

NEET/JEE PHYSICS

Reverse Bias

p-n Junction Diode

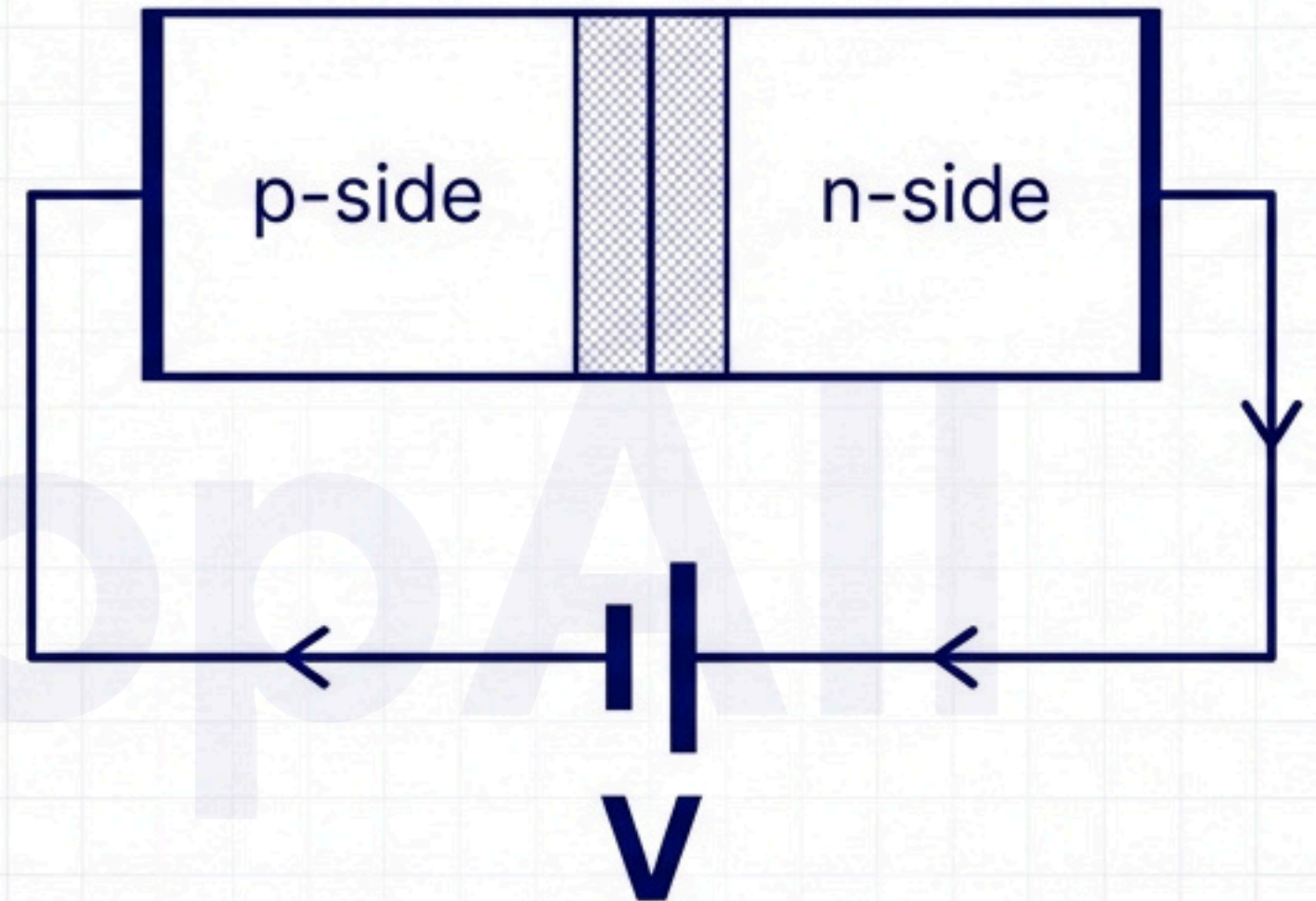
THE SETUP

Connecting the Battery

To reverse bias a p-n junction diode, the external battery is connected in opposition to the majority carriers:

- p-side is connected to the negative terminal.
- n-side is connected to the positive terminal.

The applied voltage (V) will mostly drop across the depletion region.



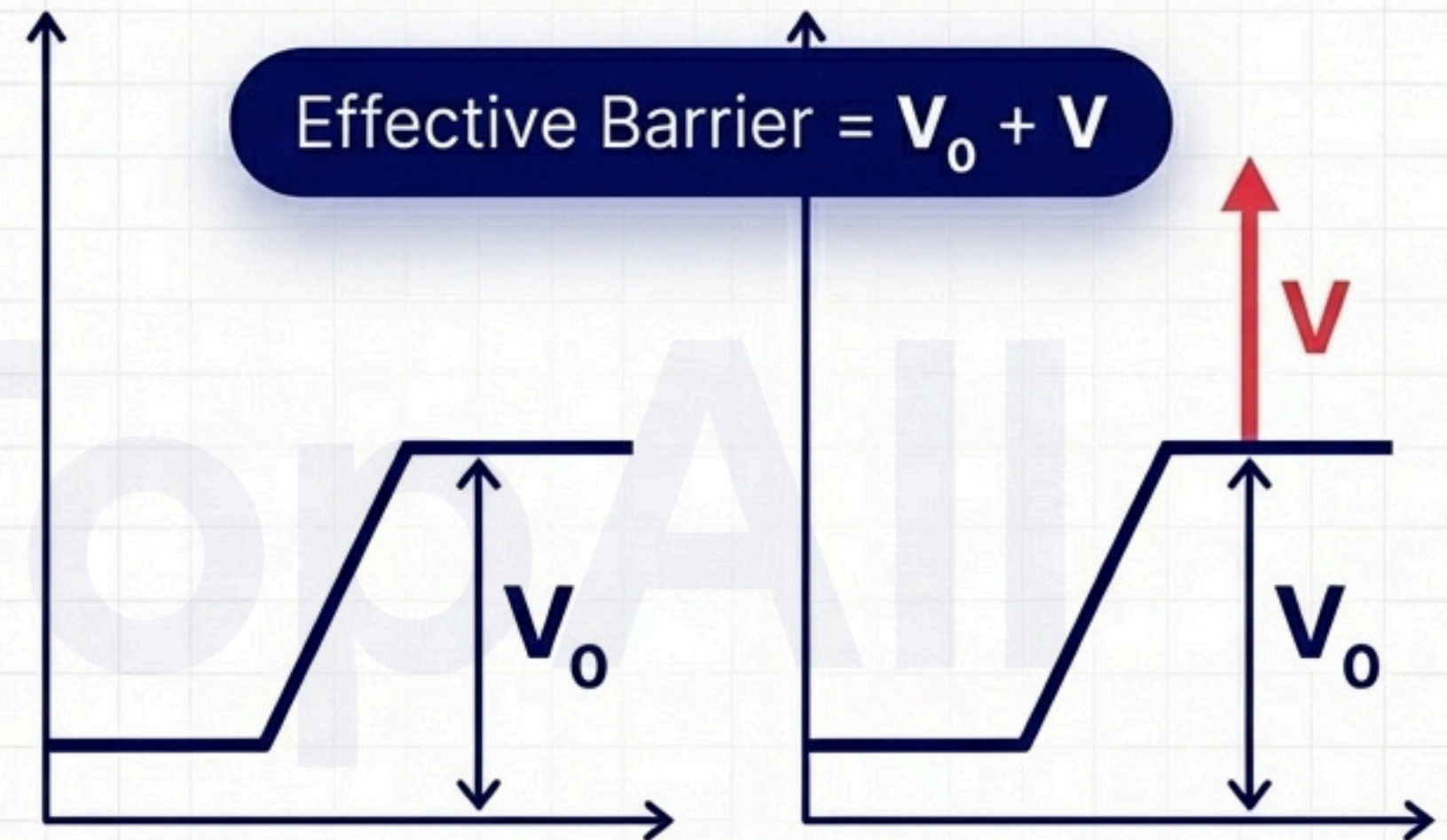
The Barrier Increases

The direction of the applied reverse voltage (V) matches the direction of the built-in barrier potential (V_0).

Because the external voltage pushes with the internal field, they add together. This heightened barrier strongly suppresses the flow of majority carriers (electrons from $n \rightarrow p$, holes from $p \rightarrow n$), dropping the diffusion current to almost zero.

No Bias

Reverse Bias





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$$E=mc^2$$



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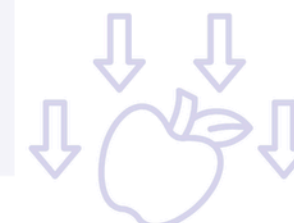
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Key Highlights

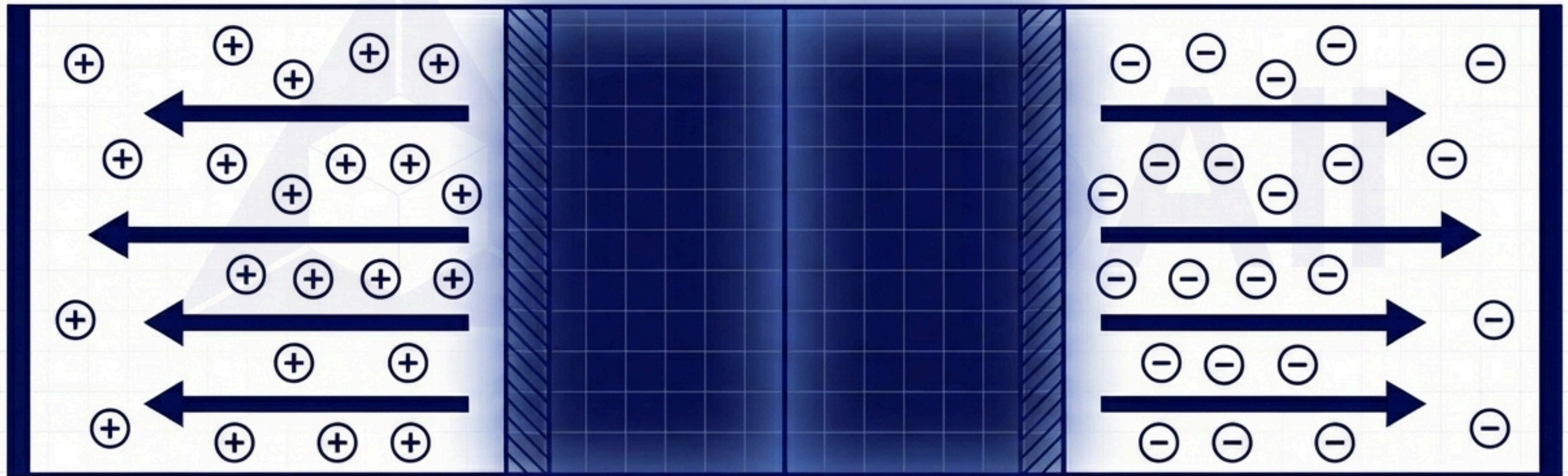
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Depletion Layer Widens

The external electric field pulls majority carriers away from the junction.

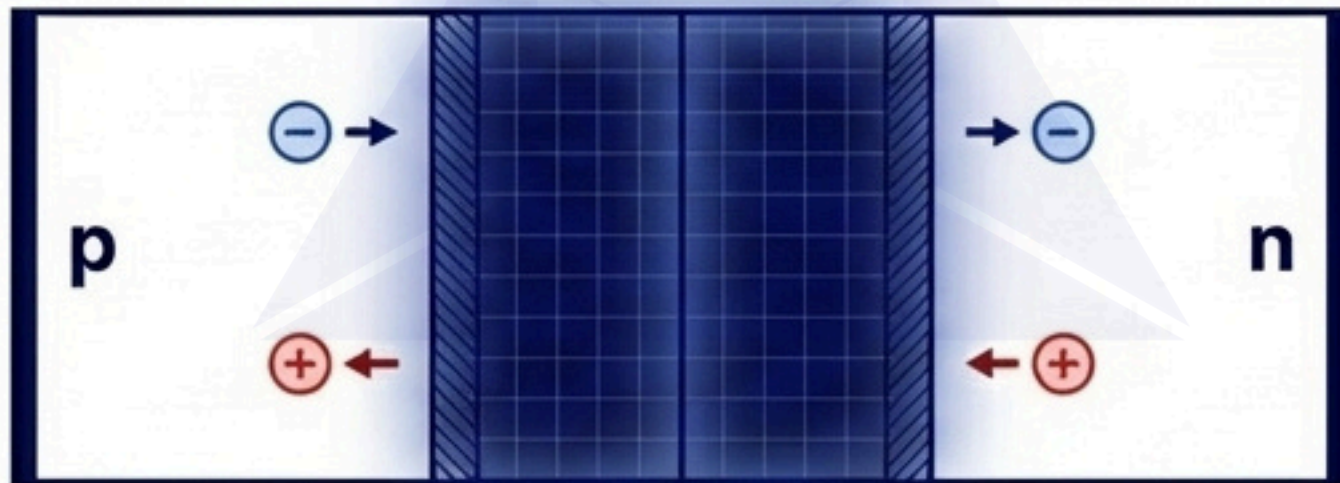
As holes and electrons recede toward the battery terminals, the region stripped of mobile charges grows. The depletion region widens, acting as an insulating force-field that halts standard conduction.



Reverse Current & Breakdown

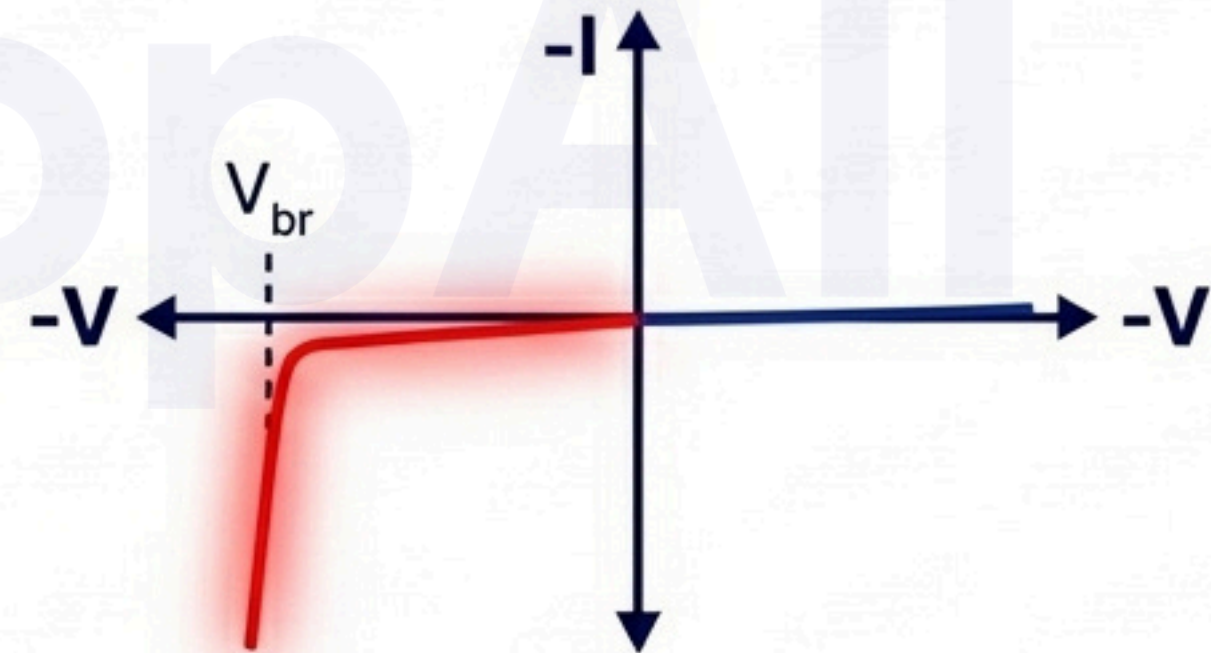
Drift Current (μA)

A tiny current flows due to minority carriers being swept across the junction by the strong electric field. This is voltage-independent and measured in micro-amperes (μA).

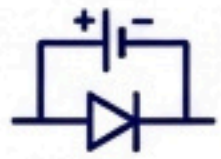


Avalanche Breakdown (V_{br})

At a critical reverse voltage (V_{br}), the barrier breaks. Current spikes sharply. If not limited by an external circuit, the diode will be destroyed by overheating.



Key Takeaways



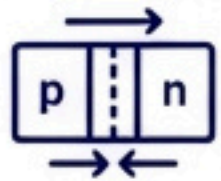
Connections

p-side to negative, n-side to positive.



Barrier Potential

Increases to $(V_0 + V)$. Majority carrier diffusion stops.



Depletion Zone

Widens physically as majority carriers are pulled away from the junction.



Current & Breakdown

Tiny minority drift current (μA). Spikes dangerously at Breakdown Voltage (V_{br}).



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