

Physics 264 - Lecture 5

Conductor
Conduct very well

Conduction Band

Valence Band

- Availability of free electrons

Semiconductor

Conduction Band

Energy Gap $< 3\text{eV}$

Valence Band

Insulator

Conduction Band

Energy Gap $> 3\text{eV}$

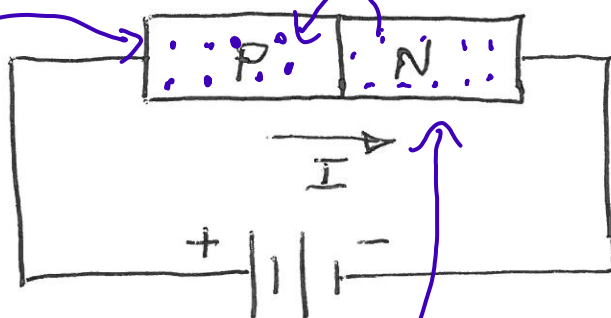
Valence Band

- energy gap of 0

PN Junction Diode

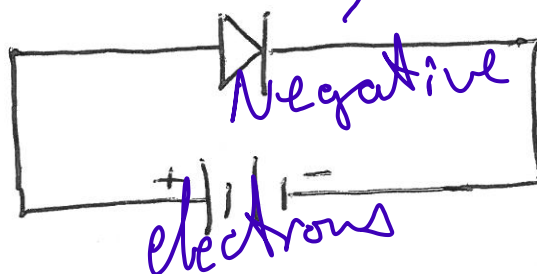
- takes effort to go through but not as much as an insulator

Forward Bias



Positive holes

- Missing an electron



Negative electrons

- have an extra electron

Diode
- all or nothing device

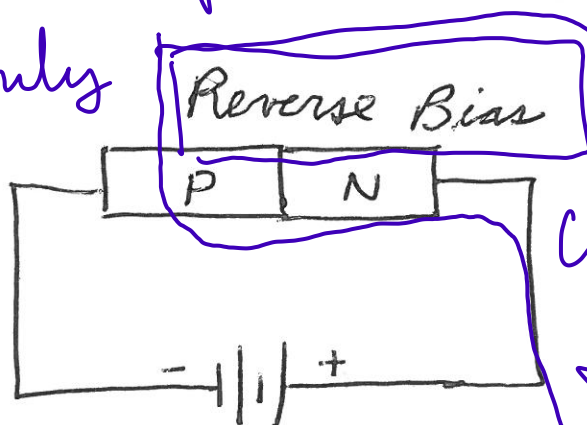
- can act as an open or closed switch

Composed of 2 materials - anode or cathode

- If we apply battery w/ + toward P side, then

- This diode only

wants the current to go 1 way



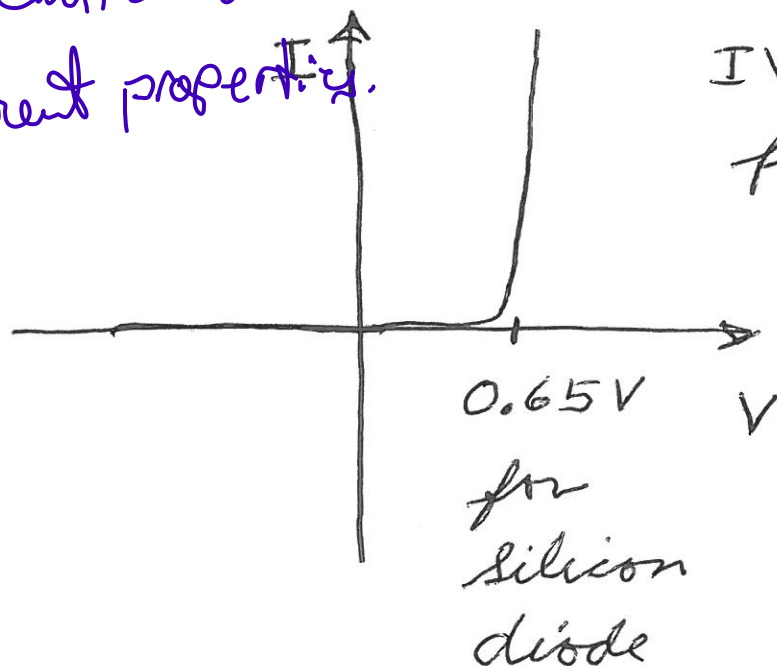
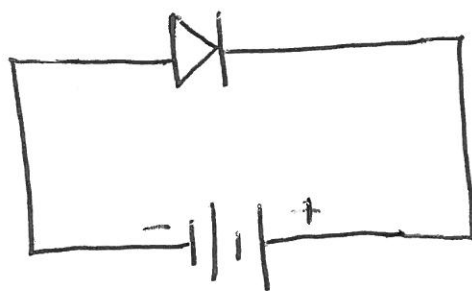
Reverse Bias

Forward Bias

Current will not flow, acts as a perm. open switch

"Perfect diode" would start @ 0 V, reality is

different semiconductors have different properties.



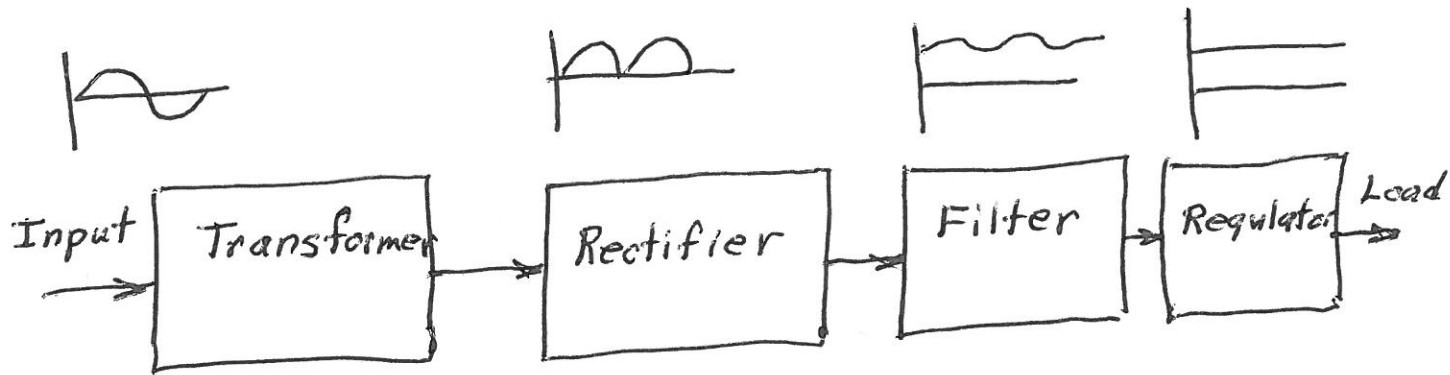
IV characteristic for a diode

- All or Nothing devices

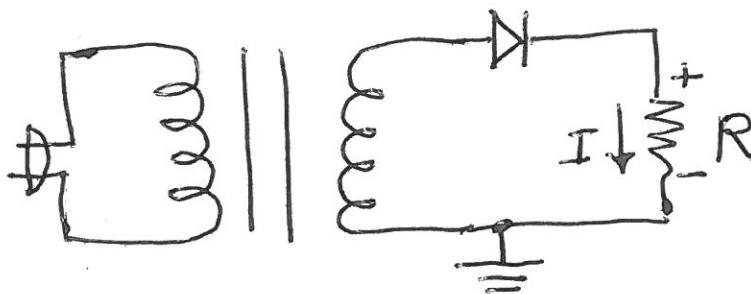
- Changes AC current to DC current

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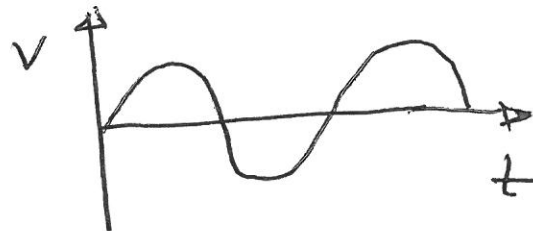
Block Diagram Power Supply



Types of Rectifiers

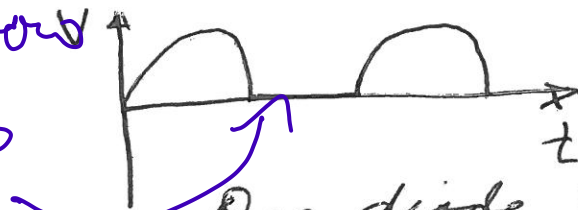


Half-Wave Rectifier



Input

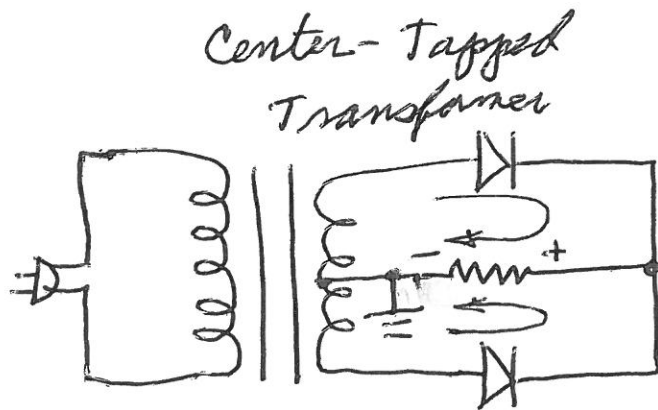
Diode doesn't allow
neg. current to
go through



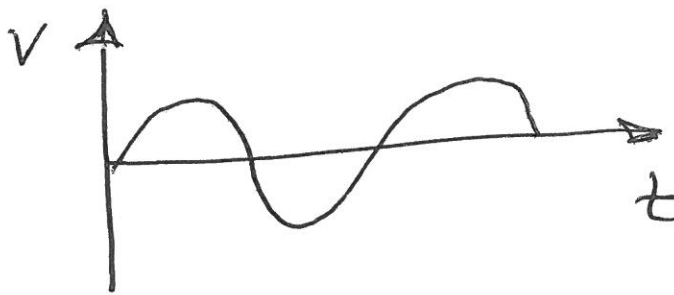
One diode voltage drop

Output

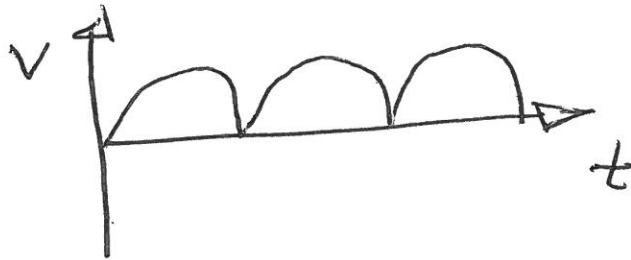
5-4



Full-Wave Rectifier



Input

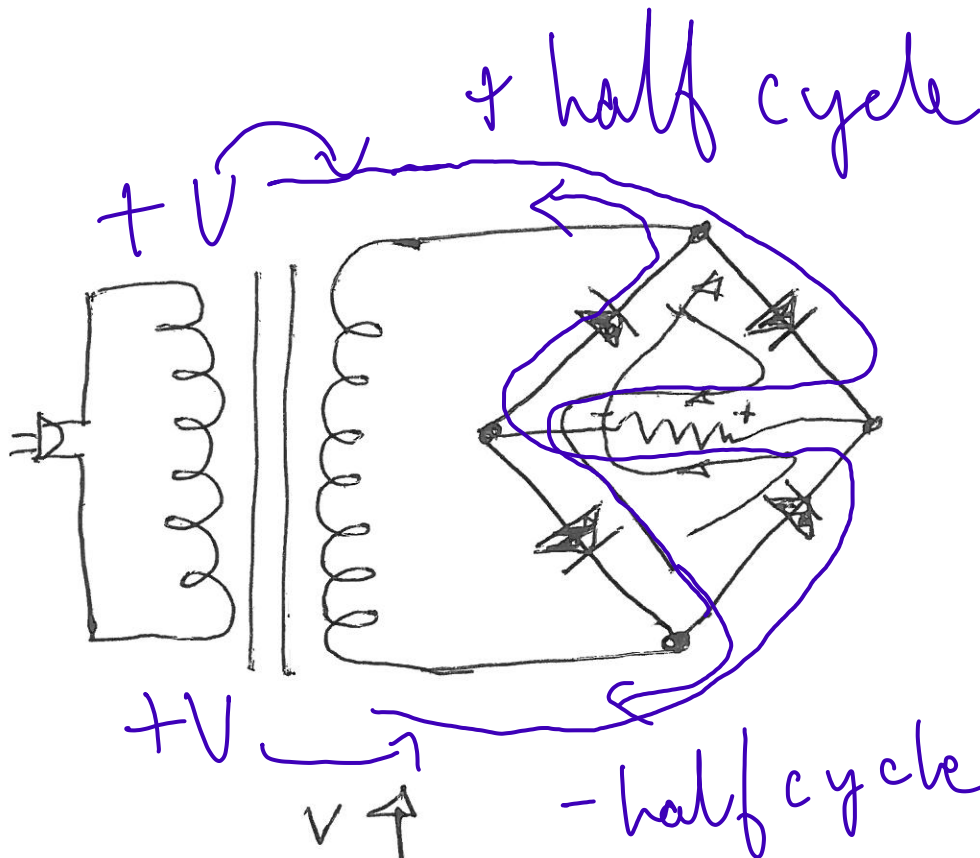


Output

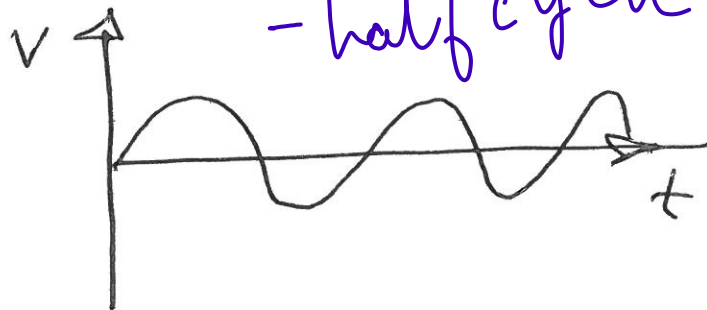
One diode voltage drop

- Both diodes work together to create only positive voltages

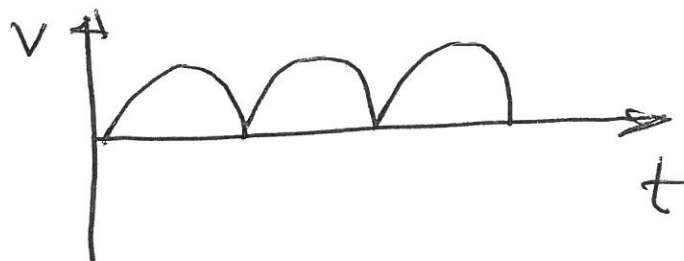
5-5



Full-Wave
Bridge
Rectifier



Input

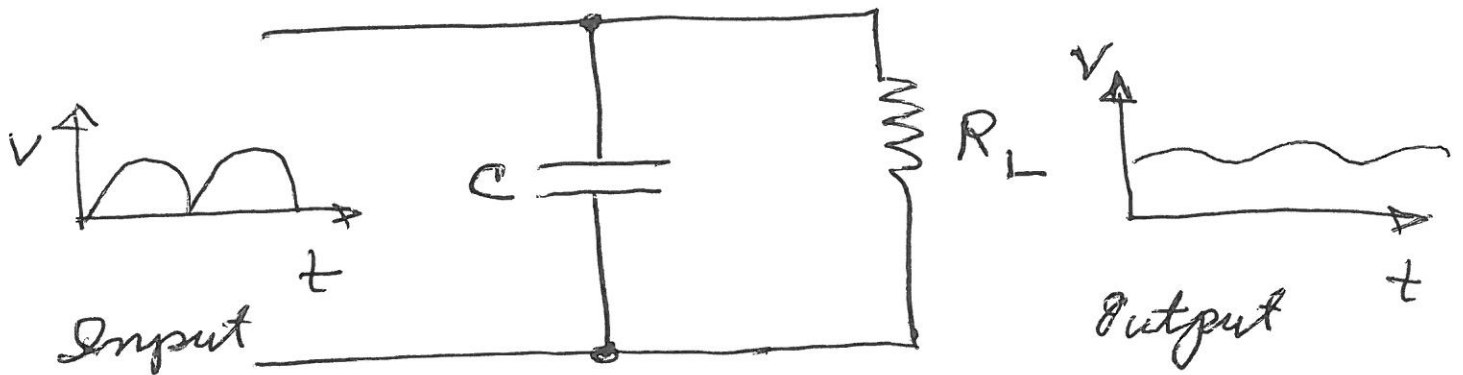


Output

Two diode voltage drop

- Current is still oscillating

Simple RC Filter



- Capacitor holds a charge, which it can release energy to smooth out the hills from the AC current
- Diodes allow for current to only go 1 way