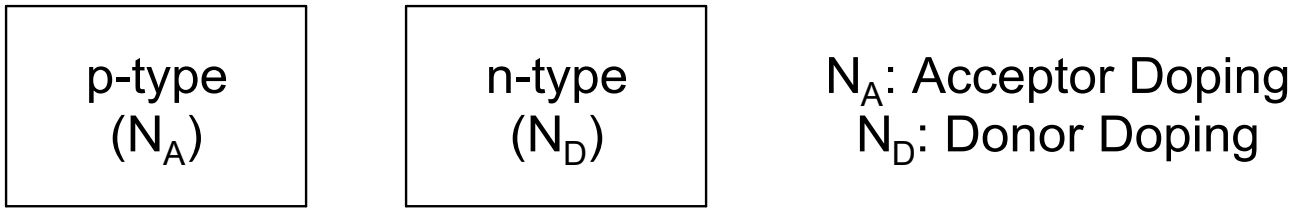
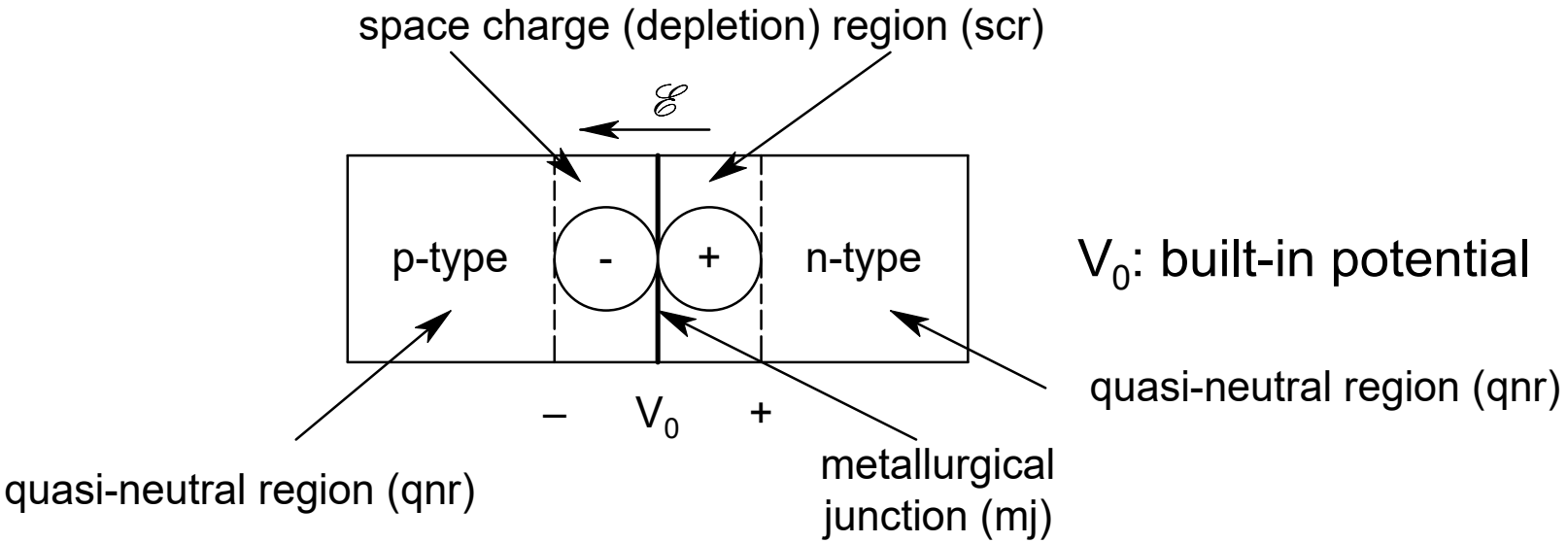
DIODE



Before Joining

- ***p-side***:
  - ***Holes majority carriers***
  - ***Electrons minority carriers***
- ***n-side***:
  - ***Electrons majority carriers***
  - ***Holes minority carriers***
- ***Holes***: ***Anti-particles*** of ***electrons***



After Joining (**In Equilibrium**)

- ***Dissociation Relations***:

$$N_A \leftrightarrow N_A^- + \text{hole}$$

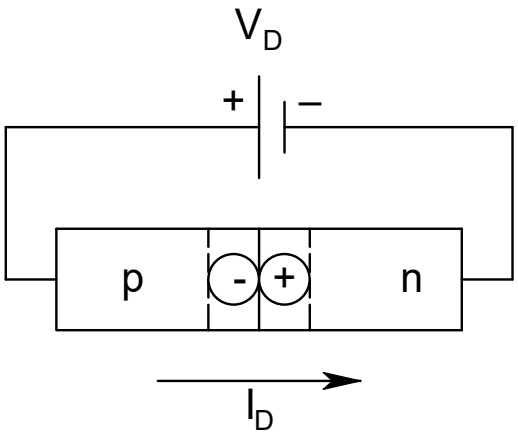
$$N_D \leftrightarrow N_D^+ + \text{electron}$$

Establishment of Equilibrium

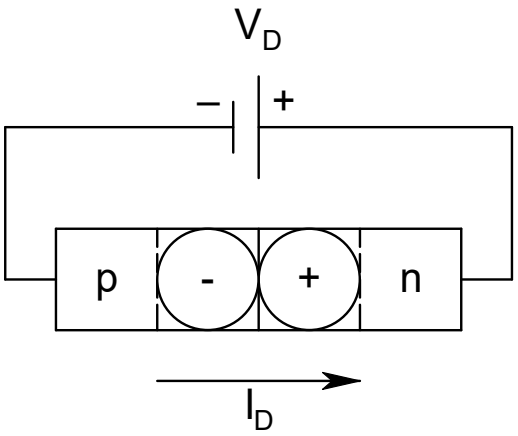
- ***Holes diffuse from p to n***
  - ***Negatively charged acceptor ions uncovered near MJ***
- ***Electrons diffuse from n to p***
  - **Positively charged donor ions uncovered near MJ**
- ***Establishment of a charge dipole around MJ***
  - ***Generation of an electric field $\mathscr{E}$ around MJ***
  - ***Creation of built-in potential V_0***

- ***$\mathscr{E}$ creates drift components of carriers***
  - ***Holes pushed back to p***
  - ***Electrons pushed back to n***
- When these two motions (***drift and diffusion***) completely ***balance out***
  - ***Equilibrium*** is reached
- Under this condition, the ***net fluxes*** of ***both electrons and holes*** across MJ are ***zero***
  - ***No net current flows through the device***

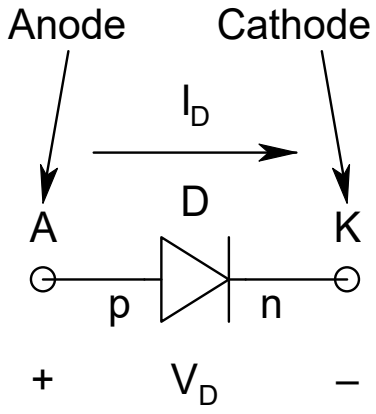
Diode Under Bias



Forward Bias:
p-side positive w.r.t. n-side



Reverse Bias:
n-side positive w.r.t. p-side



Symbol and current-voltage convention

Voltage and Current Conventions:
V_D: **0** (**Equilibrium**), **Positive** (**Forward Bias**), **Negative** (**Reverse Bias**)
I_D: **p to n** (**Positive**), **n to p** (**Negative**)