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Department of Biomedical Engineering

Course Name: 23BMB101-Electron Devices and Circuits

I Year : II Semester

Unit I –Semiconductor Diodes

Topic : PN Junction Diode



INTRODUCTION



- A pure silicon crystal or germanium crystal is known as an **intrinsic semiconductor**. There are not enough free electrons and holes in an intrinsic semi-conductor to produce a usable current.
- The electrical action of these can be modified by **doping**.
- When a crystal has been doped, it is called a extrinsic semi-conductor.
 - ✓ n-type semiconductor having free electrons as majority carriers
 - ✓ p-type semiconductor having free holes as majority carriers
- If a junction is made by joining p-type semiconductor to n-type semiconductor a useful device is produced known as diode. It will allow current to flow through it only in one direction.

Vision Tit 2

Vision Title 3



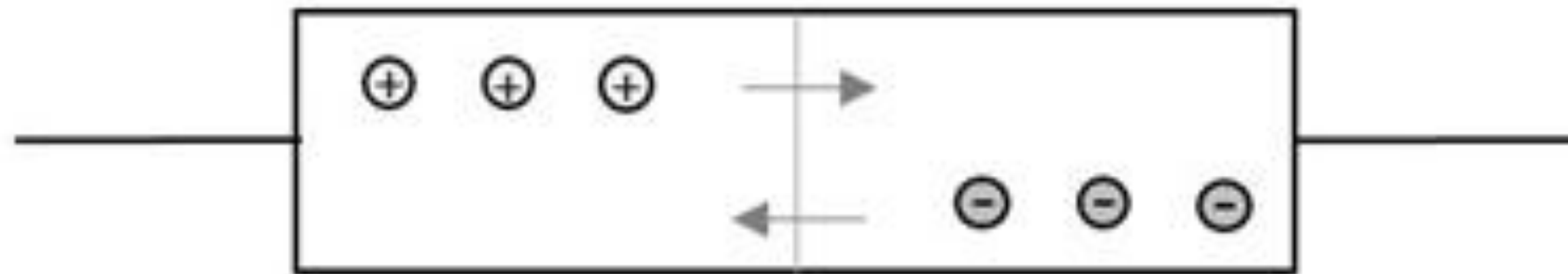
PN Junction



P-Type
Material



N-Type
Material



P-Type

N-Type



PN Junction



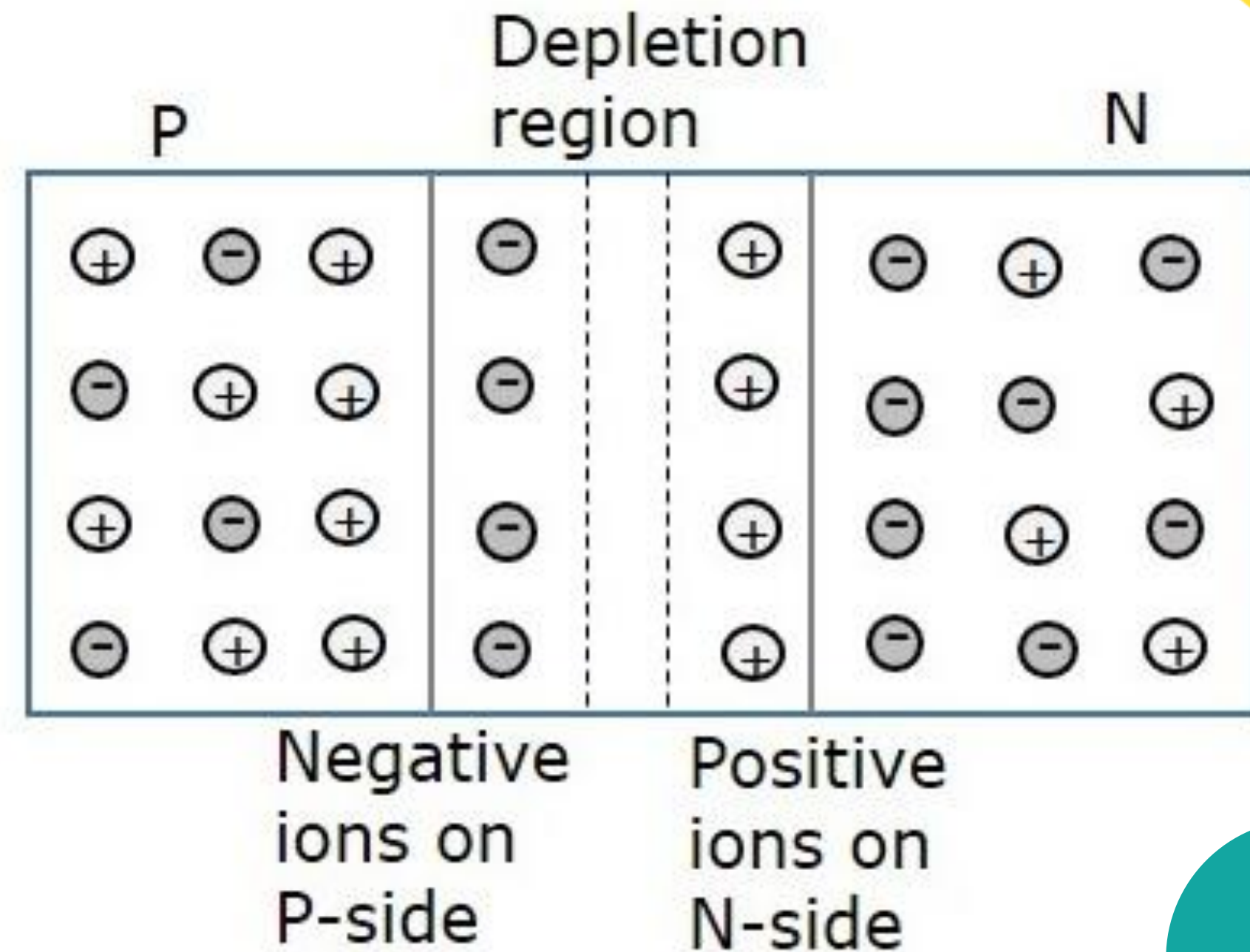
- Holes from the p-side diffuse into n-side where they recombine with free electrons.
- Free electrons from n-side diffuse into p-side where they recombine with free holes.
- The diffusion of electrons and holes is due to the fact that large no of electrons are concentrated in one area and large no of holes are concentrated in another area.
- When these electrons and holes begin to diffuse across the junction then they collide each other and negative charge in the electrons cancels the positive charge of the hole and both will lose their charges.
- The diffusion of holes and electrons is an electric current referred to as a recombination current. The recombination process decay exponentially with both time and distance from the junction. Thus most of the recombination occurs just after the junction is made and very near to junction.



Properties of Semiconductors



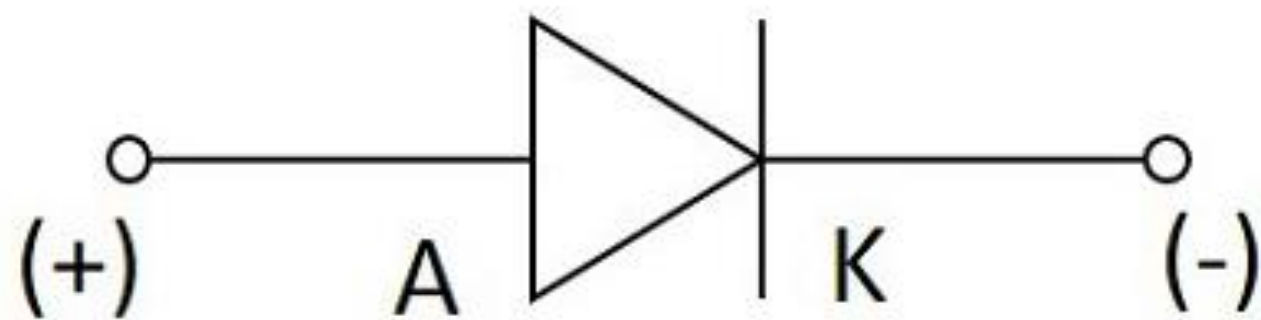
- The electrically charged atoms are called ions since they are no longer neutral.
- After several collisions occur, the electric field is great enough to repel rest of the majority carriers away of the junction.
- The region is produced immediately surrounding the junction that has no majority carriers.
- The junction is known as the barrier region or depletion region.
- The physical width of the depletion region depends on the doping level.





PN Junction Diode

- A semiconductor diode is a two terminal electronic component with a PN junction. This is also called as a **Rectifier**.
- The anode which is the positive terminal of a diode is represented with A and the cathode, which is the negative terminal is represented with K.



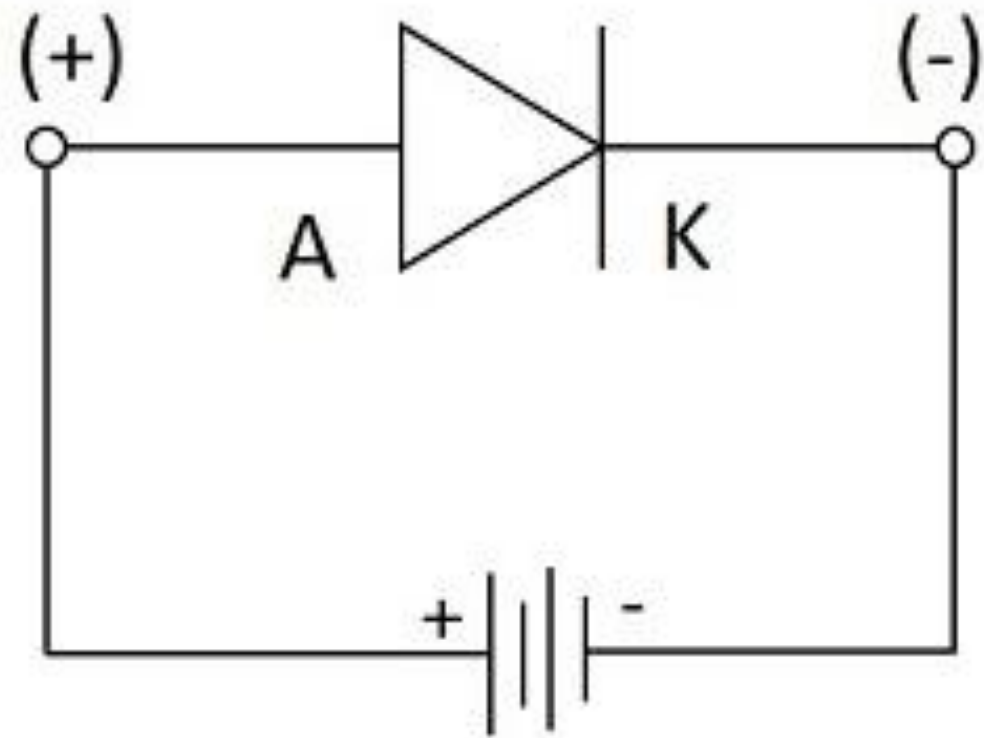
Symbol of a Diode



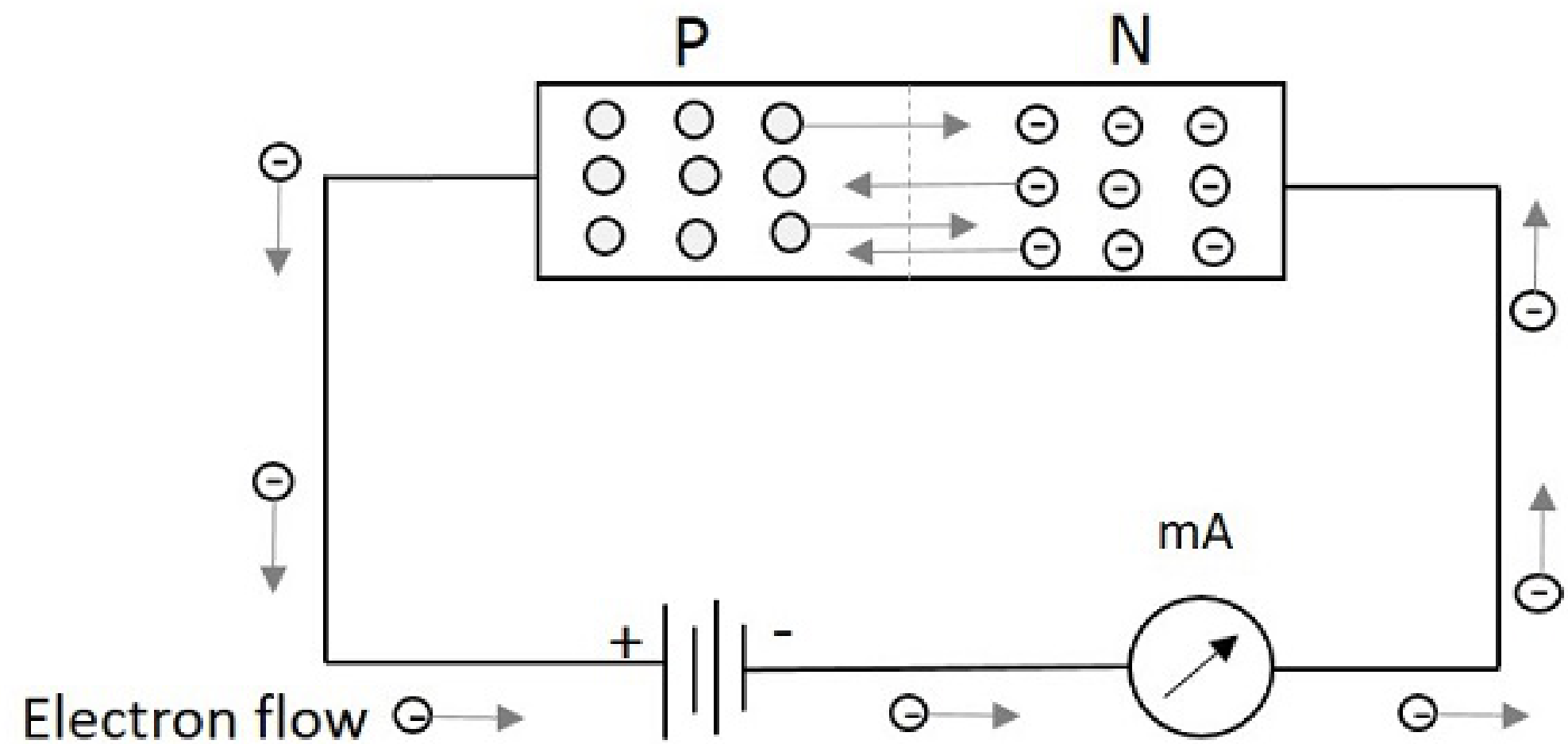
Representing anode and cathode of a practical diode through its symbol



Biasing of Diode- Forward Biased Condition



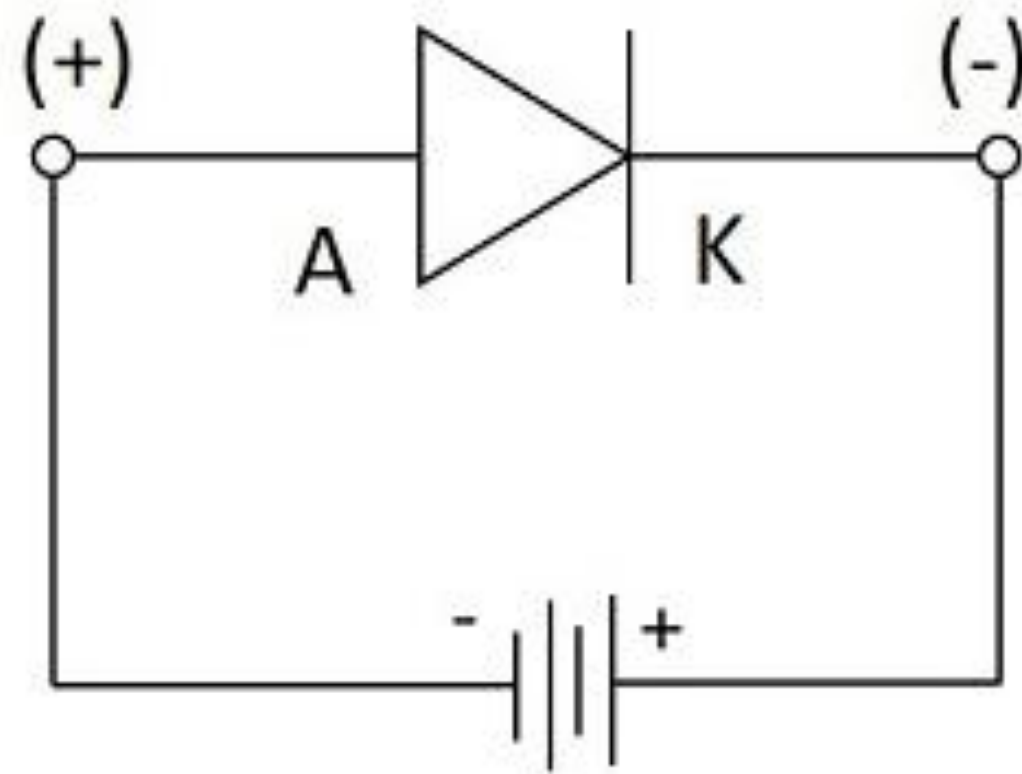
Forward biased Connection



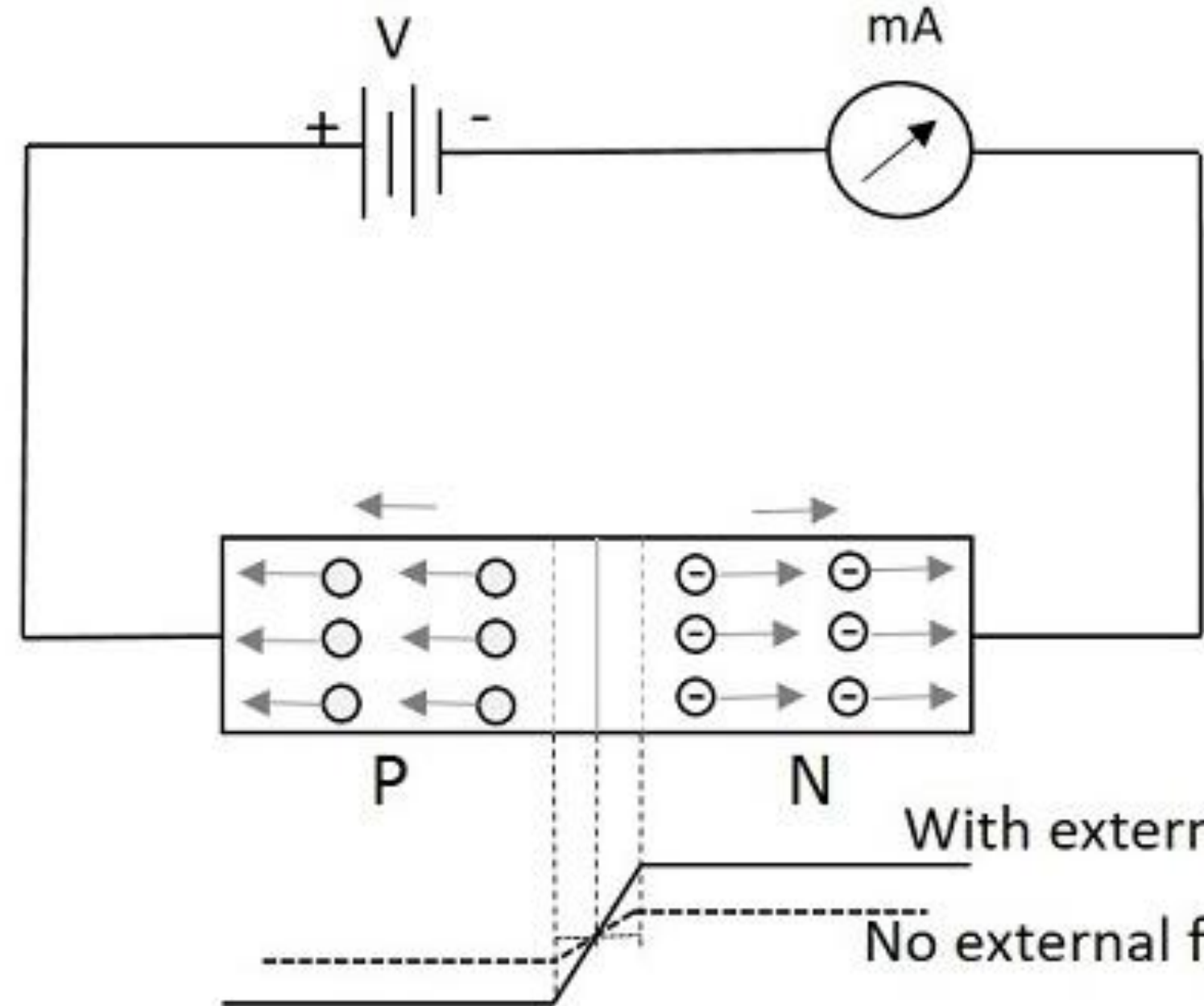
PN junction forward biased



Biasing of Diode- Reverse Biased Condition



Reverse biased Connection

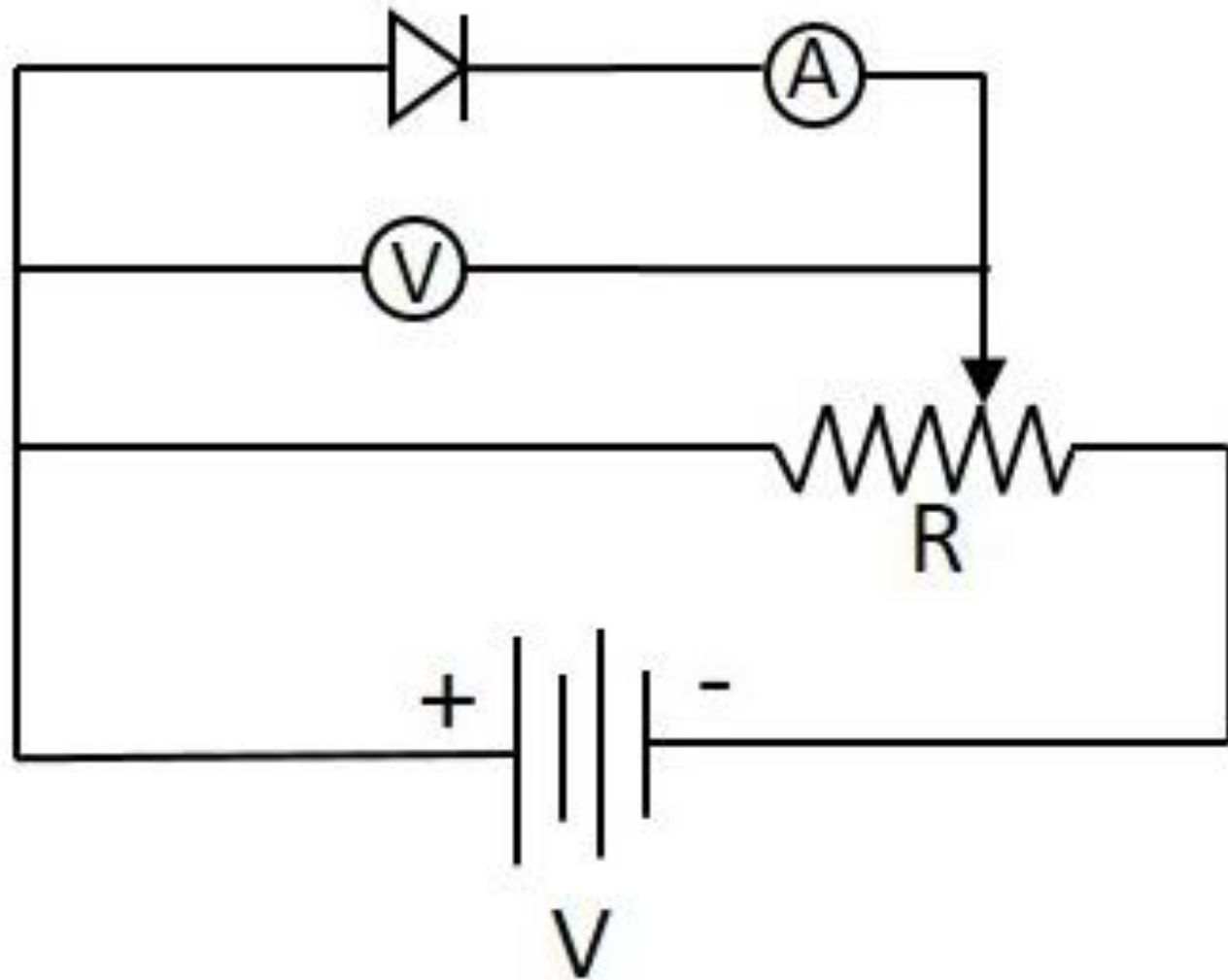


PN junction reverse biased

- The Peak Inverse Voltage can be defined as **“The maximum reverse voltage that a diode can withstand without being destroyed”**.



V - I Characteristics of a Diode



A Practical diode circuit

