

Magnetism and Gauss's Law

5.3 Concept Mastery & Exam Diagnostic

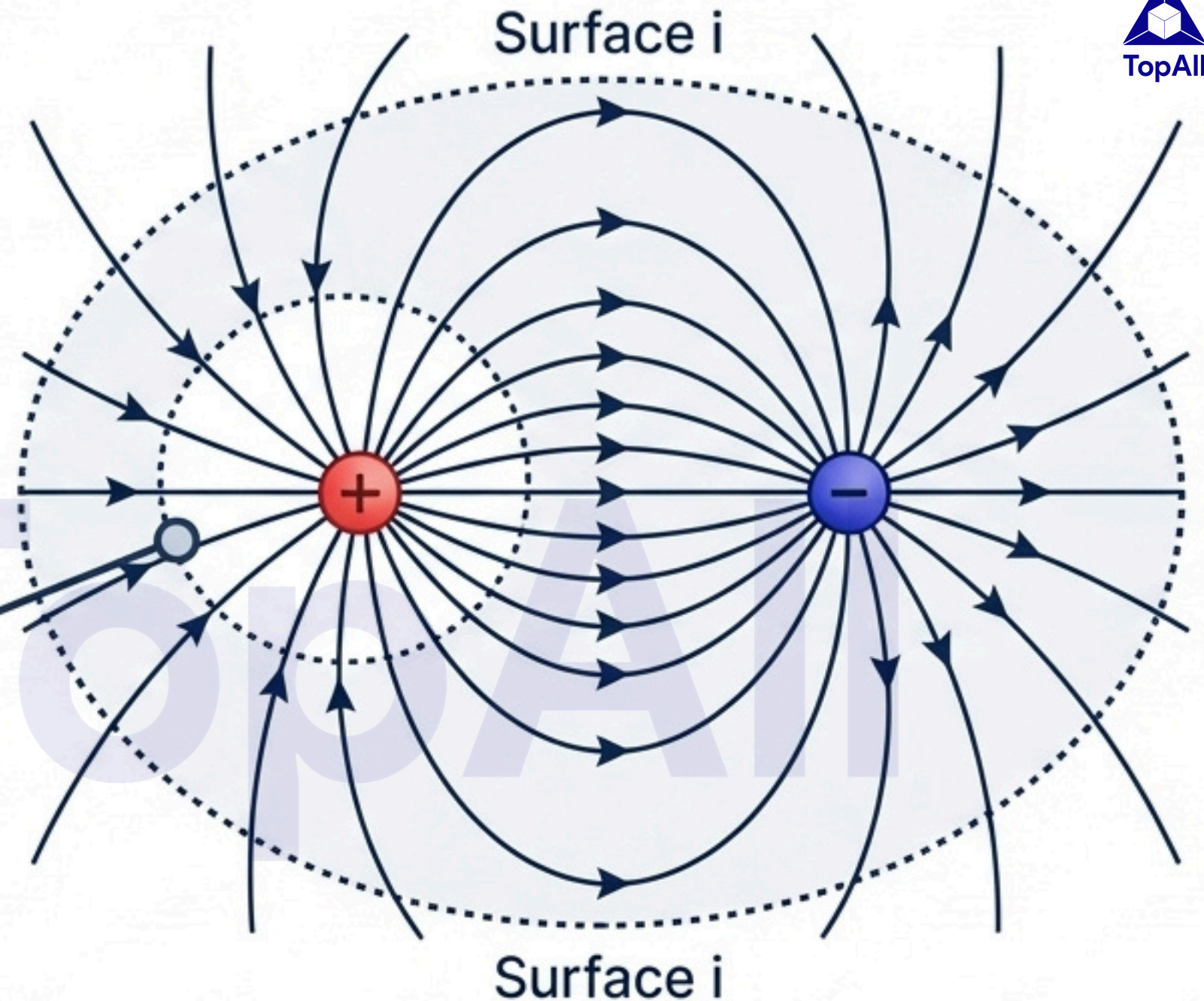
RECAP

Electrostatics: Non-Zero Flux is Possible

Net outward flux exists because isolated charges (monopoles) exist.

$$\phi_E = \sum \vec{E} \cdot \Delta \vec{S} = \frac{q}{\epsilon_0} \neq 0$$

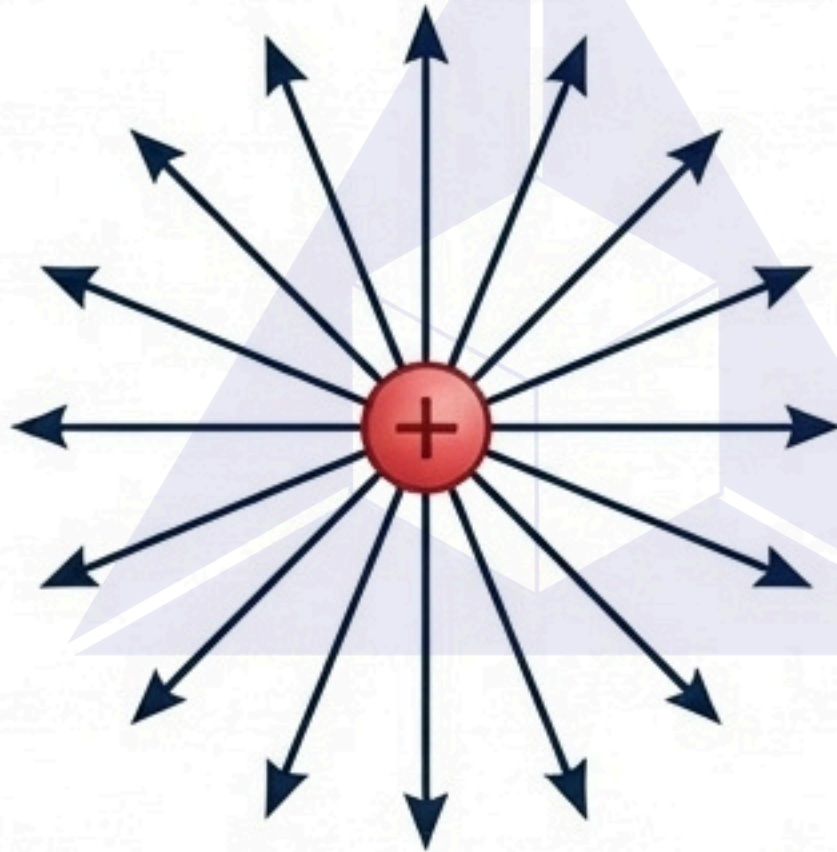
In electrostatics, field lines can begin or end on isolated charges.



The Magnetic Difference: Continuous Loops



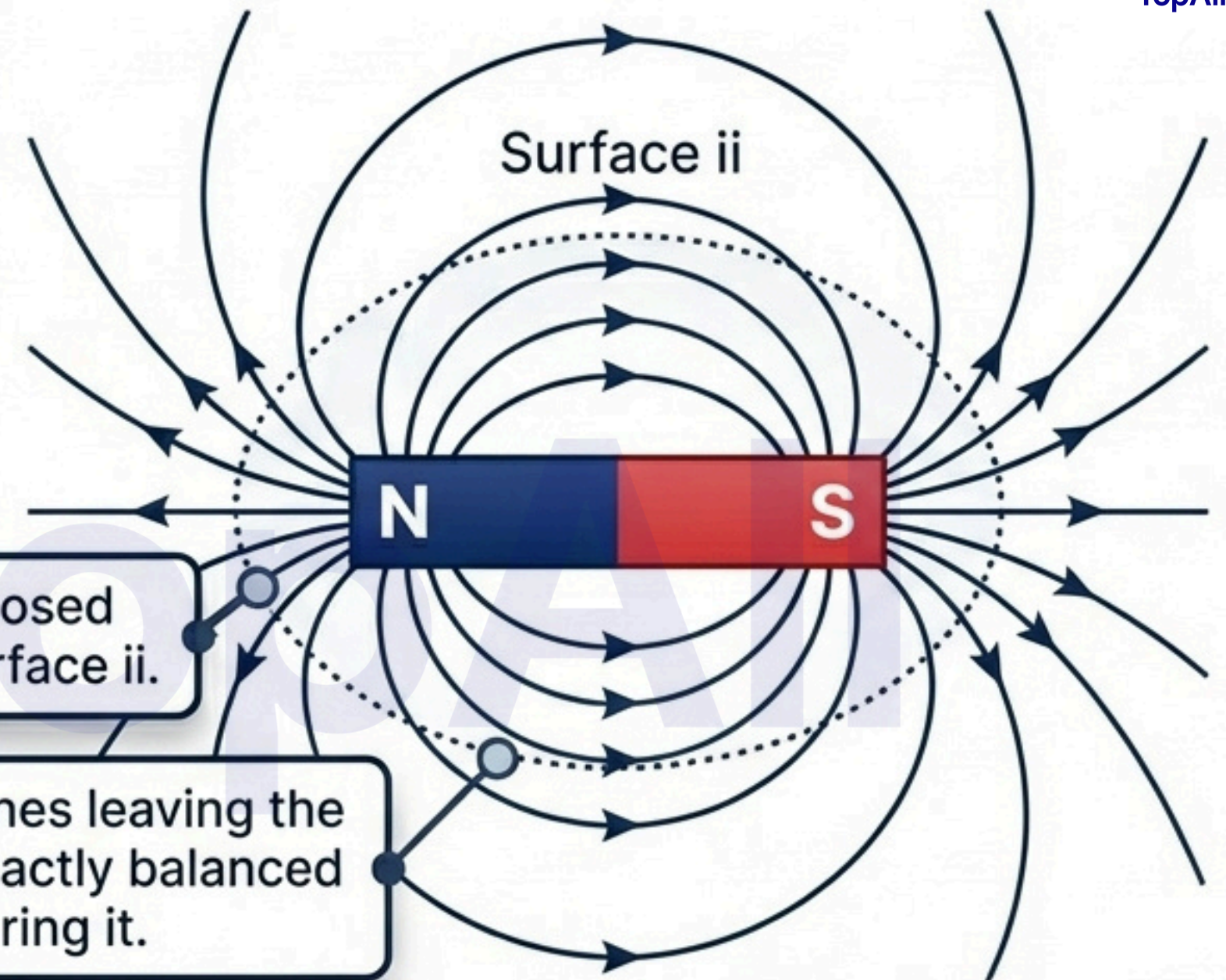
Electric Field: Starts and Stops



Notice the closed
Gaussian surface ii.

Number of lines leaving the
surface is exactly balanced
by lines entering it.

Magnetic Field: Continuous Loops



KEY TAKEAWAY

Unlike electric field lines, **magnetic** field lines **NEVER** escape to infinity or end abruptly. They always form **continuous closed loops**.



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

$$E=mc^2$$



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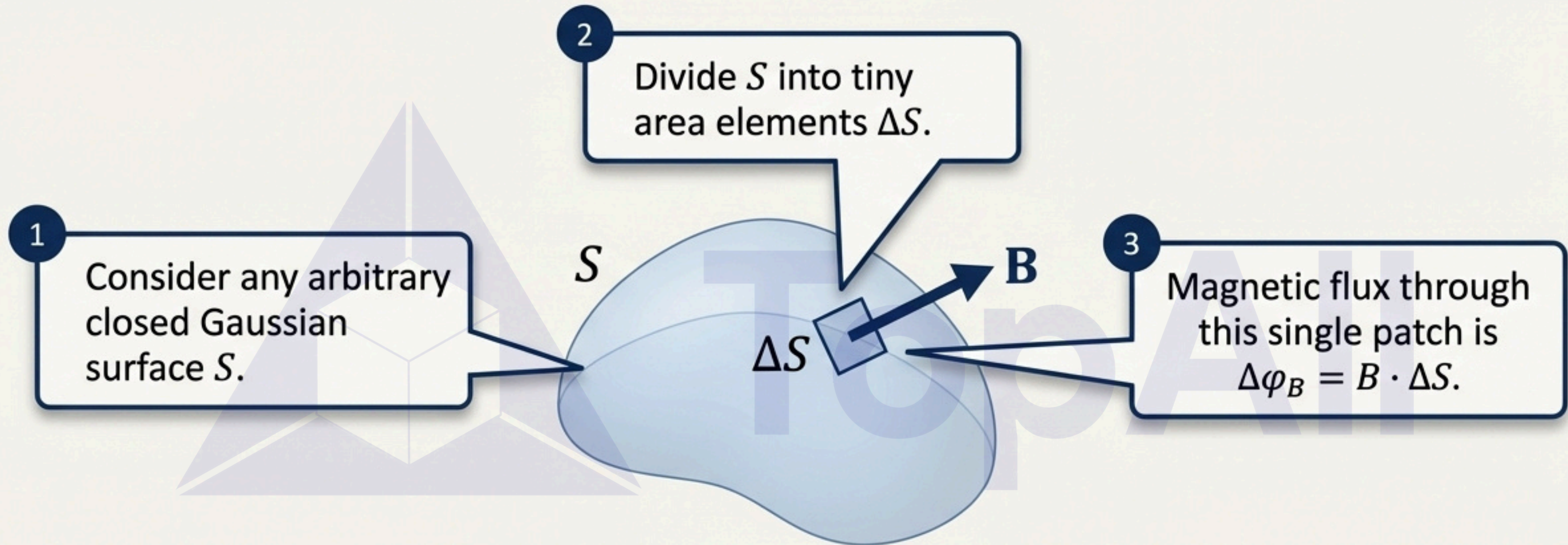
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- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



Defining the Gaussian Surface



To find the total flux, we must sum the flux through every single patch on the surface.

Gauss's Law for Magnetism



Total Net Magnetic Flux

Dot product of Magnetic Field and Area Vector

$$\varphi_B = \sum_{all} \mathbf{B} \cdot \Delta \mathbf{S} = 0$$

Sum over all area elements on a closed surface

The Absolute Boundary:
Always exactly zero

KEY TAKEAWAY The net magnetic flux through ANY closed surface is zero.

The Physical Reality: No Magnetic Monopoles

Lines In = Lines Out

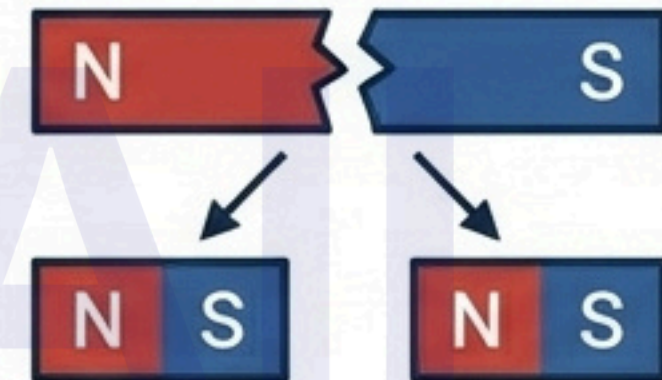


Net Flux = 0

$$\phi_B = 0$$



No Monopoles Exist



There are no “sources” or “sinks” of **B**. The simplest magnetic element is a dipole or a current loop.



NEET TRAP

Exam Trap: Gauss's Law of Magnetism explicitly proves that **isolated magnetic poles** (monopoles) **DO NOT exist**.

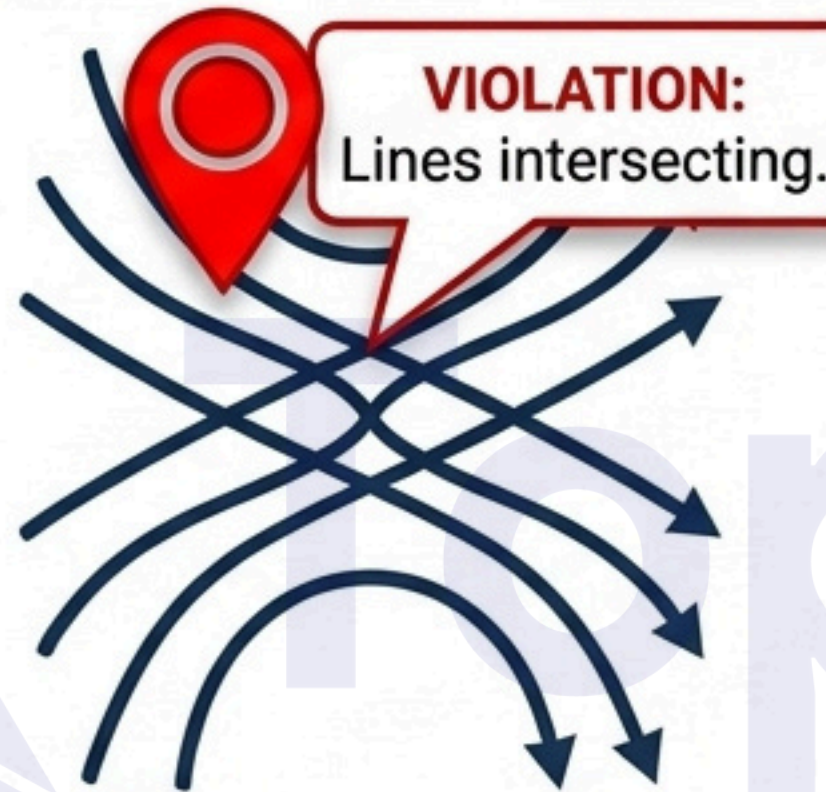
Exam Diagnostic: Identifying Impossible Diagrams

Apply Gauss's Law to spot the errors in these field line diagrams.



VIOLATION:
Emanating
from a point.

Over any closed surface, net flux must be zero. Lines cannot start at a point (implies a monopole).



VIOLATION:
Lines intersecting.

Direction of the magnetic field would not be unique at the point of intersection.



VIOLATION:
Incomplete loops.

Lines must curve out and meet eventually to form continuous closed loops.

Exam Rule: If it doesn't loop, it's not a magnetic field.



You've Learned the Theory.

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