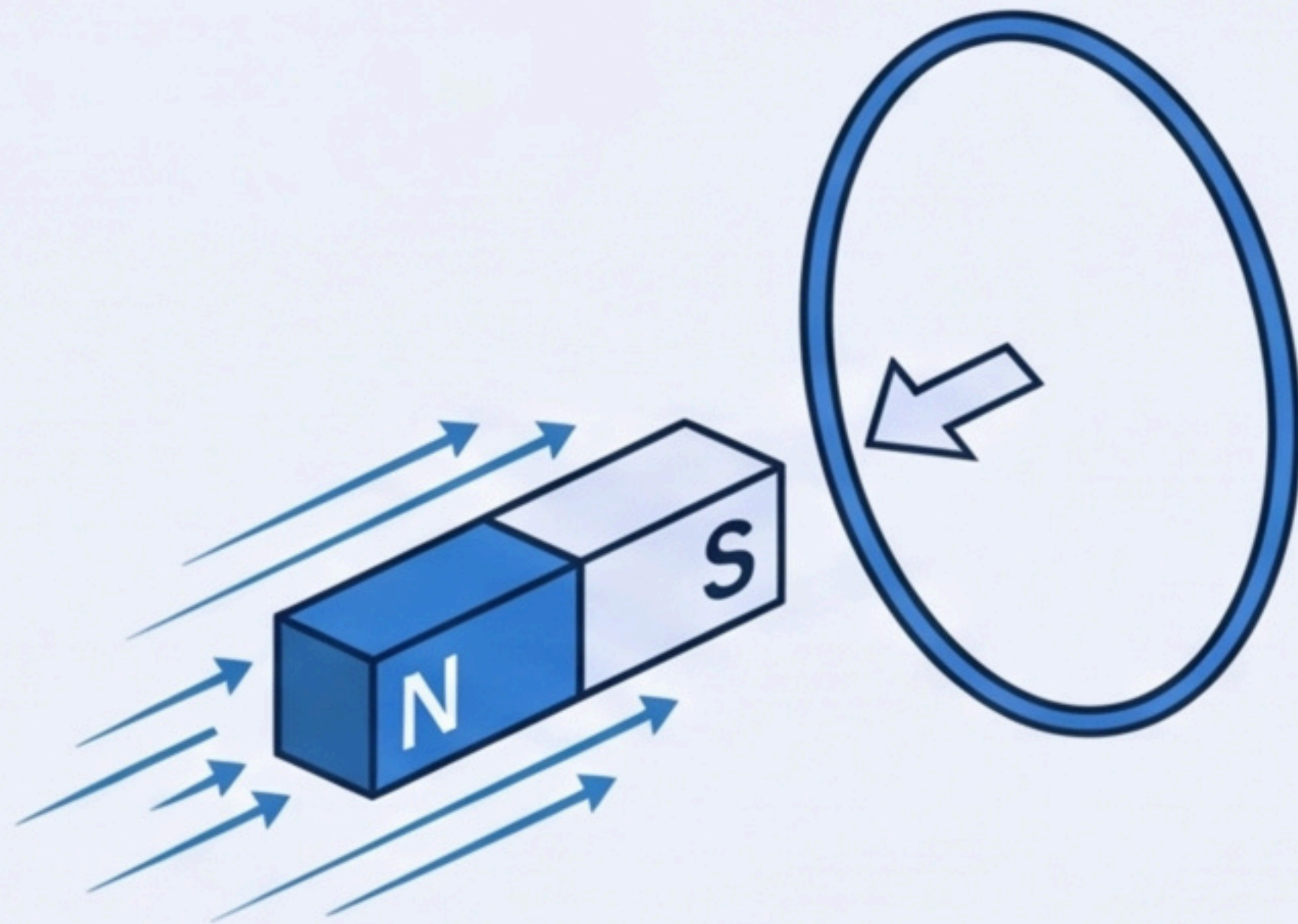
The faster the magnetic flux changes, the greater the induced electromotive force.

[EXAM TIP: APPLICATION]

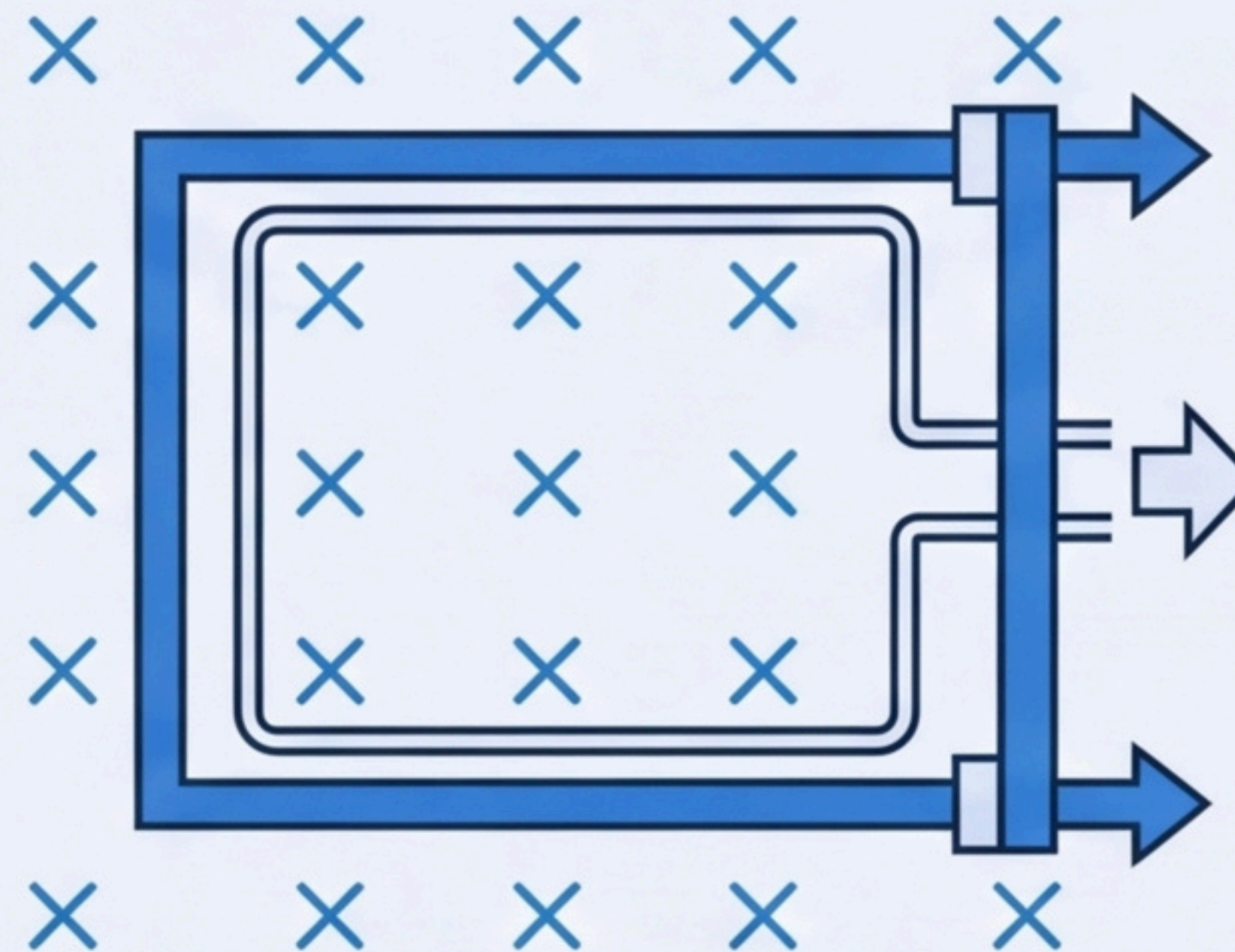
Three Ways to Change Magnetic Flux

Because $\Phi_B = BA \cos \theta$, changing any of these three variables induces an EMF.

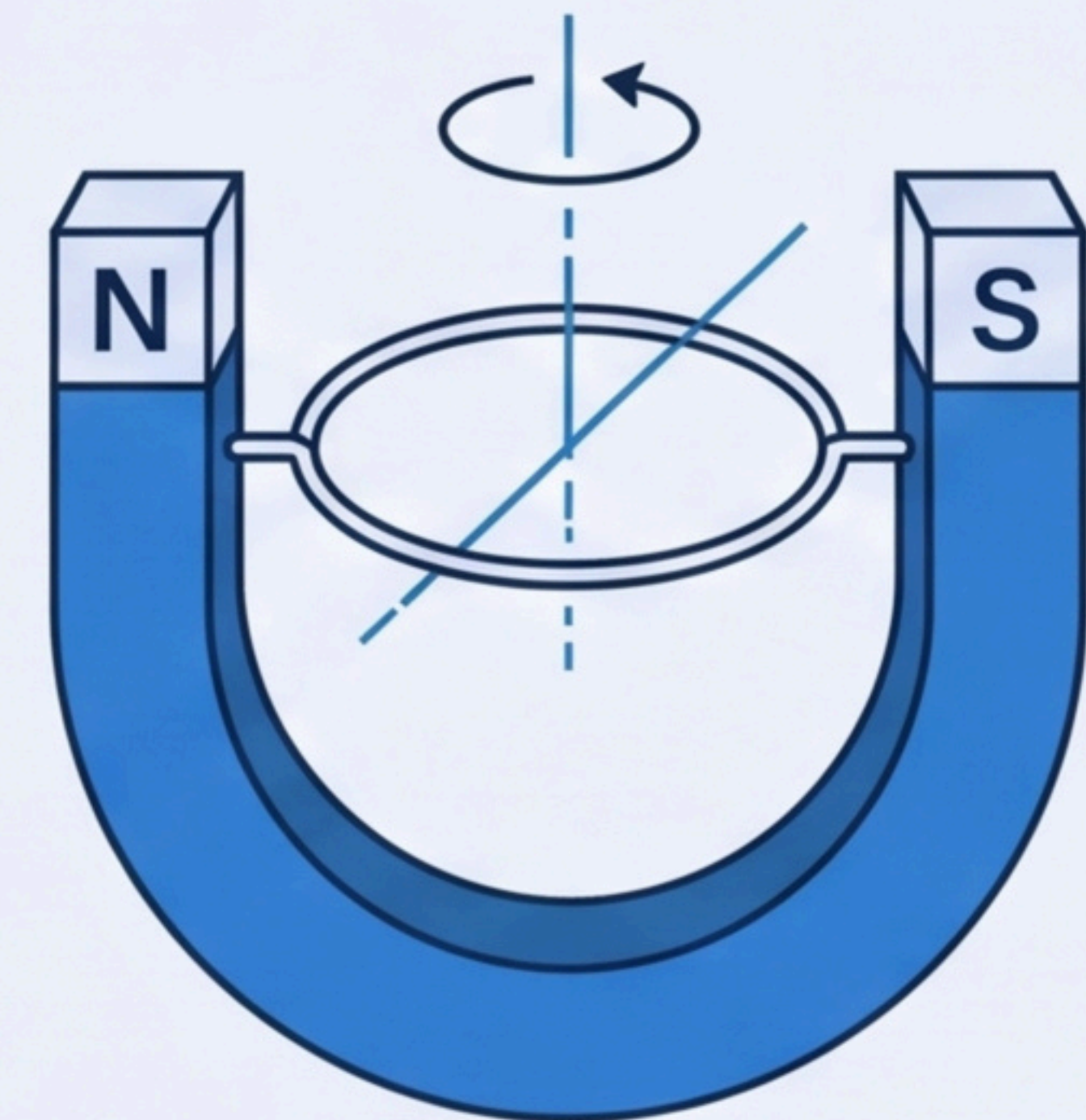
1. Change Magnetic Field (B)



2. Change Area (A)



3. Change Angle (θ)



Key Takeaways

- **Rate is Everything:** Induced EMF depends on the time rate of change of magnetic flux, not the absolute value.
- **The Master Formula:** $\varepsilon = -N (d\Phi_B / dt)$ is your primary tool for calculating magnitude.
- **The Three Triggers:** You can induce an EMF by altering the magnetic field (B), the loop's area (A), or its orientation angle (θ).

[START PRACTICE] Try Chapter 6 MCQs Next →



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