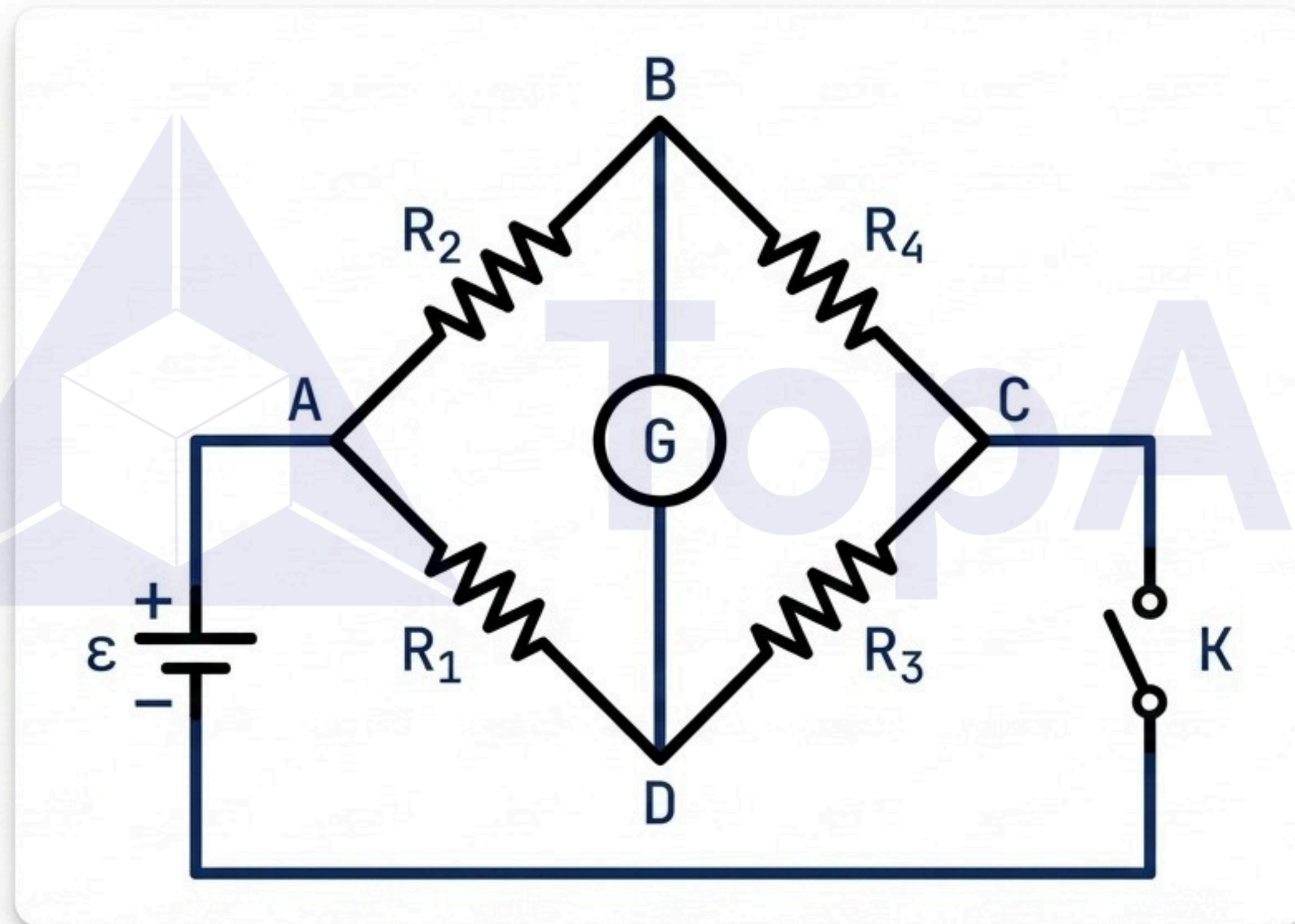
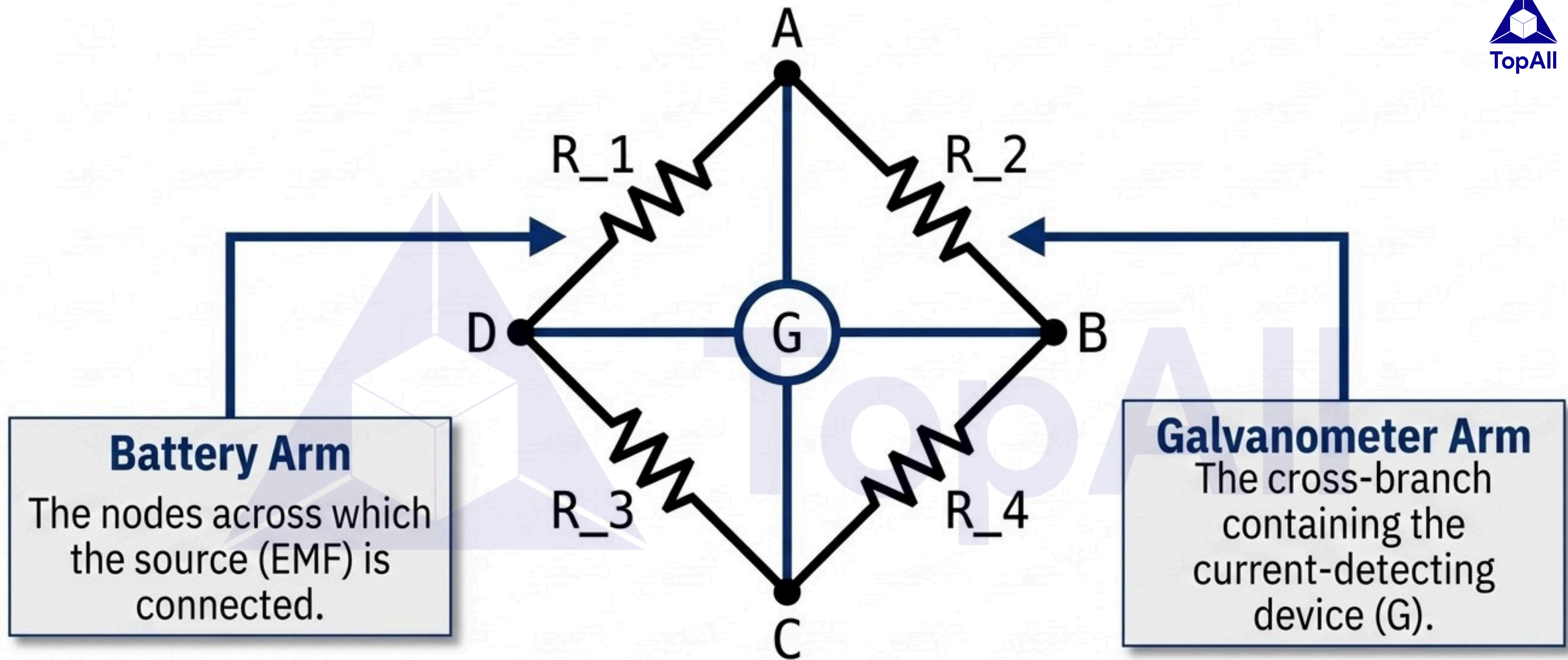


Wheatstone Bridge and Null Deflection





Purpose: A precise configuration used primarily to determine unknown resistances by achieving a state of electrical balance.



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

$$E=mc^2$$



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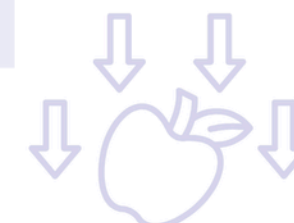
Practice Now

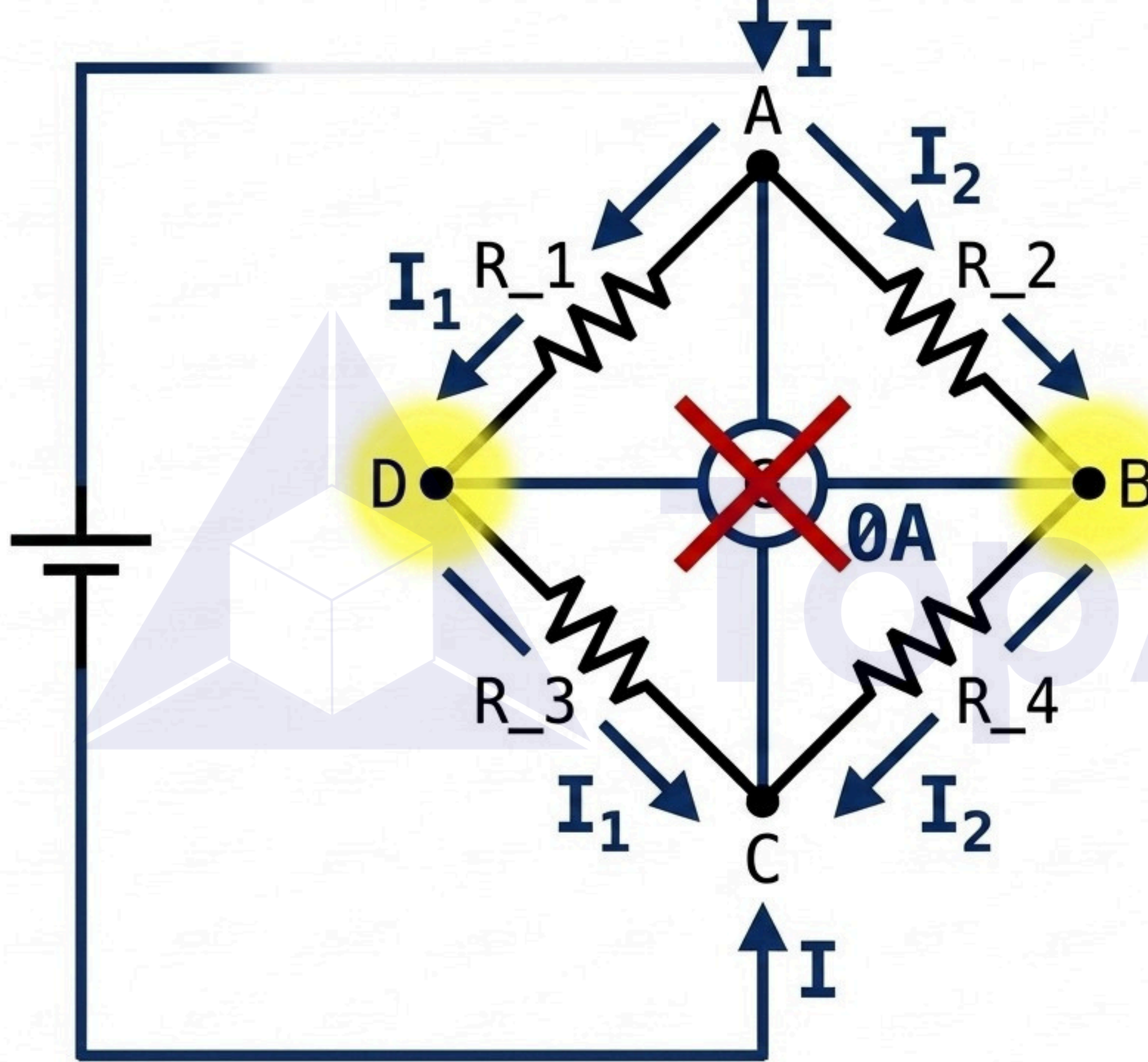


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$$V_B = V_D$$

$$I_g = 0$$

When the potential at B equals the potential at D, no current flows through the central arm. The bridge is perfectly balanced.

The Permutation Matrix

Standard Ratios

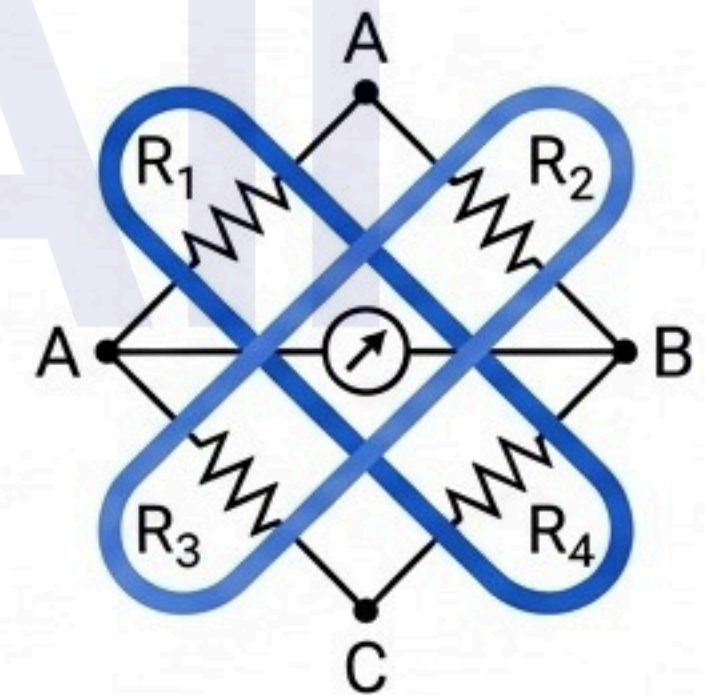
$$\frac{R_1}{R_2} = \frac{R_3}{R_4}$$

or

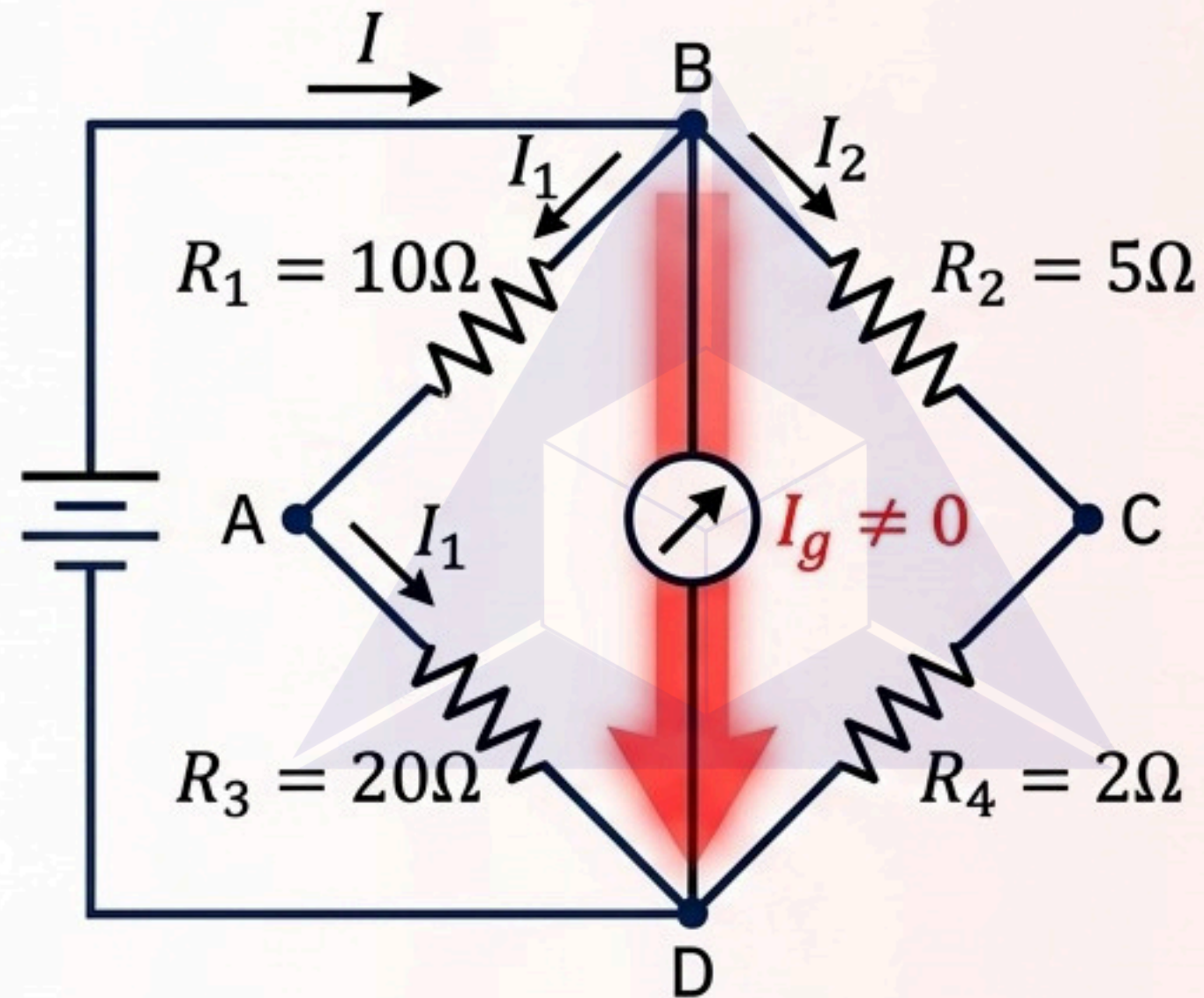
$$\frac{R_2}{R_1} = \frac{R_4}{R_3}$$

The Cross-Product Rule

$$R_1 \times R_4 = R_2 \times R_3$$



⚠ JEE TRAP ALERT: The Blind Ratio Error



$$10 \times 2 \neq 20 \times 5$$

The Trap:

Blindly applying the $R_1 \times R_4 = R_2 \times R_3$ balance formula to unbalanced bridges.

The Counter-Measure:

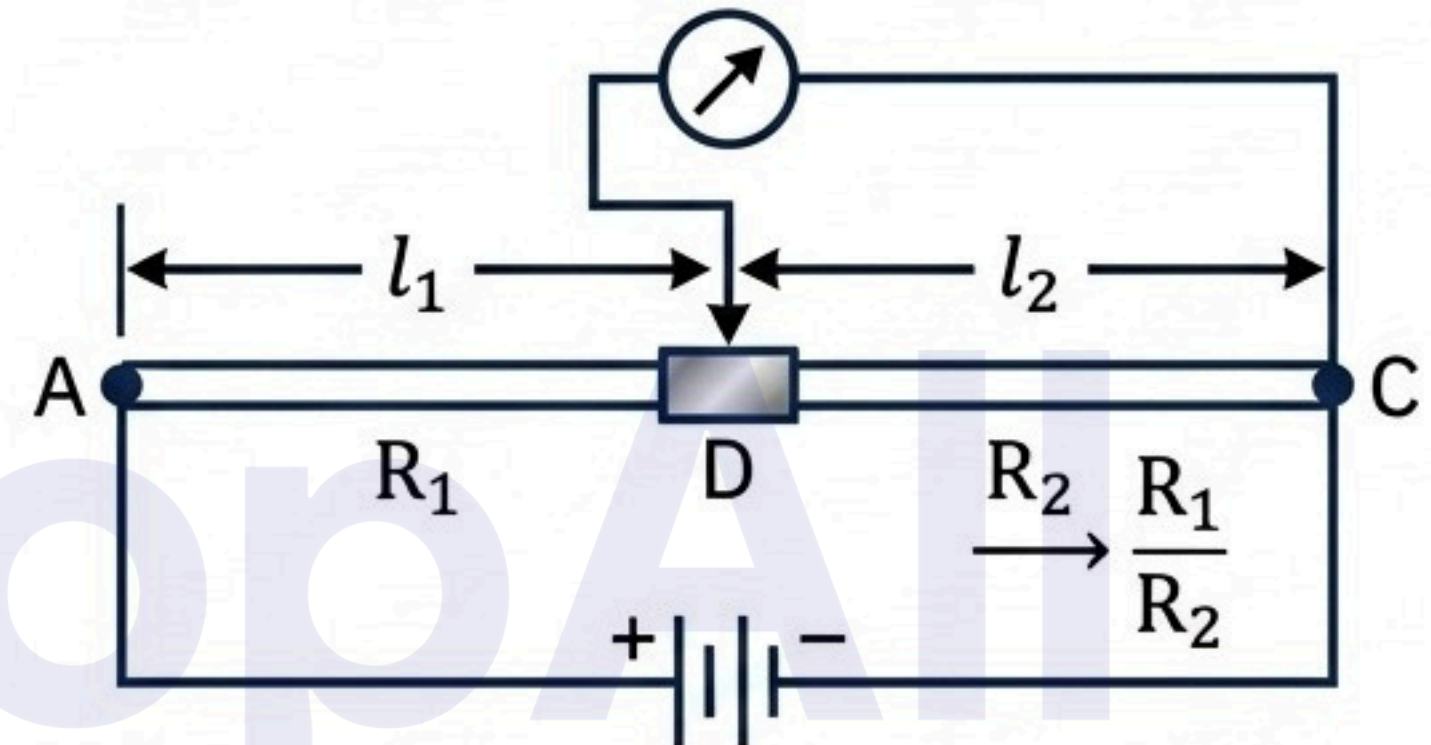
Always verify $I_g = 0$ (Null Deflection) first. If $I_g \neq 0$, the shortcut formula is mathematically useless. You MUST revert to Kirchhoff's Loop Rules (KVL/KCL) to solve the circuit.

Isolating the Unknown

$$R_4 = R_3 \times \frac{R_2}{R_1}$$

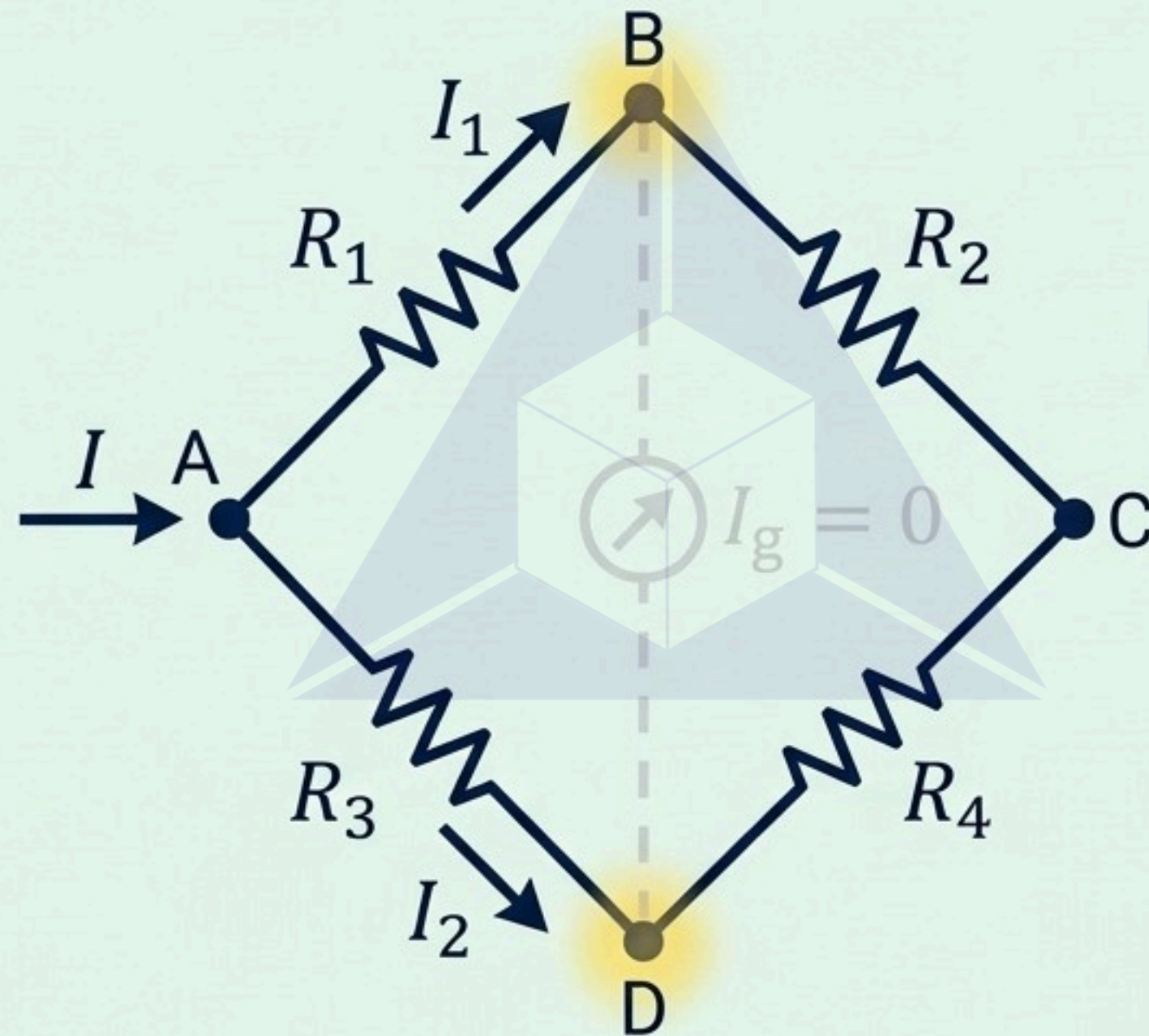
By adjusting the known resistance R_3 until $I_g = 0$ is achieved, the value of the unknown R_4 is instantly revealed.

The Meter Bridge



A practical lab device utilizing the Wheatstone principle, seamlessly abstract resistance ratios into easily measurable physical wire lengths.

Core Revision Takeaway



- $I_g = 0$ in the middle branch does NOT mean the whole circuit is dead.
- It means the incoming current perfectly splits into the parallel upper and lower branches because the midpoint potentials (B and D) are perfectly identical.

It is a state of dynamic electrical balance, not zero current.



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