8. Elektronikarako sarrera

http://zthiztegia.elhuyar.org/

http://www.allaboutcircuits.com/vol_3/chpt_2/index.html

http://pvcdrom.pveducation.org/index.html

http://library.thinkquest.org/12666/junction.html

http://www.ndt-ed.org/EducationResources/HighSchool/Electricity/hs_elec_index.htm

Materialen sailkapena eroankortasunaren arabera

- Eroaleak
- Erdieroaleak
- Isolatzaileak

http://www.britannica.com/EBchecked/topic/41549/atom/260973/Conductors-and-insulators

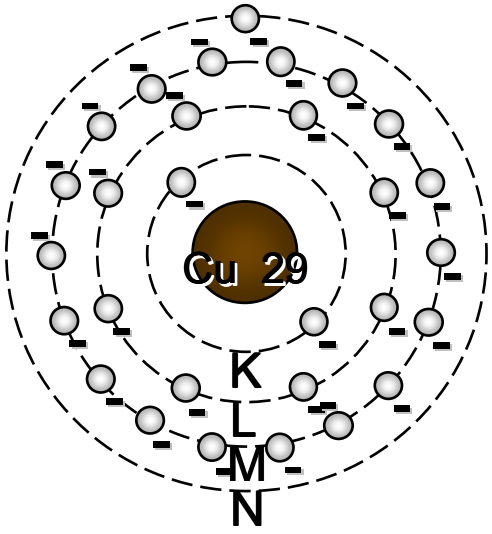
Material eroaleak:

Zenbaki atomiko altua →
kanpoko geruzetako elektroiek erakarpen indar txikia jasaten dute →
atomotik askatzeko energia txikia behar da →
elektroi askeak sortzea erraza da
eta horiek erraz mugitzen dira korronte elektrikoa sortzeko

Kobre atomoa

Shell #	Maximum # e^- per shell	Actual # e^- per shell
K	2	2
L	8	8
M	18	18
N	32	1
Total #	60	29

One electron in the valence ring



Material isolatzaileak :

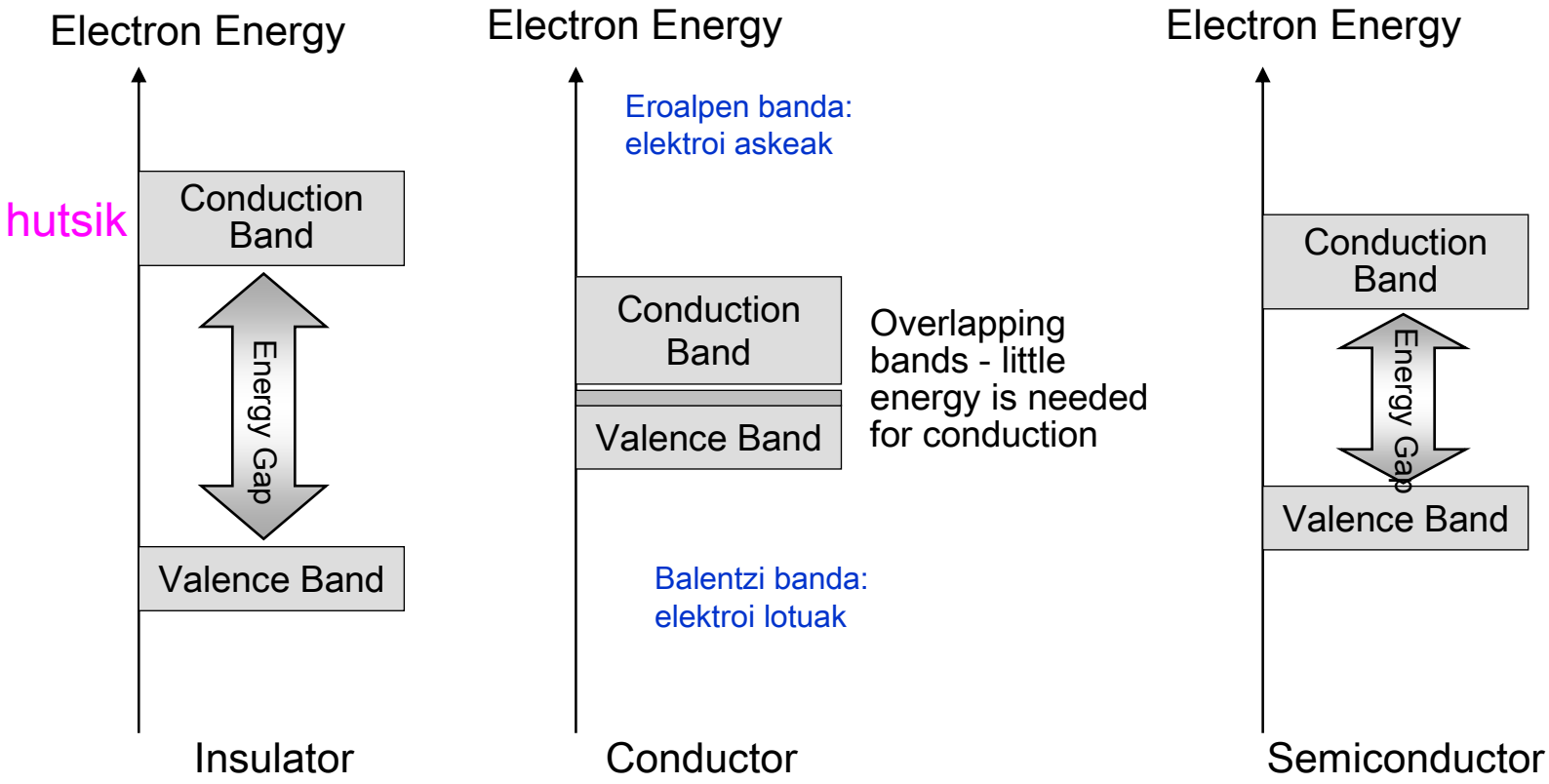
Zenbaki atomiko baxua →
kanpoko geruzetako elektroiek erakarpen
indar handia jasaten dute →
atomotik askatzeko energia oso handia
behar da

Material Erdieroaleak:

Eroaleen eta isolatzaileen artekoak dira, ez dira eroale onak eta isolatzaile txarrak dira baina... ezaugarri horiei esker egokiak dira elektronikarako

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

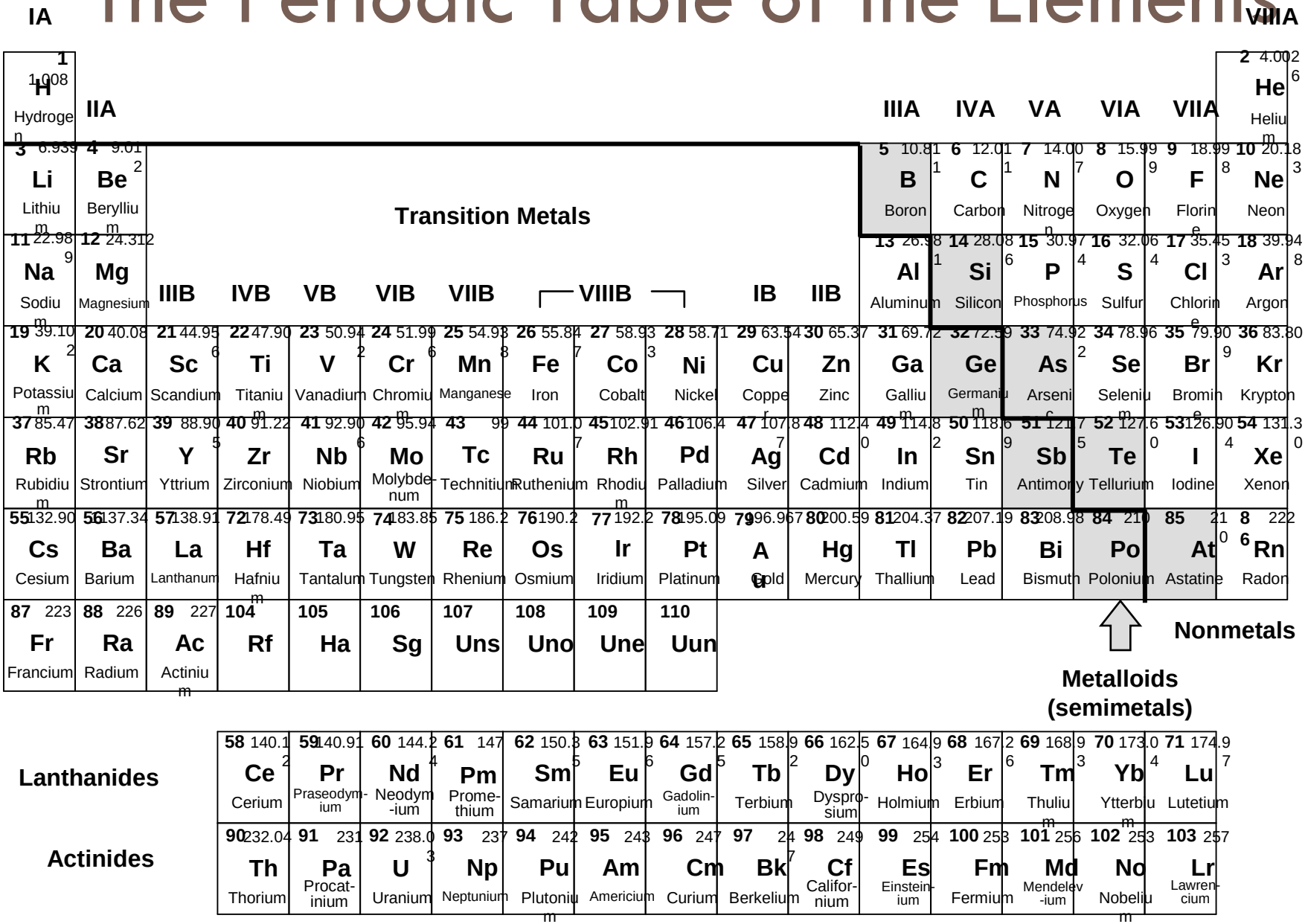
Energia banden teoria



http://www.youtube.com/watch?v=qkjCe0r5-cw&feature=related

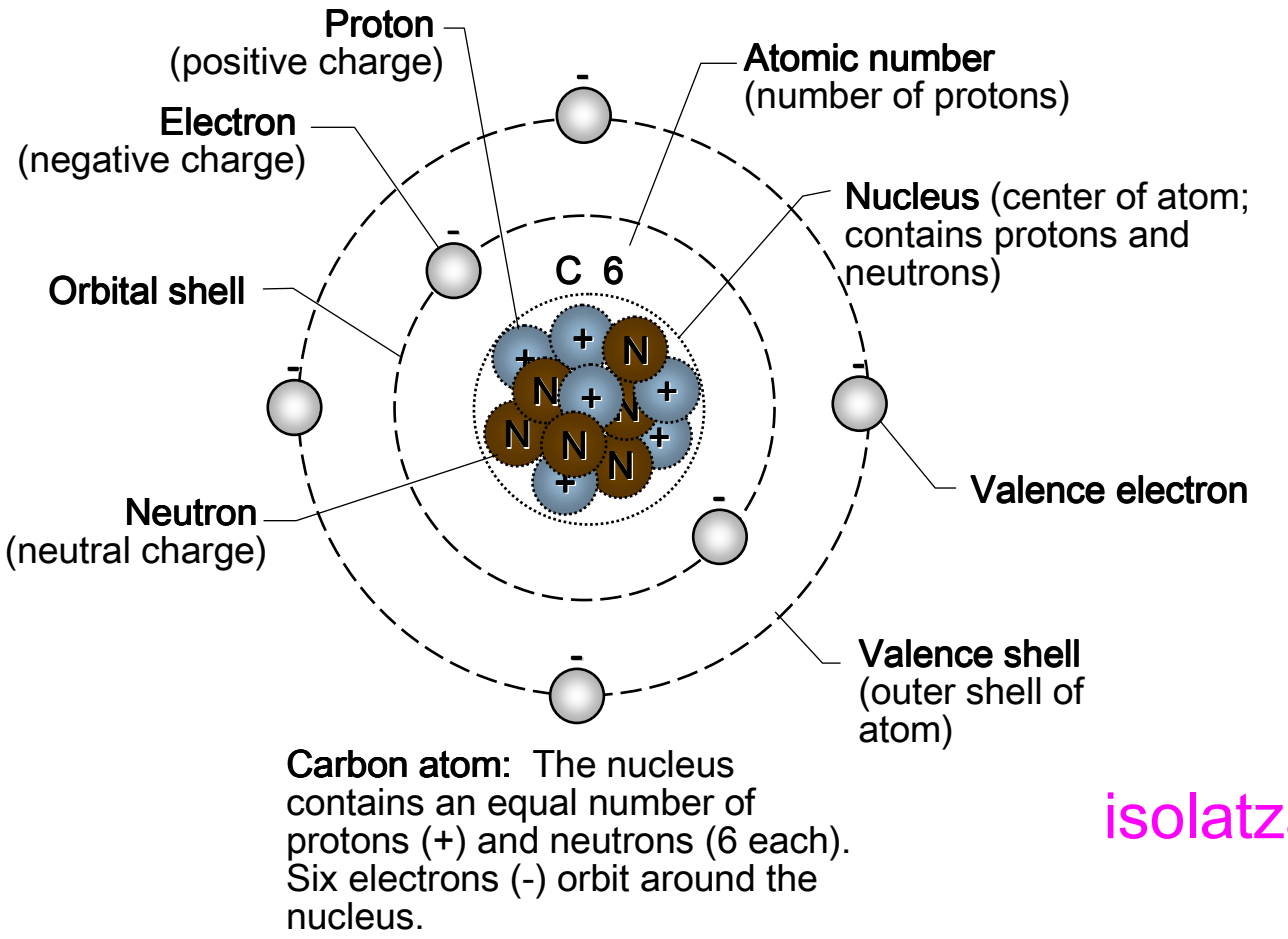
http://www.youtube.com/watch?v=AgkQrCeJF1Y&NR=1

The Periodic Table of the Elements



Lanthanides	58 Ce Cerium 140.12	59 Pr Praseodym-ium 140.91	60 Nd Neodym-ium 144.24	61 Pm Prome-thium 147	62 Sm Samarium 150.35	63 Eu Europium 151.96	64 Gd Gadolin-ium 157.25	65 Tb Terbium 158.92	66 Dy Dyspro-sium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.97
Actinides	90 Th Thorium 232.04	91 Pa Procat-inium 231	92 U Uranium 238.03	93 Np Neptunium 237	94 Pu Plutonium 242	95 Am Americium 243	96 Cm Curium 247	97 Bk Berkelium 247	98 Cf Califor-nium 249	99 Es Einstein-ium 254	100 Fm Fermium 253	101 Md Mendelev-ium 256	102 No Nobelium 253	103 Lr Lawren-cium 257

Karbono atomoaren oinarrizko eredua



isolatzailea

Ohiko erdieroaleak

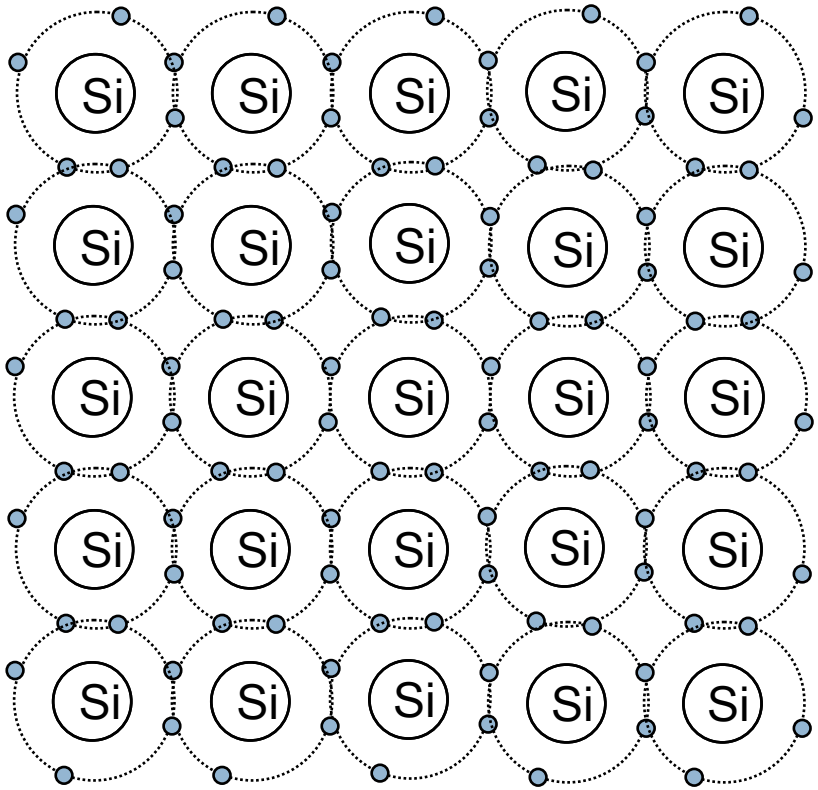
isolatzailea

erdieroaleak

Group IVA	
C, Carbon	6
Si, Silicon	14
Ge, Germanium	32
Sn, Tin	50
Pb, Lead	82

Silizioa

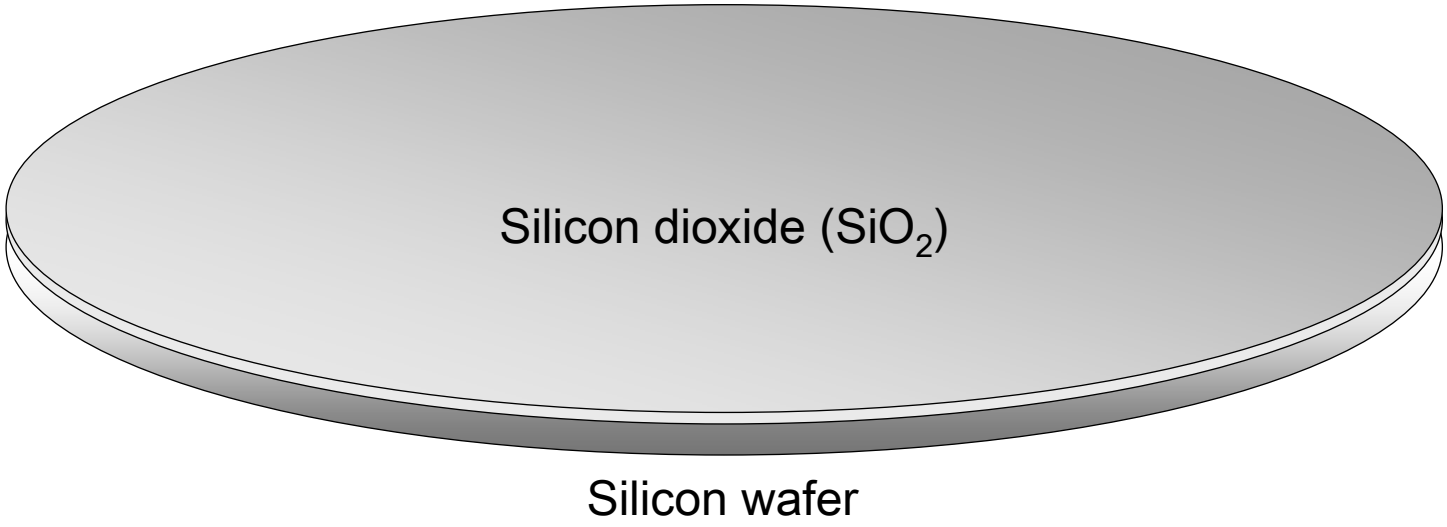
Covalent Bonding of Pure Silicon



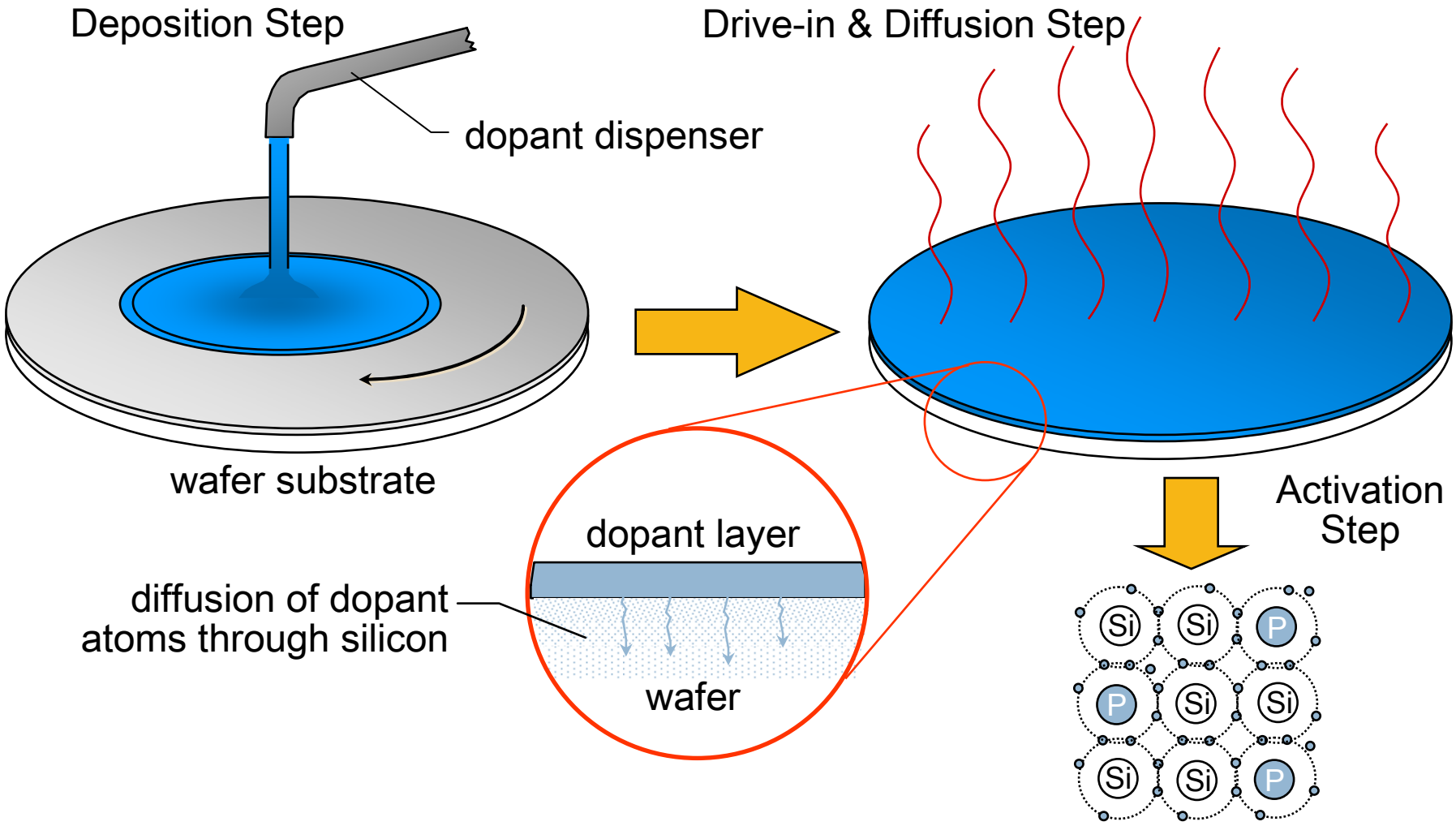
Silicon atoms share valence electrons to form insulator-like bonds.

Erdieroale intrintsekoak

SiO_2 on Silicon Wafer



Doping of Silicon



Silicon Dopants

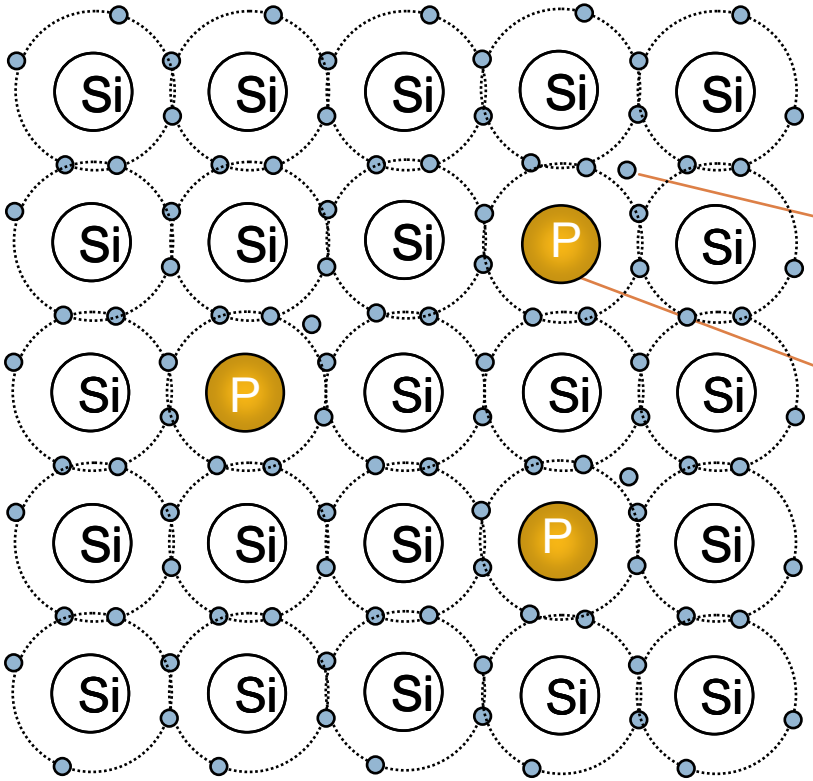
Acceptor Impurities		Semiconductor		Donor Impurities	
Group III (p-type)		Group IV		Group V (n-type)	
Boron	**5**	Carbon	6	Nitrogen	7
Aluminum	13	**Silicon**	**14**	**Phosphorus**	**15**
Gallium	31	Germanium	32	**Arsenic**	**33**
Indium	49	Tin	50	**Antimony**	**51**

** Items underlined are the most commonly used in silicon-based IC manufacturing.*

http://www.youtube.com/watch?v=IMiuD-PNIts&feature=related

http://www.youtube.com/watch?v=o-PPbmMm0eA&feature=related

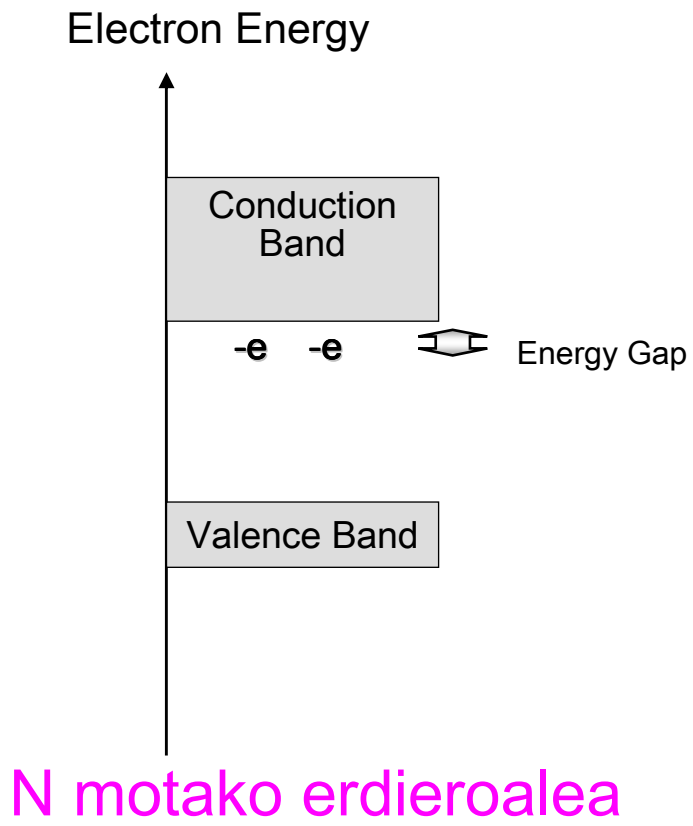
Electrons in N-Type Silicon with Phosphorus Dopant



Donor atoms provide excess electrons to form n-type silicon.

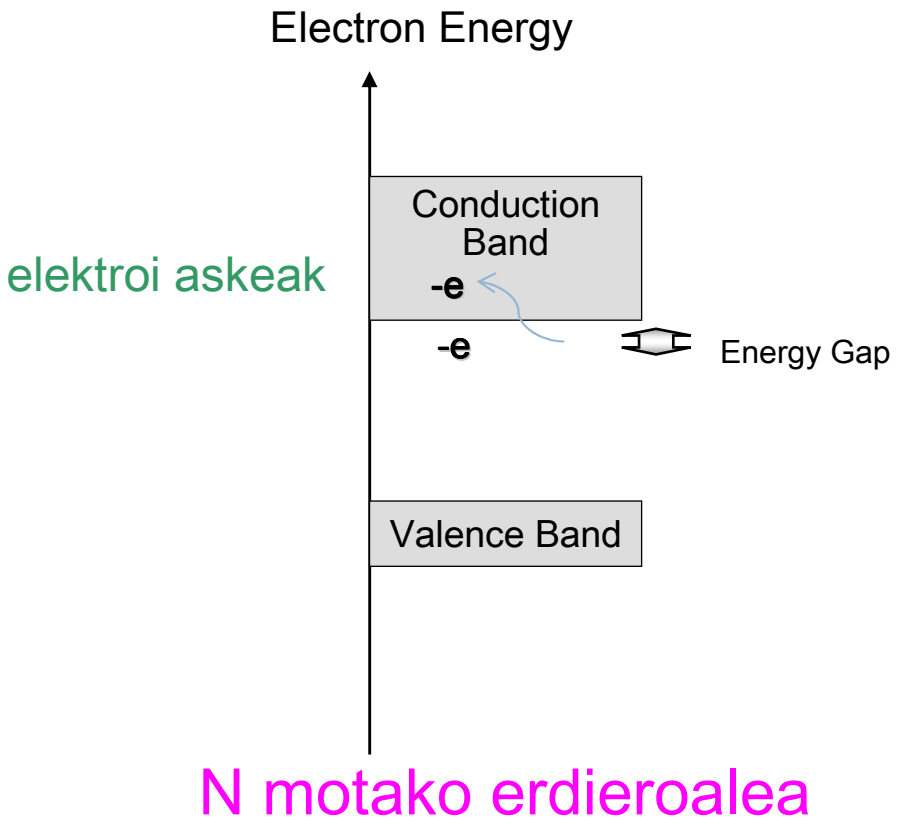
Erdieroale estrintsekoak:
N motakoa

Energy Band Gaps



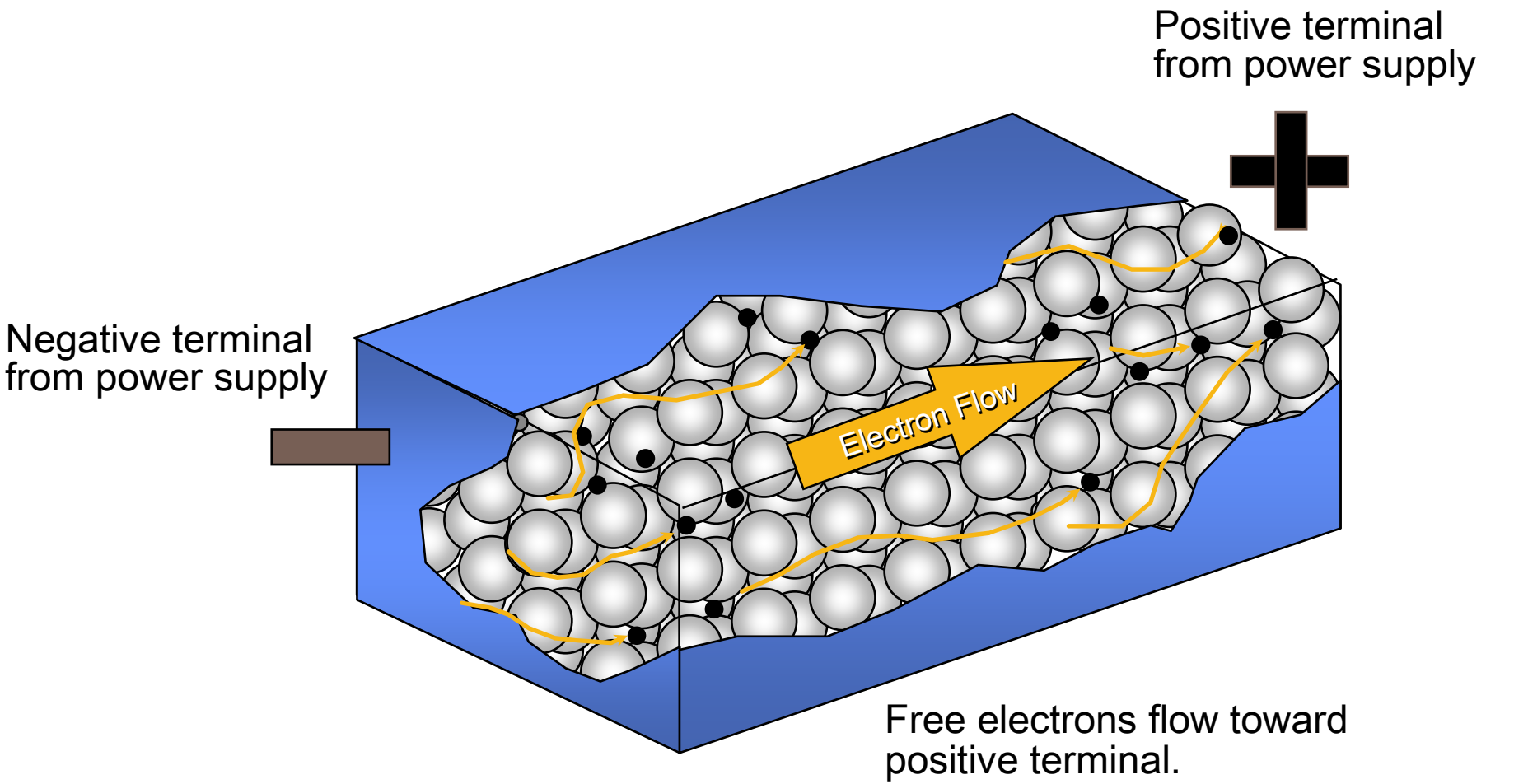
Elektroiak eroalpen bandatik gertu

Energy Band Gaps

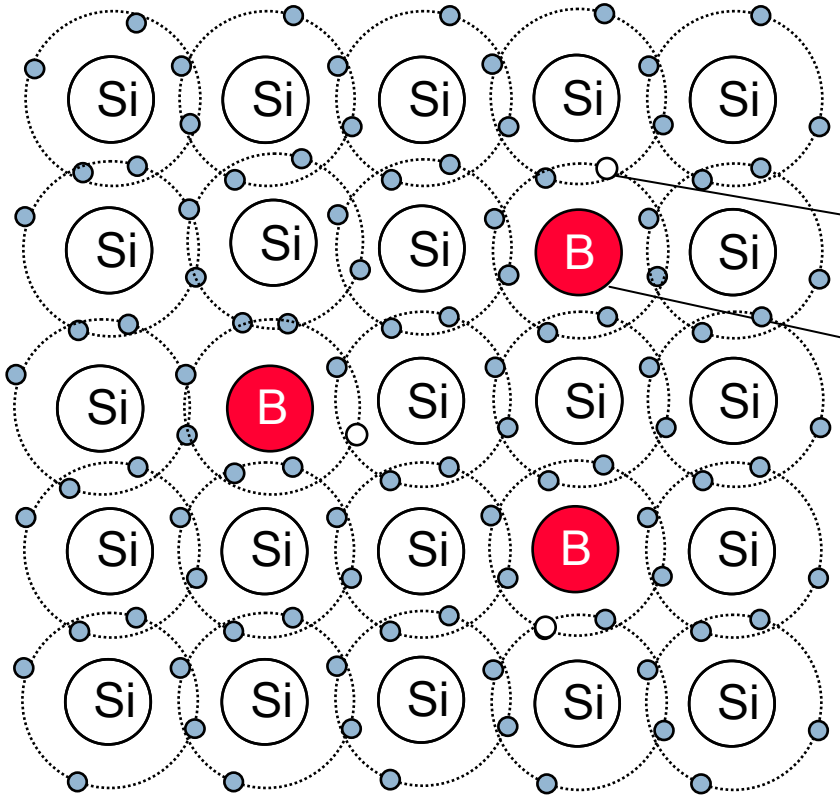


Energia pixka bat emanez gero, elektroi horiek jauzi egiten dute eroalpen bandara eta elektroi aske bihurtzen dira.
Potentzial-diferentzia baten eraginez mugituko dira: korronte elektrikoa sortuko da

Conduction in n-Type Silicon



Holes in p-Type Silicon with Boron Dopant

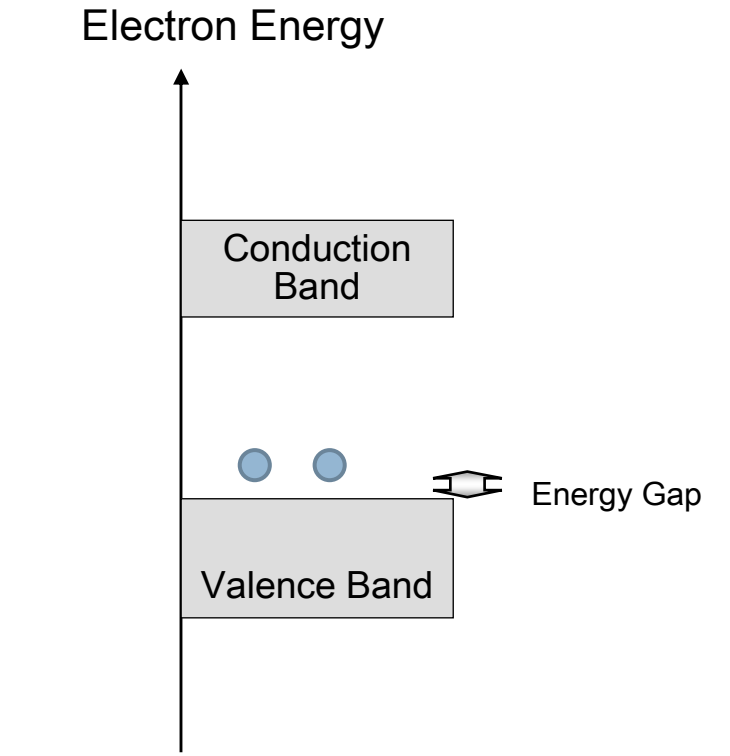


Acceptor atoms provide a deficiency of electrons to form p-type silicon.

hutsuneak

Erdieroale estrintsekoak:
P motakoa

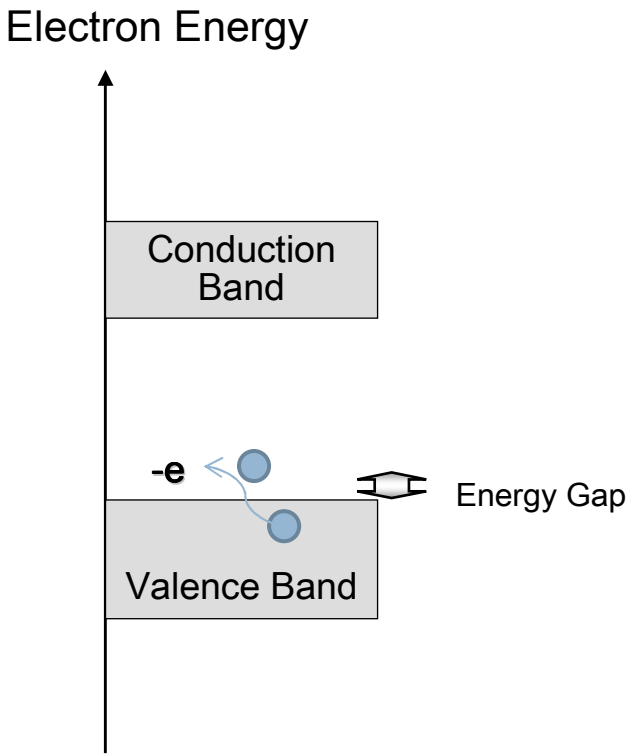
Energy Band Gaps



Hutsuneak balentzi bandatik gertu

P motako erdieroalea

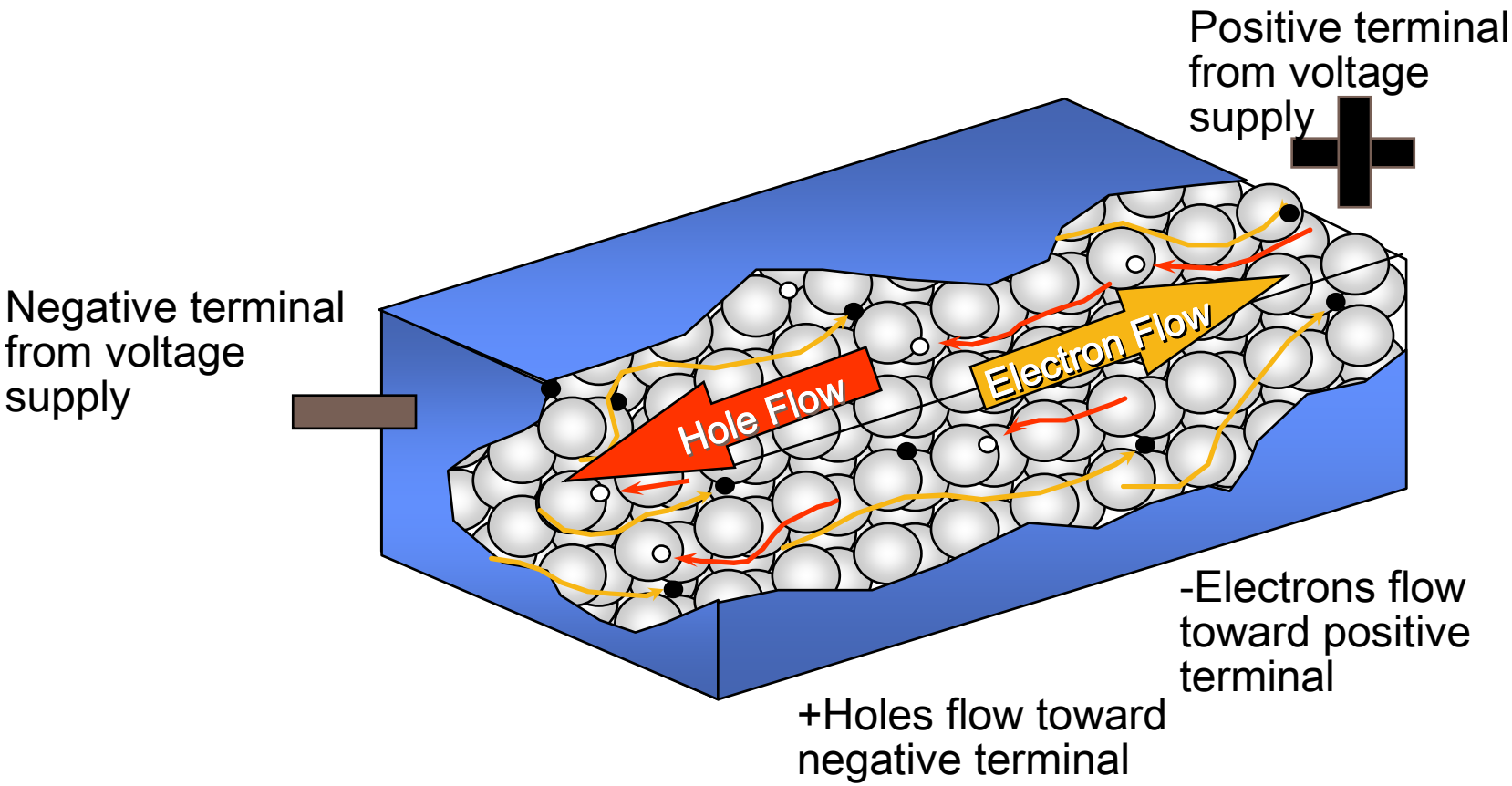
Energy Band Gaps



P motako erdieroalea

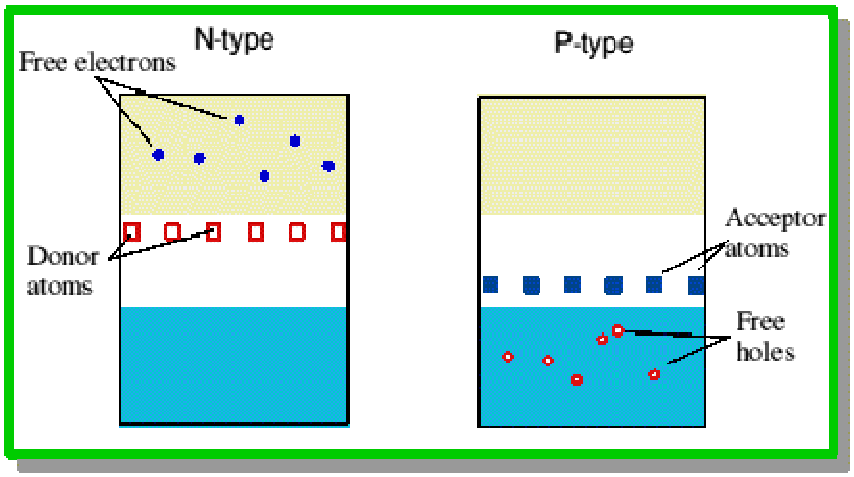
Energia pixka bat emanez gero, balentzi bandako elektroi batzuk hutsune horietara jauzi egiten dute eta balentzi bandan hutsuneak uzten dituzte.
Potentzial-diferentzia baten eraginez balentzi bandako elektroi lotuak mugitu daitezke hutsunez hutsune: korronte elektrikoa sortuko da

Conduction in p-Type Silicon



http://www.youtube.com/watch?v=gMTOH2rYIOE&feature=related

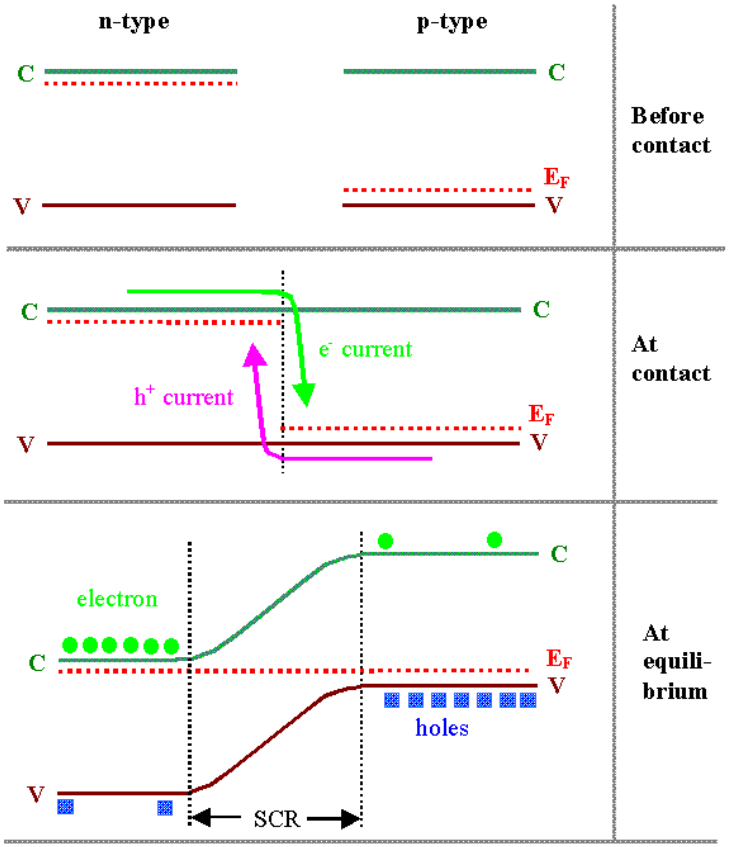
Laburpena: erdieroale estrintsekoak



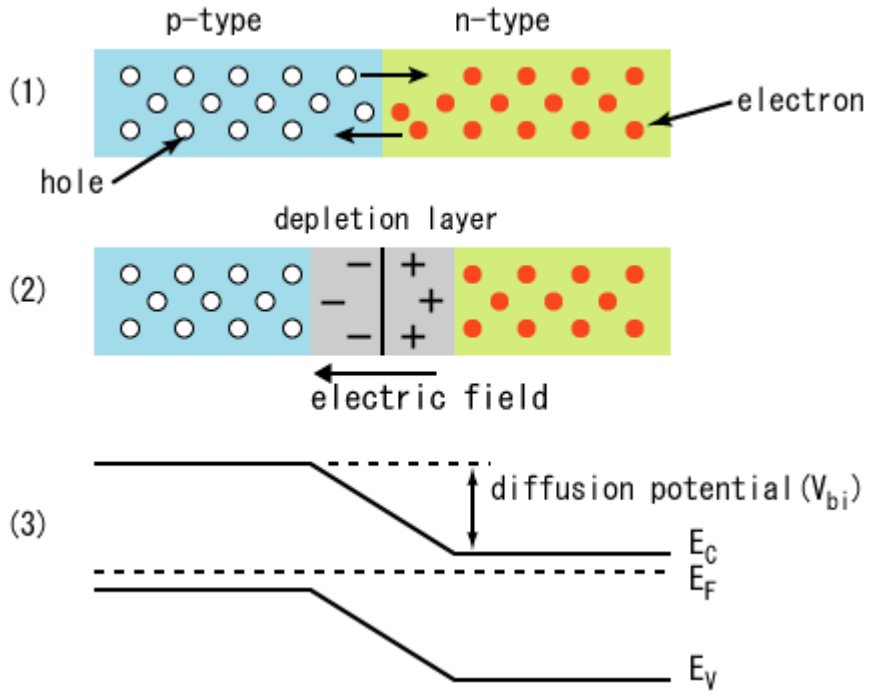
http://mrsec.wisc.edu/Edetc/SlideShow/slides/contents/pn.html

PN juntura

http://pvcdrom.pveducation.org/SEMICON/PN.HTM

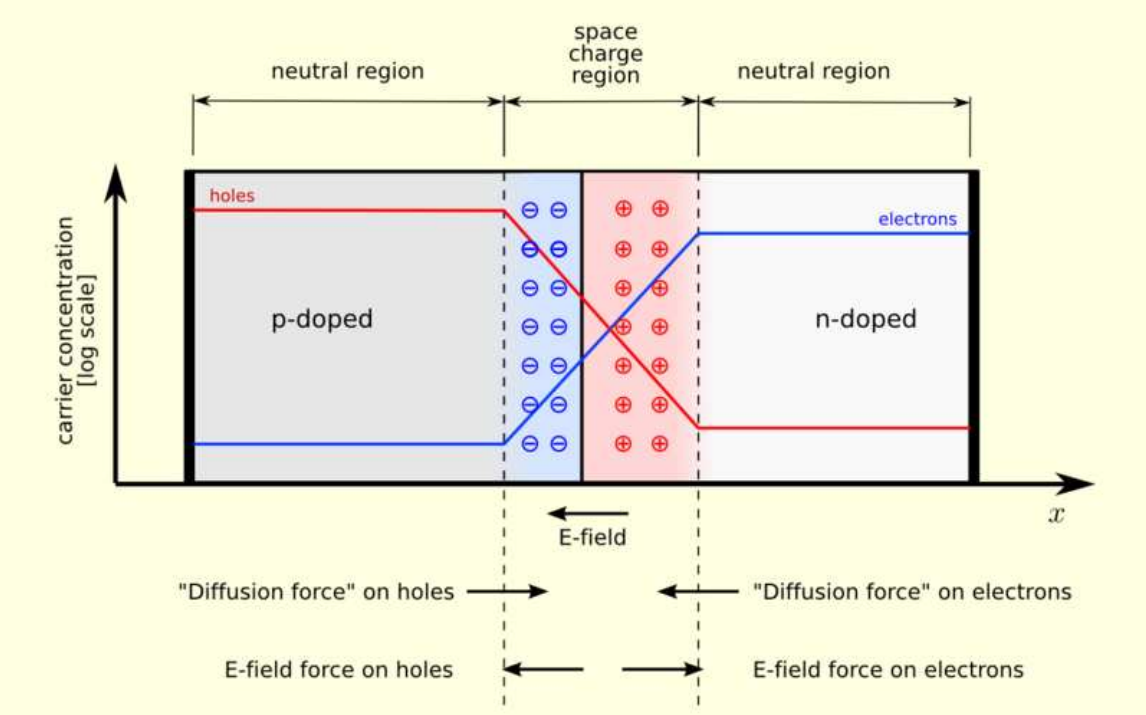


PN juntura


p-type
n-type
(1)
electron
hole
depletion layer
(2)
electric field
(3)
diffusion potential (V_{bi})
E_C
E_F
E_V

PN juntura

http://en.wikipedia.org/wiki/P-n_junction



PN juntura

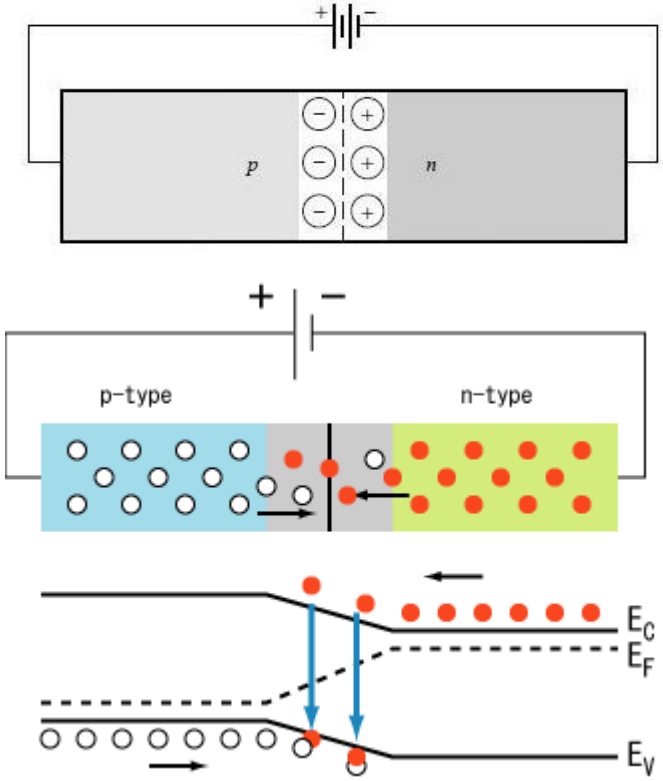
http://www.youtube.com/watch?v=W6QUEq0nUH8&feature=related

http://www.youtube.com/watch?v=kaSXVfWUqEw&NR=1

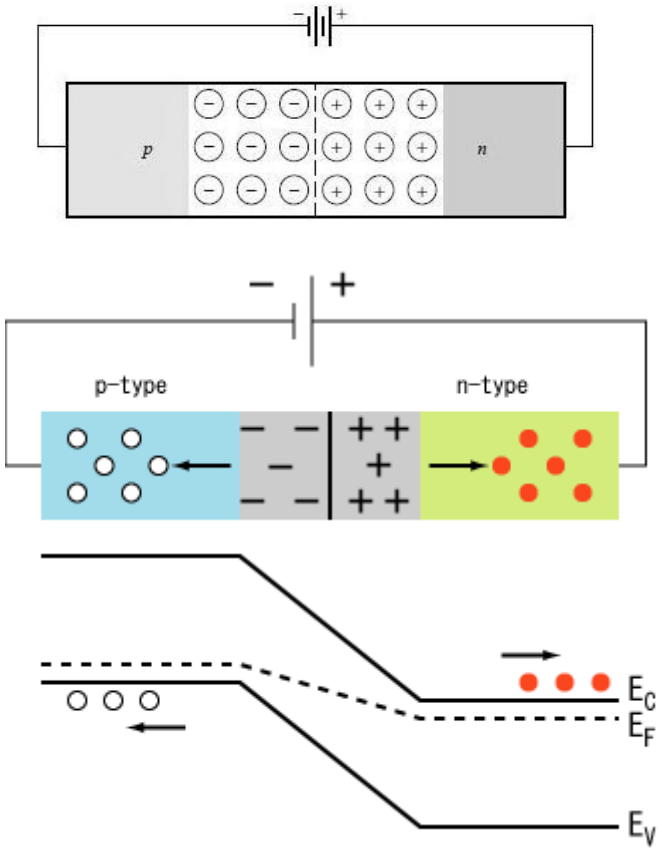
http://www.tpub.com/neets/book7/24h.htm

PN juntura

Zuzeneko polarizazioa (ZP)

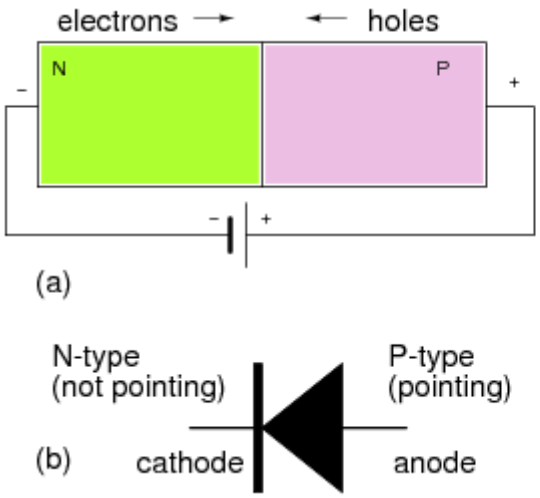


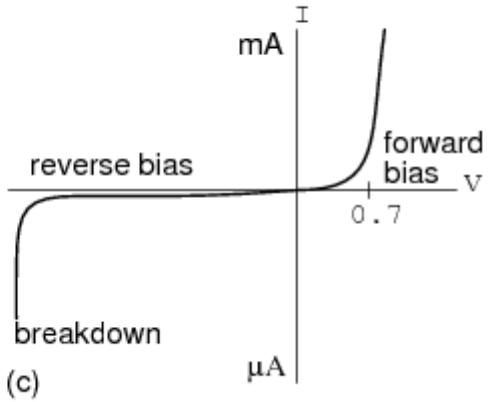
Alderantzizko polarizazioa (AP)



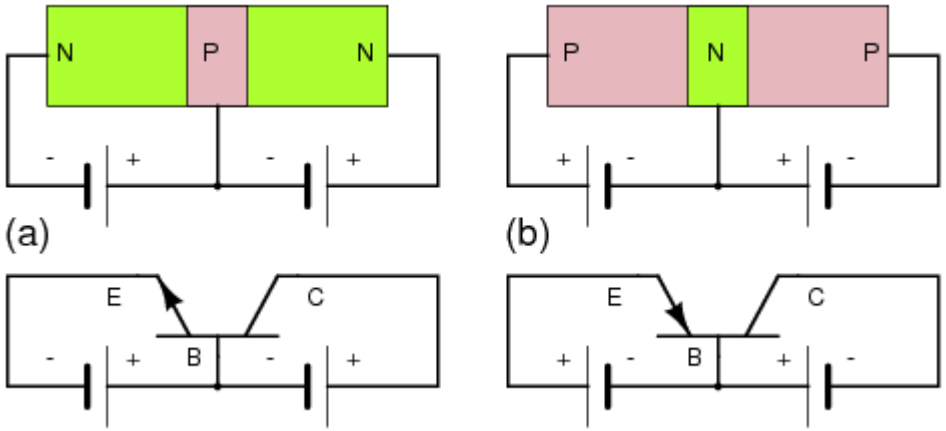
PN juntura: diodoa

http://www.electronics-tutorials.ws/diode/diode_3.html



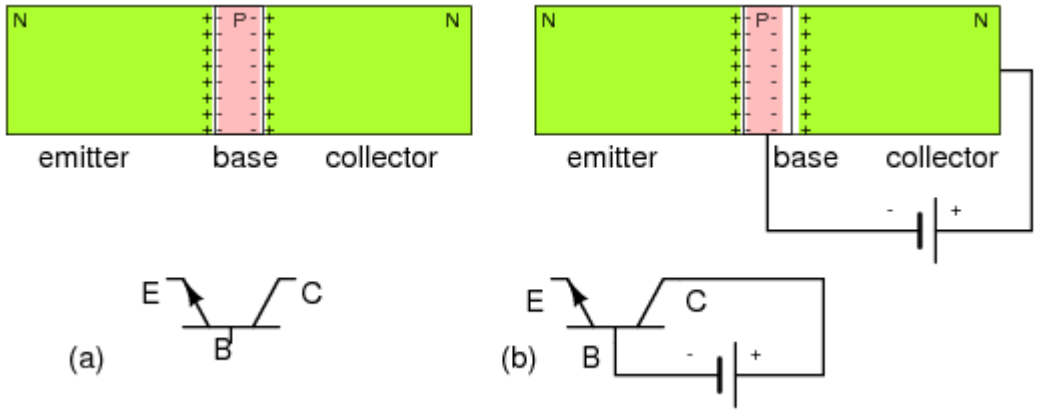


Transistore bipolarra (BJT)

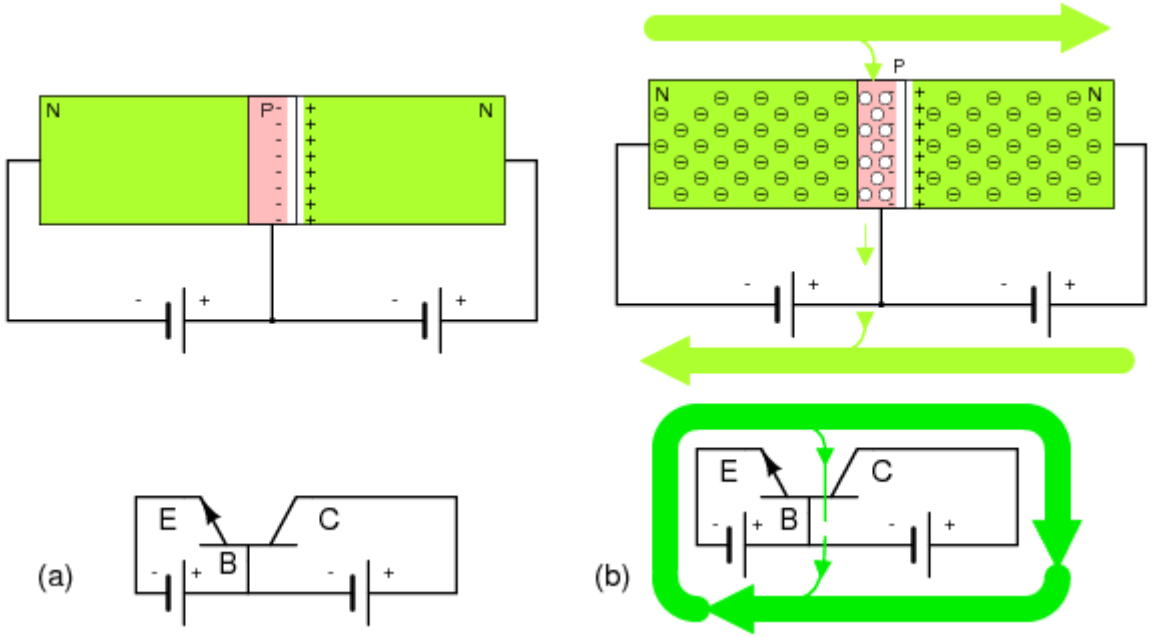


http://www.youtube.com/watch?v=ZaBLiciesOU

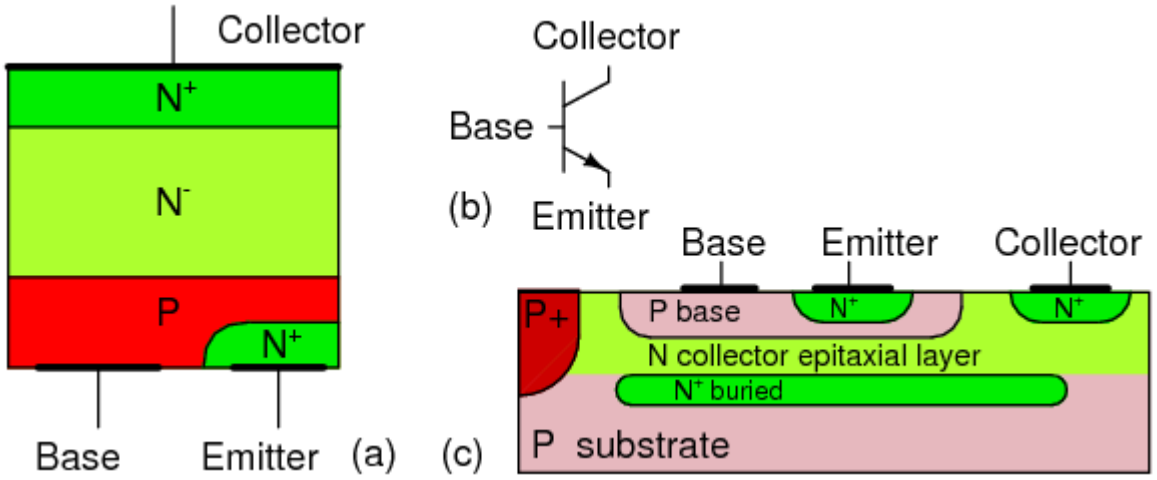
Transistore bipolarra (BJT)



Transistore bipolarra (BJT)

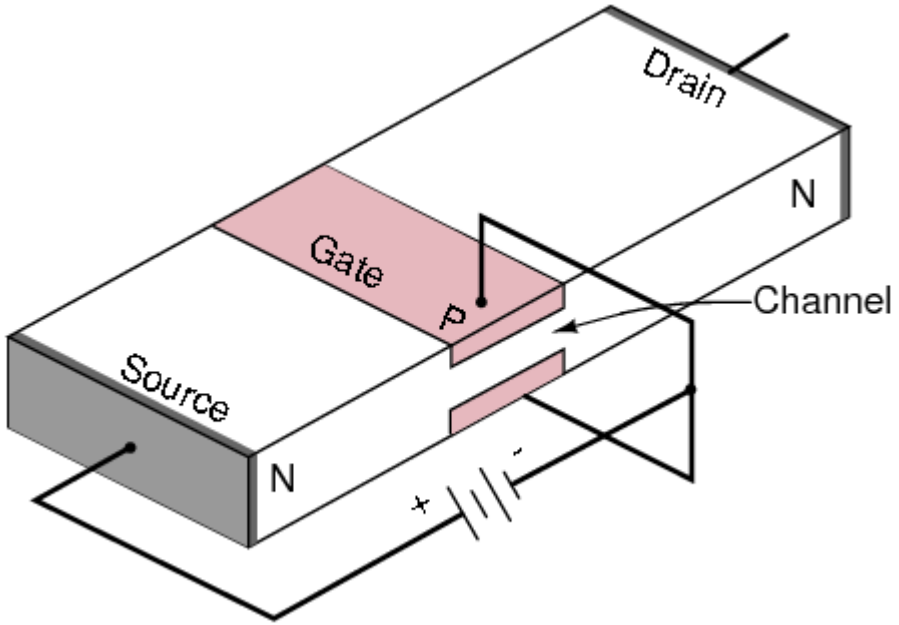


Transistore bipolarra (BJT)

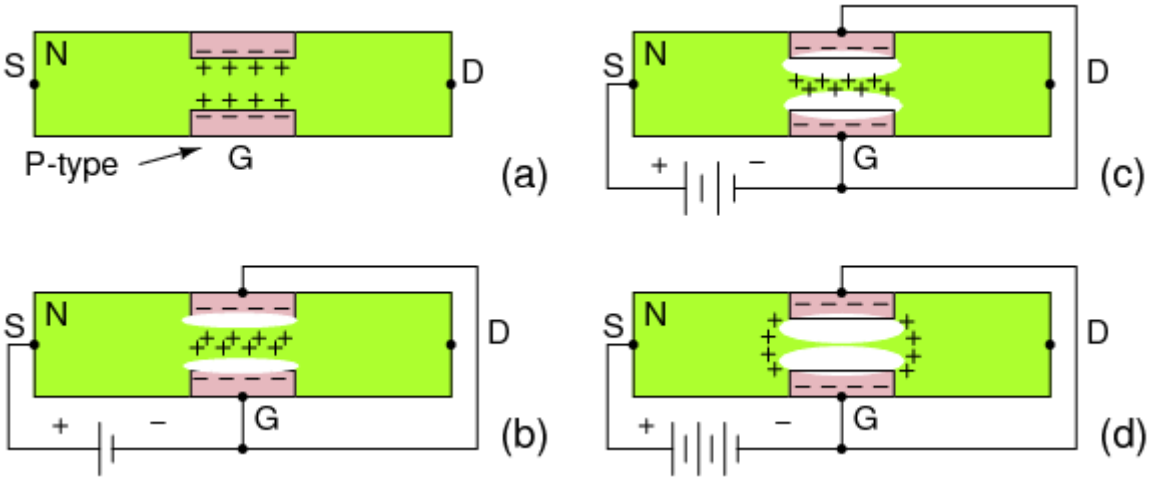


Eremu efektuzko transistoreak (FET)

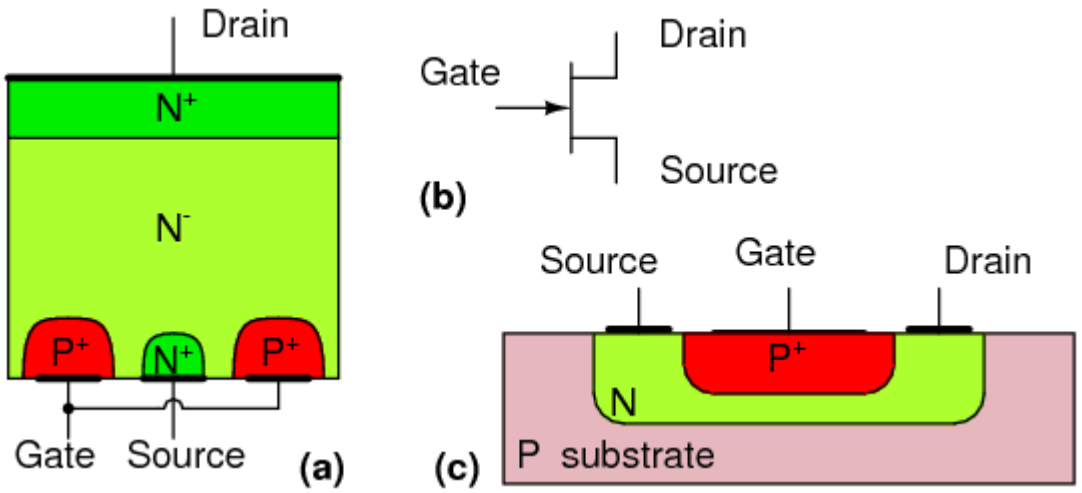
JFET:



JFET



JFET


Drain
N+
N-
P+
N+
P+
Gate
Source
(a)
Drain
Gate
Source
(b)
Source
Gate
Drain
P+
N
P substrate
(c)

FETMOS transistoreak