

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>

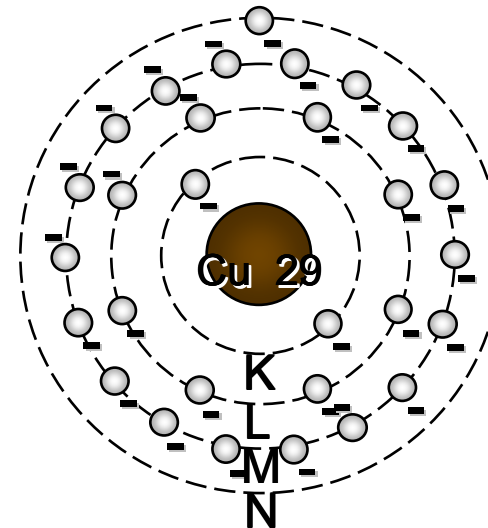
Material eroaleak:

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 korrante 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

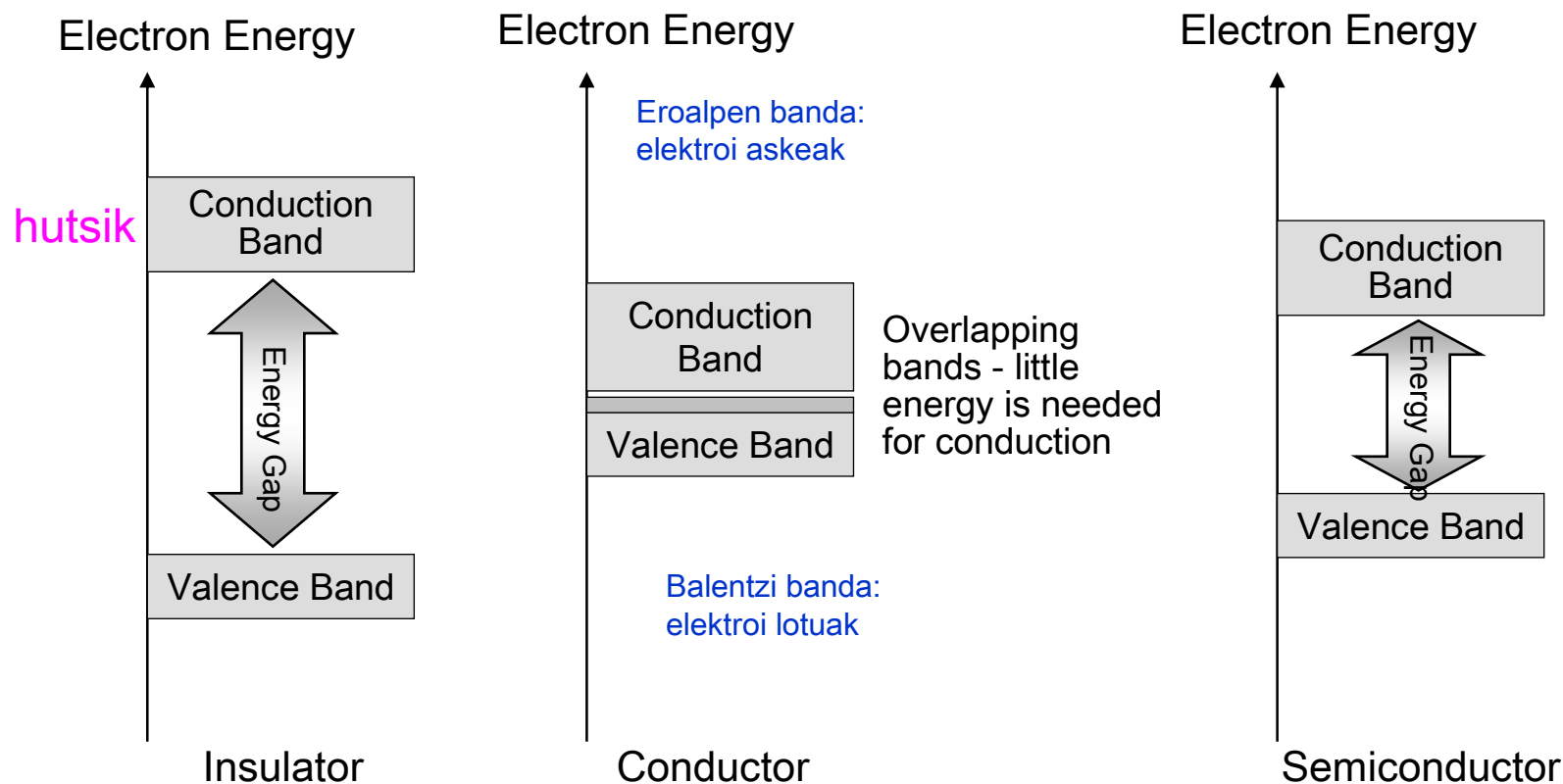
Material Erdieroaleak:



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>

IA The Periodic Table of the Elements VIIIA

1 1.008 H Hydrogen																	2 4.0026 He Helium
IIA		Transition Metals										IIIA	IVA	VA	VIA	VIIA	
3 6.938 Li Lithium	4 9.012 Be Beryllium											5 10.81 B Boron	6 12.01 C Carbon	7 14.00 N Nitrogen	8 15.99 O Oxygen	9 18.99 F Fluorine	10 20.18 Ne Neon
11 22.98 Na Sodium	12 24.312 Mg Magnesium											13 26.98 Al Aluminum	14 28.08 Si Silicon	15 30.97 P Phosphorus	16 32.06 S Sulfur	17 35.45 Cl Chlorine	18 39.94 Ar Argon
19 39.10 K Potassium	20 40.08 Ca Calcium	21 44.95 Sc Scandium	22 47.90 Ti Titanium	23 50.94 V Vanadium	24 51.99 Cr Chromium	25 54.93 Mn Manganese	26 55.84 Fe Iron	27 58.93 Co Cobalt	28 58.71 Ni Nickel	29 63.54 Cu Copper	30 65.37 Zn Zinc	31 69.72 Ga Gallium	32 72.59 Ge Germanium	33 74.92 As Arsenic	34 78.96 Se Selenium	35 79.90 Br Bromine	36 83.80 Kr Krypton
37 85.47 Rb Rubidium	38 87.62 Sr Strontium	39 88.90 Y Yttrium	40 91.22 Zr Zirconium	41 92.90 Nb Niobium	42 95.94 Mo Molybdenum	43 99 Tc Technetium	44 101.0 Ru Ruthenium	45 102.91 Rh Rhodium	46 106.4 Pd Palladium	47 107.8 Ag Silver	48 112.4 Cd Cadmium	49 114.8 In Indium	50 118.6 Sn Tin	51 121.7 Sb Antimony	52 127.6 Te Tellurium	53 126.90 I Iodine	54 131.3 Xe Xenon
55 132.90 Cs Cesium	56 137.34 Ba Barium	57 138.91 La Lanthanum	72 178.49 Hf Hafnium	73 180.95 Ta Tantalum	74 183.85 W Tungsten	75 186.2 Re Rhenium	76 190.2 Os Osmium	77 192.2 Ir Iridium	78 195.09 Pt Platinum	79 196.96 Au Gold	80 200.59 Hg Mercury	81 204.37 Tl Thallium	82 207.19 Pb Lead	83 208.98 Bi Bismuth	84 210 Po Polonium	85 210 At Astatine	86 222 Rn Radon
87 223 Fr Francium	88 226 Ra Radium	89 227 Ac Actinium	104 Rf	105 Ha	106 Sg	107 Uns	108 Uno	109 Une	110 Uun								



Nonmetals

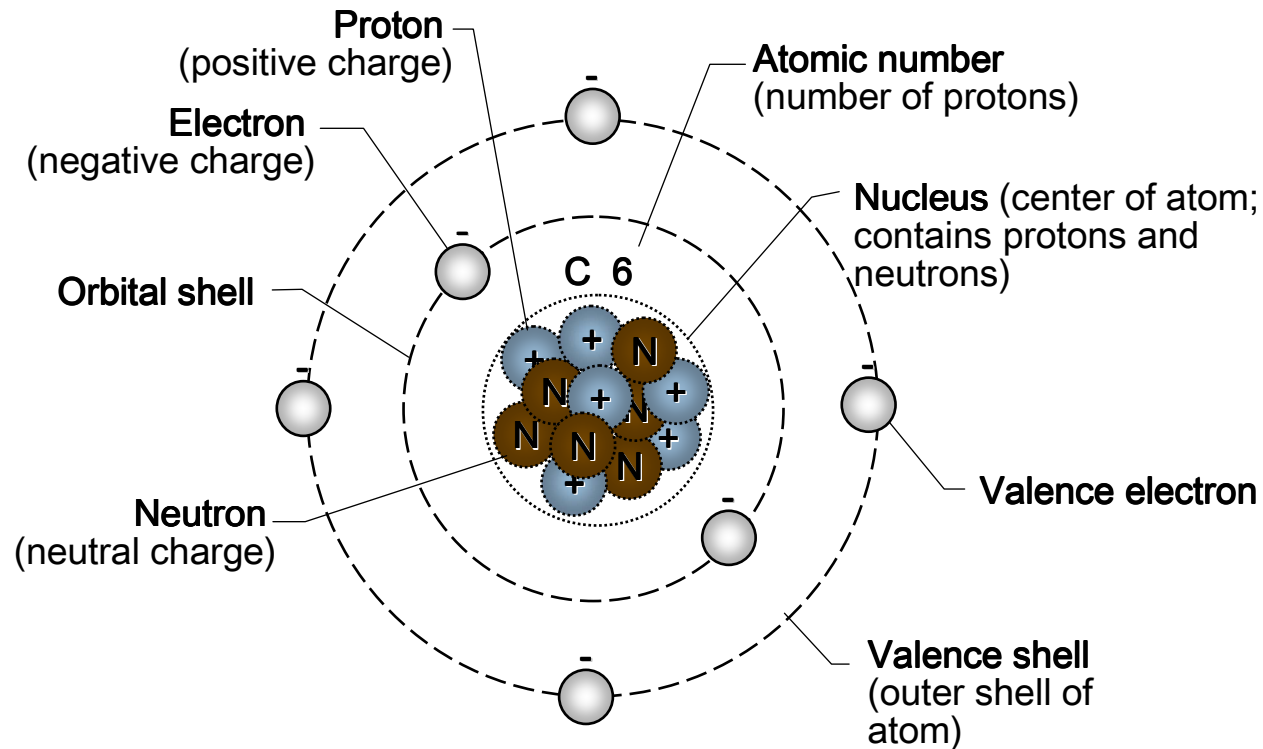
**Metalloids
(semimetals)**

Lanthanides

58 140.12 Ce Cerium	59 140.91 Pr Praseodymium	60 144.24 Nd Neodymium	61 147 Pm Promethium	62 150.35 Sm Samarium	63 151.96 Eu Europium	64 157.25 Gd Gadolinium	65 158.92 Tb Terbium	66 162.50 Dy Dysprosium	67 164.93 Ho Holmium	68 167.26 Er Erbium	69 168.93 Tm Thulium	70 173.04 Yb Ytterbium	71 174.97 Lu Lutetium
90 232.04 Th Thorium	91 231 Pa Protactinium	92 238.03 U Uranium	93 237 Np Neptunium	94 242 Pu Plutonium	95 243 Am Americium	96 247 Cm Curium	97 247 Bk Berkelium	98 249 Cf Californium	99 254 Es Einsteinium	100 253 Fm Fermium	101 256 Md Mendelevium	102 253 No Nobelium	103 257 Lr Lawrencium

Actinides

Karbono atomoaren oinarritzko eredua



Carbon atom: The nucleus contains an equal number of protons (+) and neutrons (6 each). Six electrons (-) orbit around the nucleus.

isolatzailea

Ohiko erdieroaleak

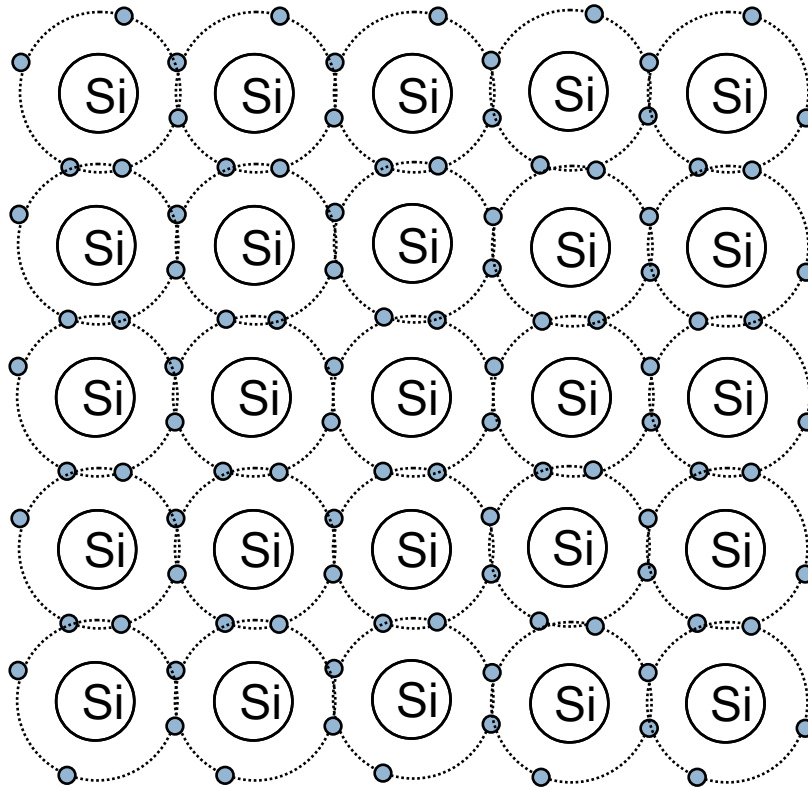
isolatzailea

erdieroaleak

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

Silizioa

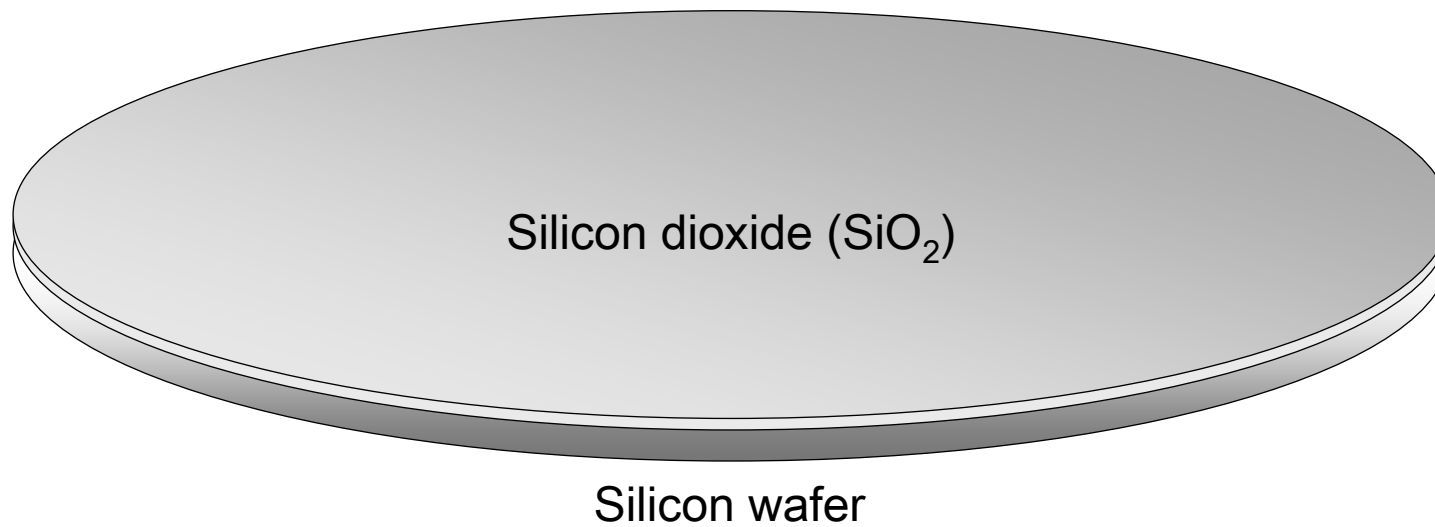
Covalent Bonding of Pure Silicon



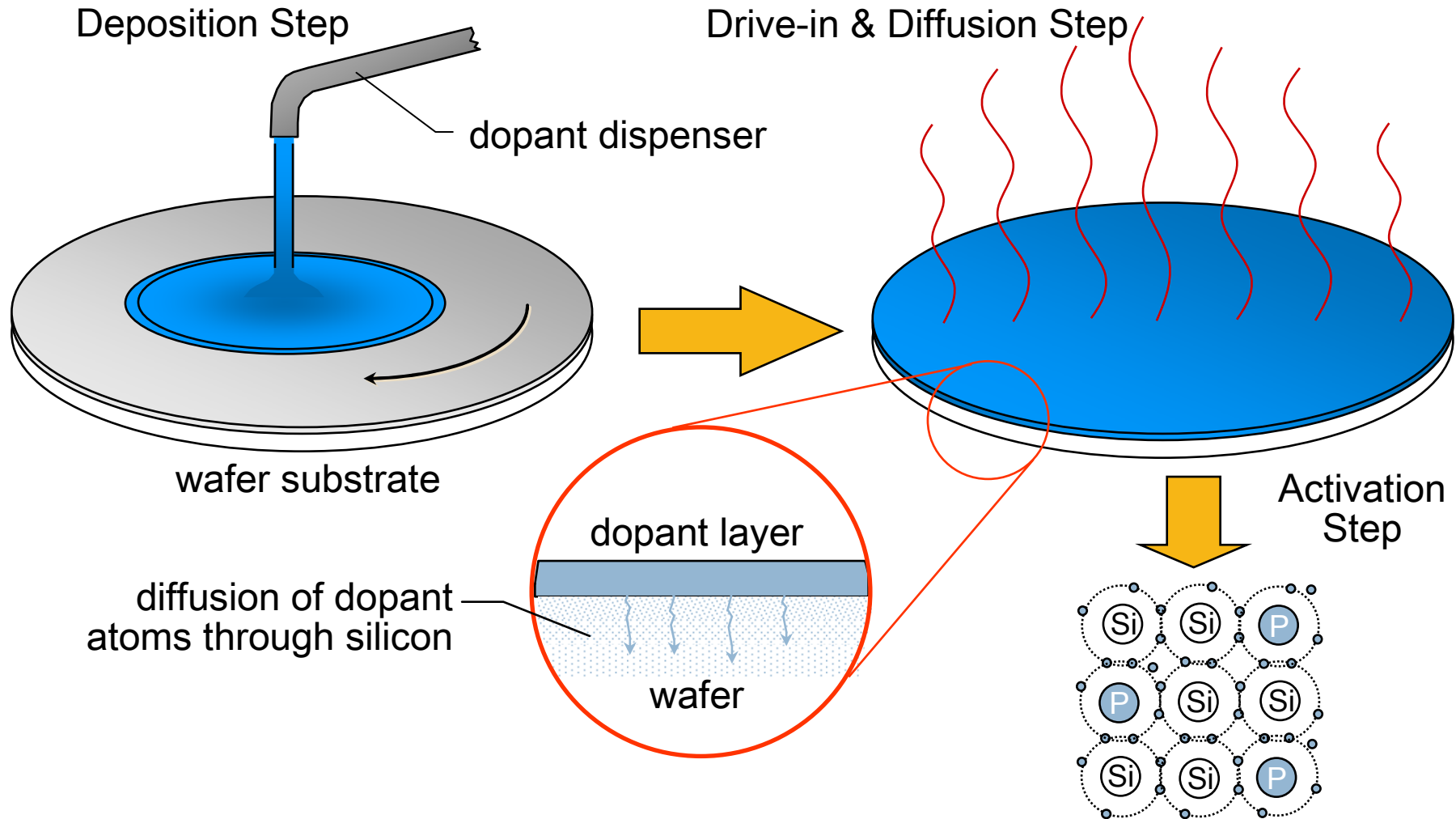
Erdieroale intrintsekoak

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

SiO_2 on Silicon Wafer



Doping of Silicon



Silicon Dopants

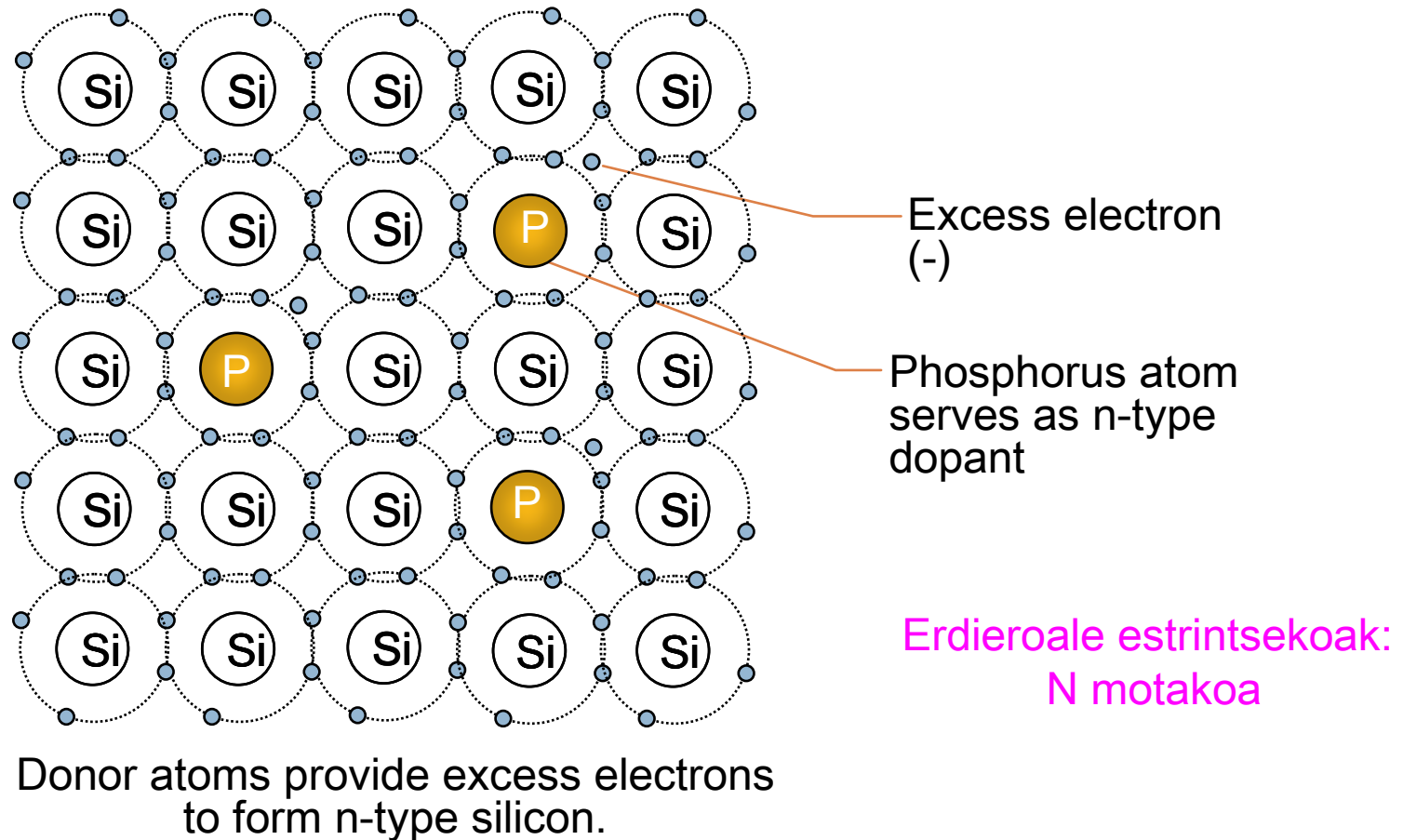
Acceptor Impurities	Semiconductor	Donor Impurities
Group III (p-type)	Group IV	Group V (n-type)
<u>Boron</u> 5	Carbon 6	Nitrogen 7
Aluminum 13	<u>Silicon</u> 14	<u>Phosphorus</u> 15
Gallium 31	Germanium 32	<u>Arsenic</u> 33
Indium 49	Tin 50	<u>Antimony</u> 51

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

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

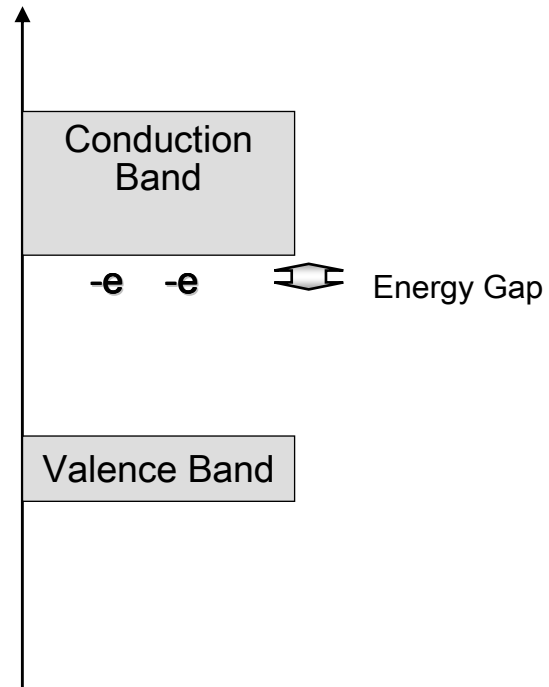
<http://www.youtube.com/watch?v=o-PPbmMm0eA&feature=related>

Electrons in N-Type Silicon with Phosphorus Dopant



Energy Band Gaps

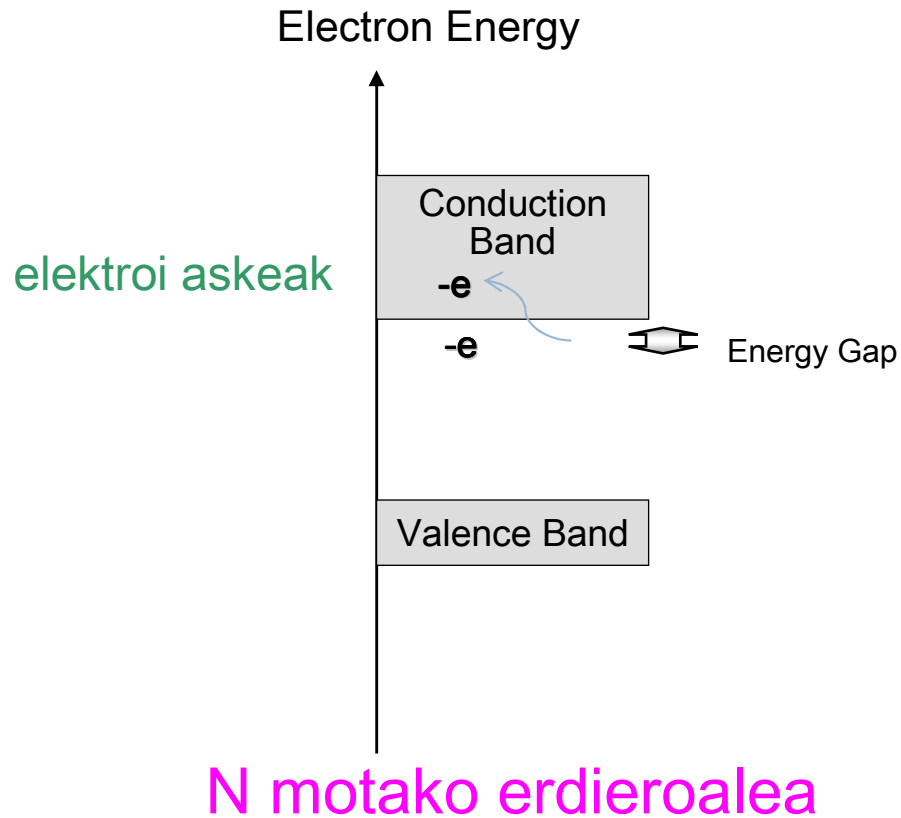
Electron Energy



Elektroiak eroalpen bandatik gertu

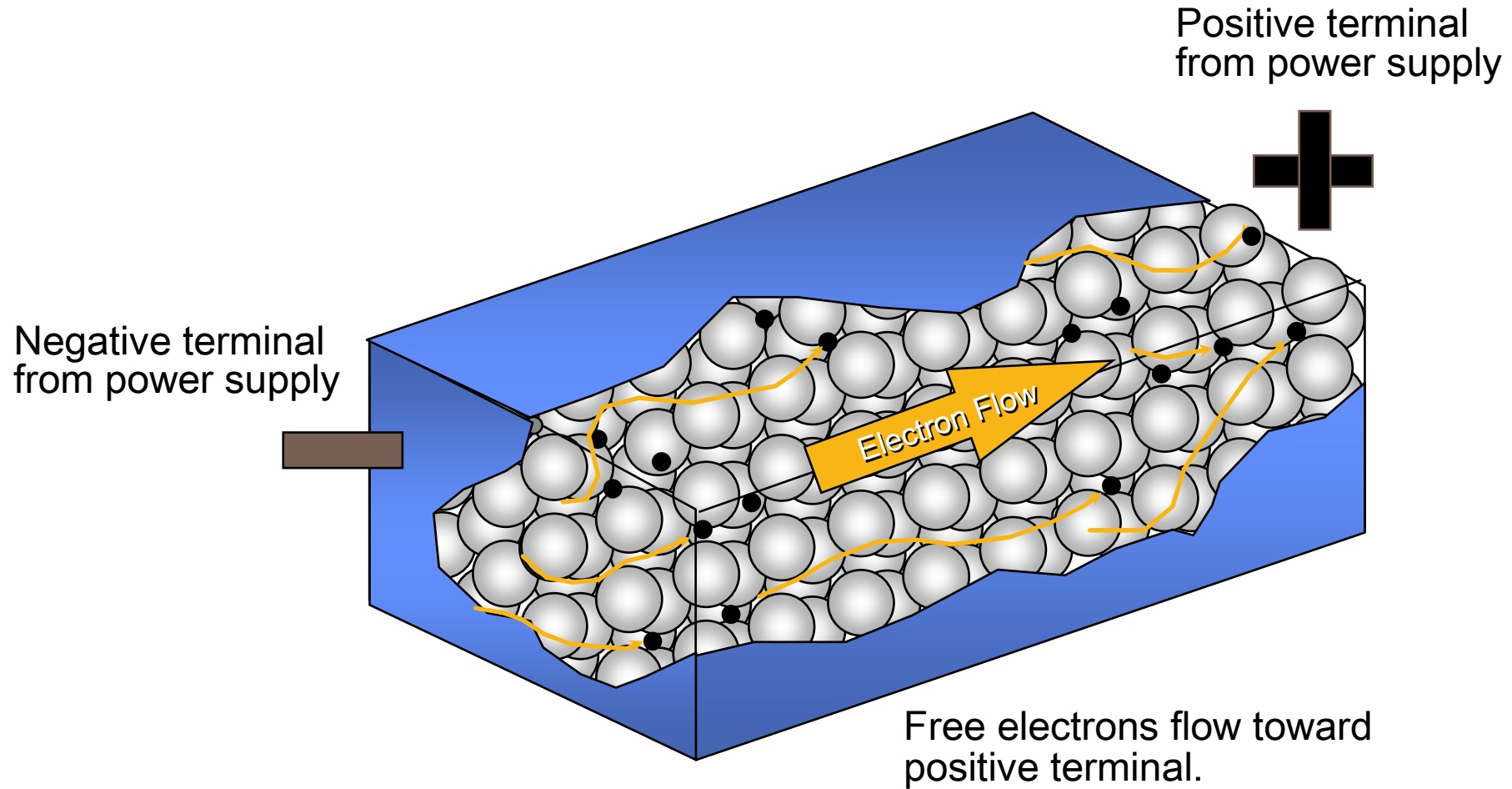
N motako erdieroalea

Energy Band Gaps

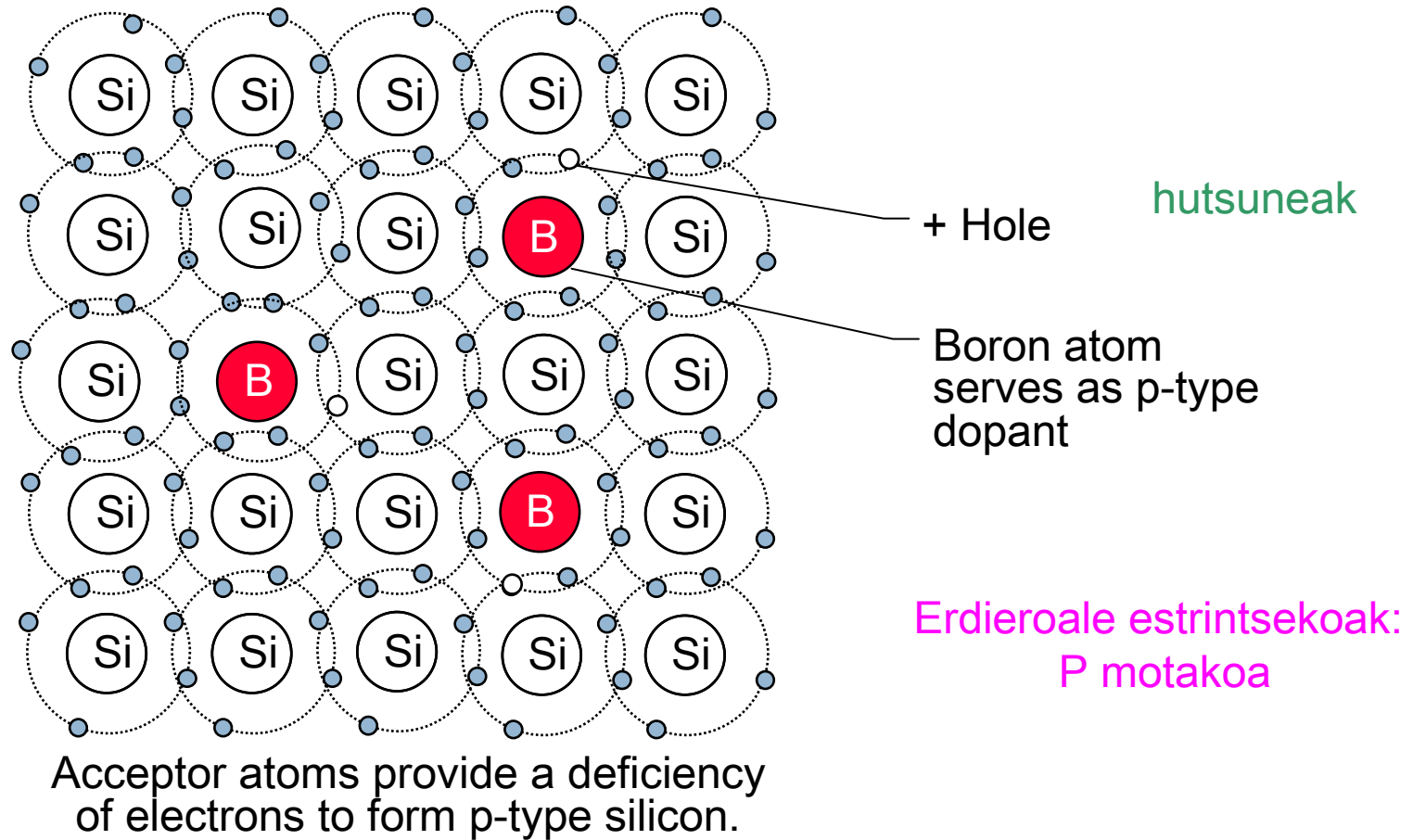


Energia pixka bat emanez gero, elektroi horiek jauzi egiten dute eroalpen bandara eta elektroi aske bihurtzen dira. Potentzial-diferentzia baten eraginez mugituko dira: korrante elektrikoa sortuko da

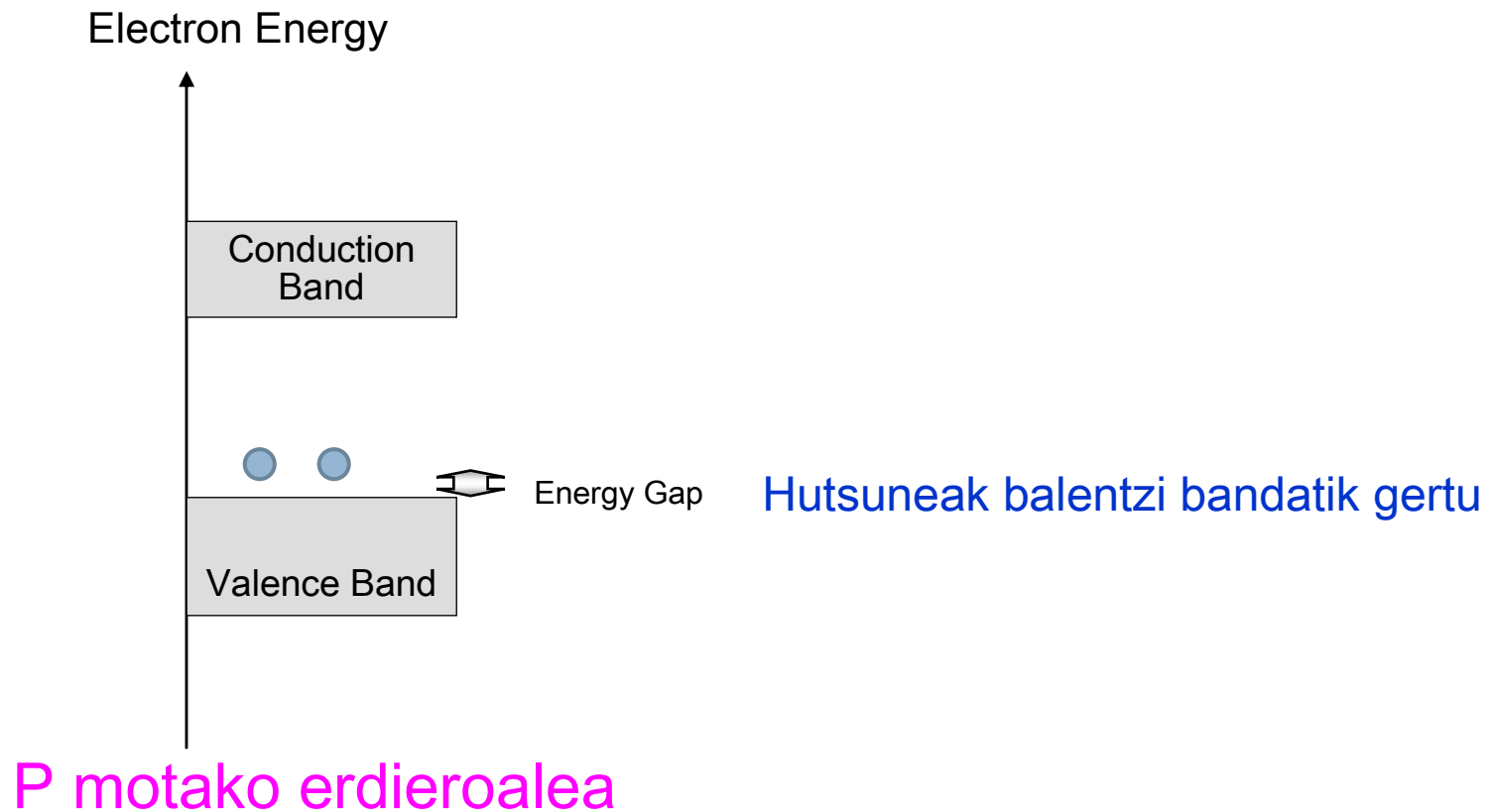
Conduction in n-Type Silicon



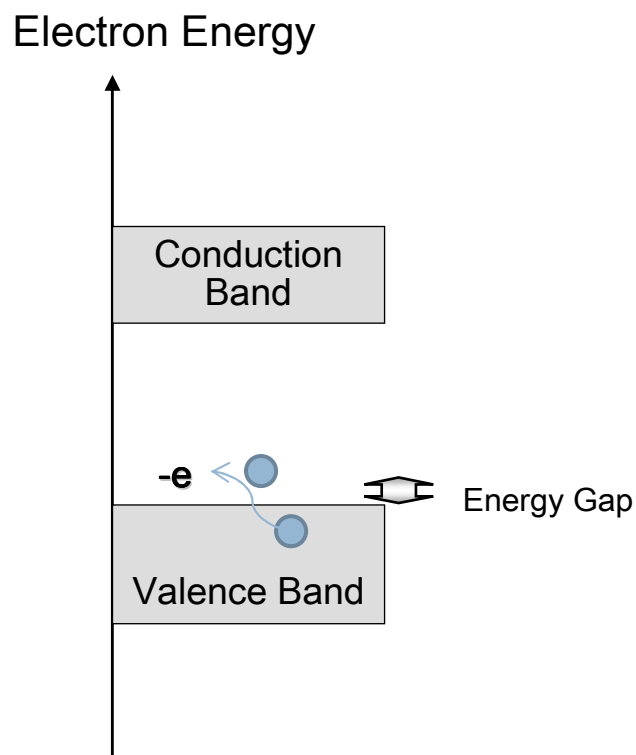
Holes in p-Type Silicon with Boron Dopant



Energy Band Gaps



Energy Band Gaps

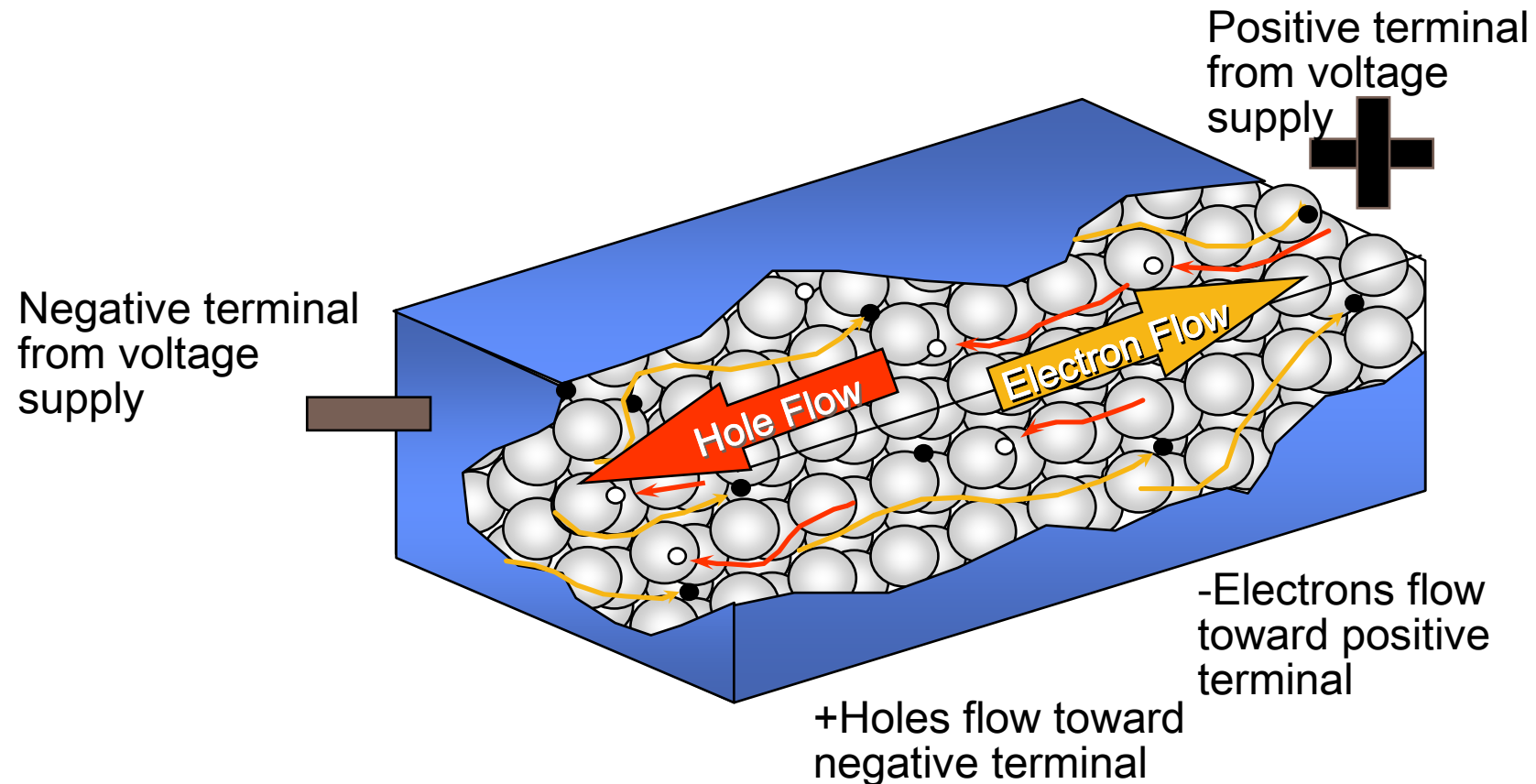


P motako erdieroalea

Energia pixka bat emanez gero, balentzi bandako elektroi batzuk hutsune horietara jauzi egiten dute eta balentzi bandan hutsuneak uzten dituzte.

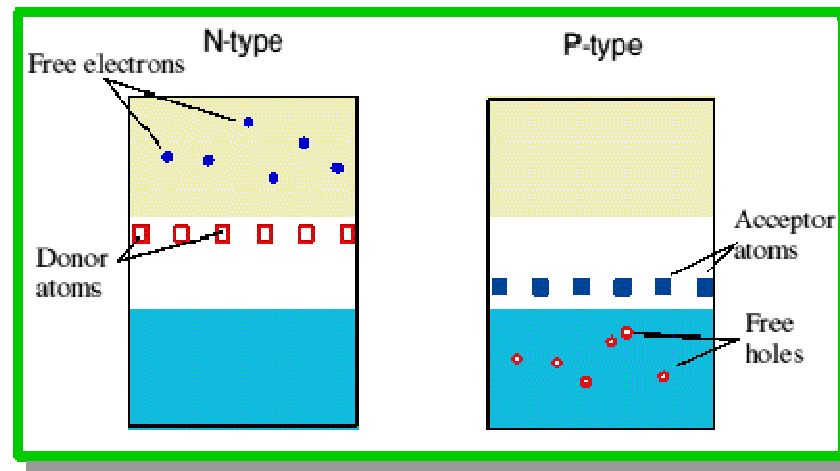
Potentzial-diferentzia baten eraginez balentzi bandako elektroi lotuak mugitu daitezke hutsunez hutsune: korrante elektrikoa sortuko da

Conduction in p-Type Silicon



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

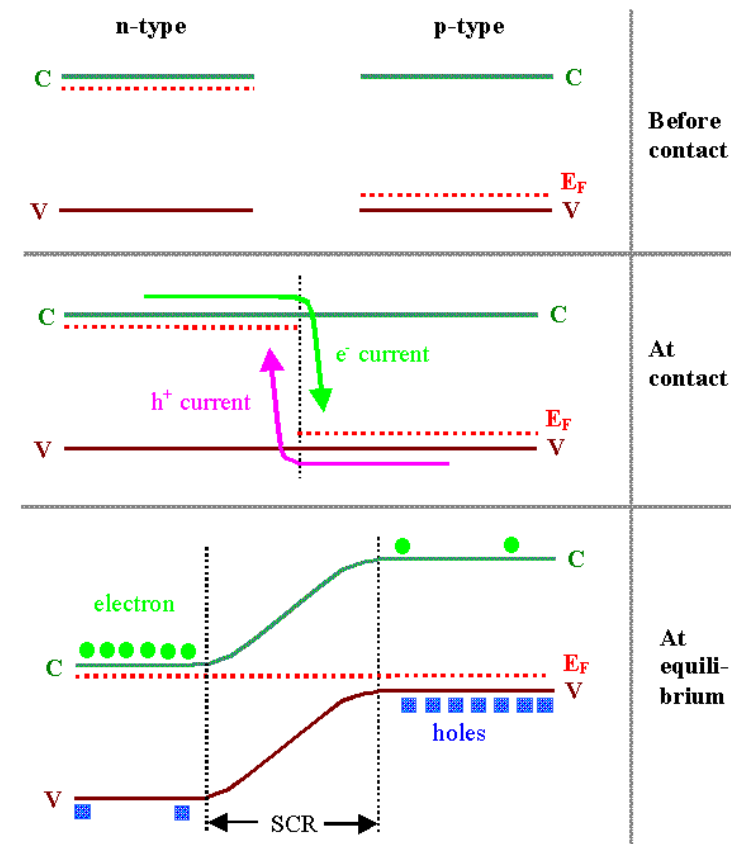
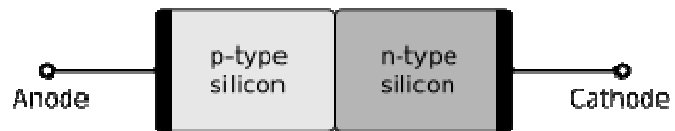
Laburpena: erdieroale estrintsekoak



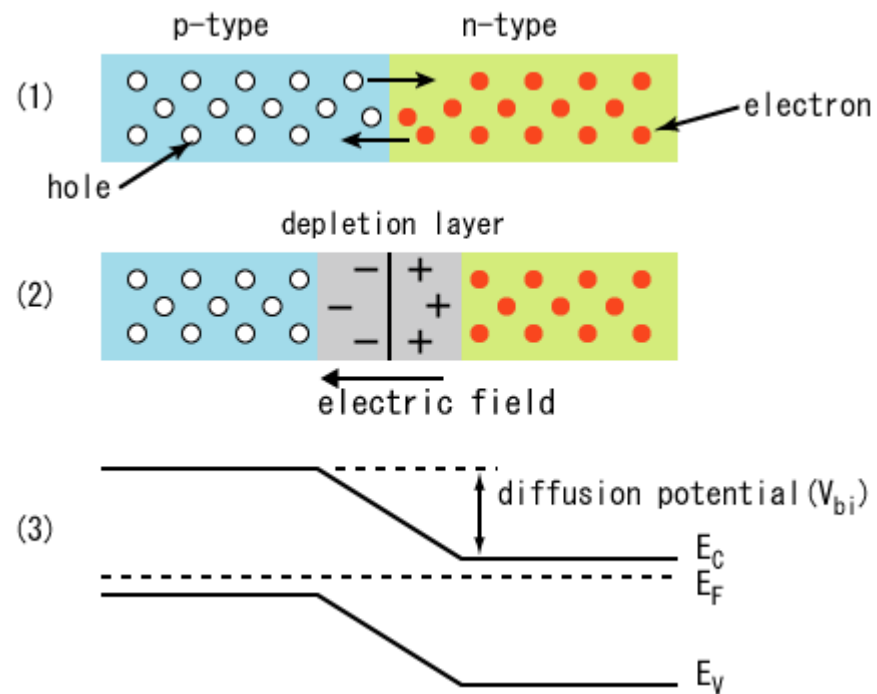
<http://mrsec.wisc.edu/Edetc/SlideShow/slides/contents/pn.html>

PN juntura

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

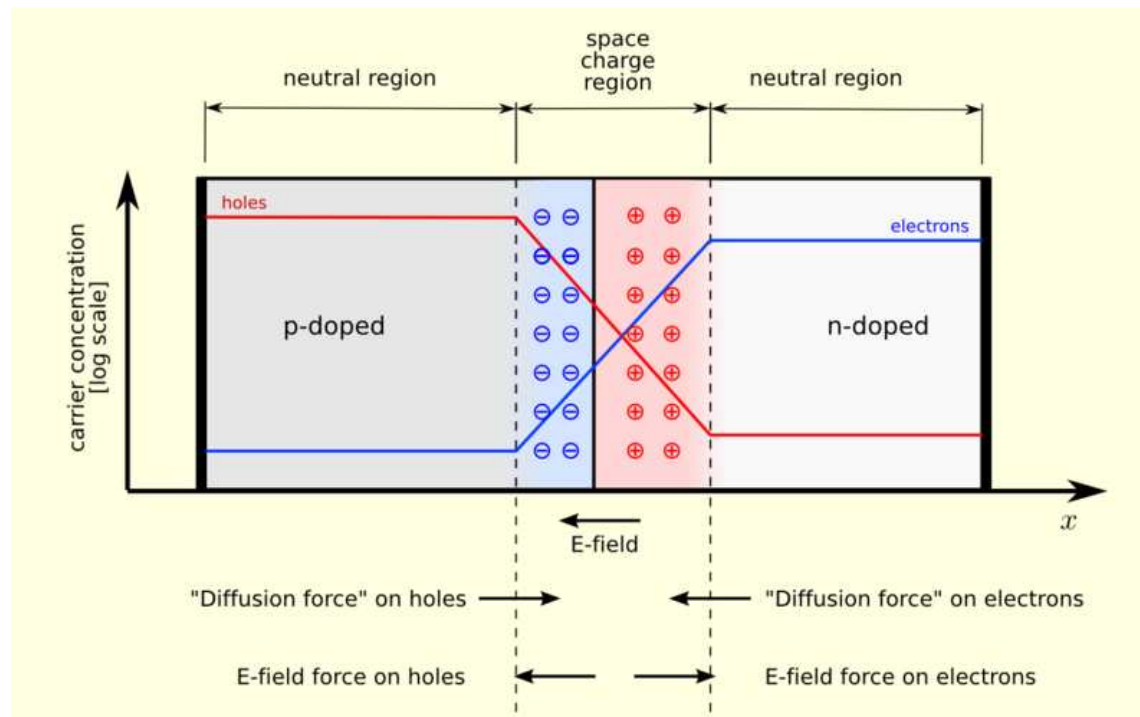


PN juntura



PN juntura

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



PN juntura



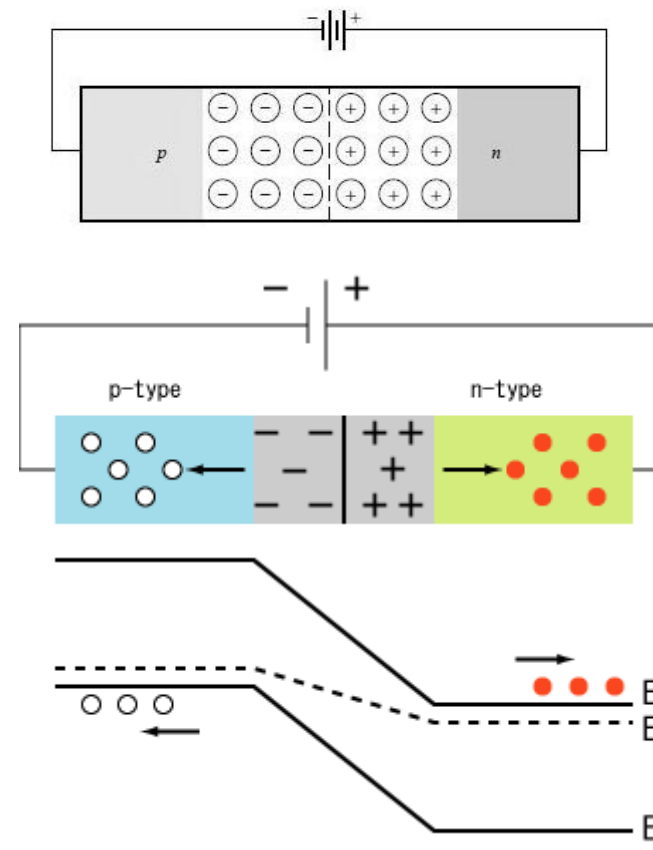
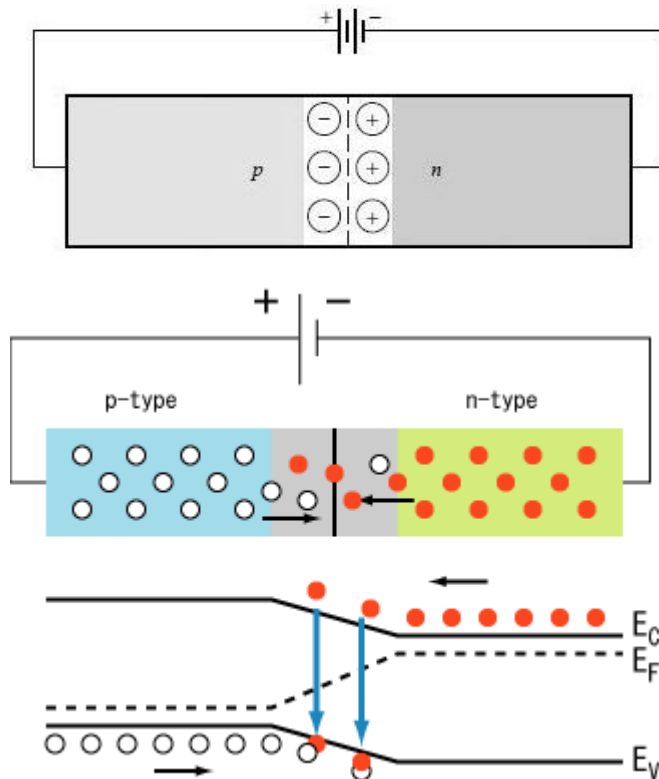
<http://www.youtube.com/watch?v=W6QUEq0nUH8&feature=related>

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

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

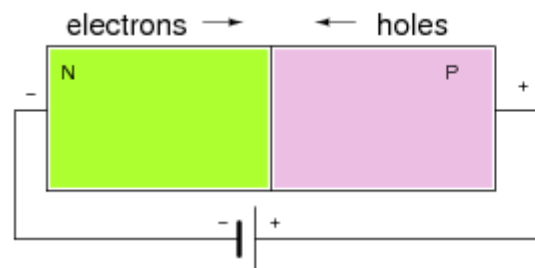
PN juntura

Zuzeneko polarizazioa (ZP) Alderantzizko polarizazioa (AP)

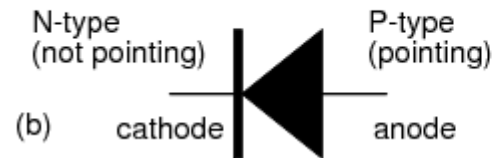


PN juntura: diodoa

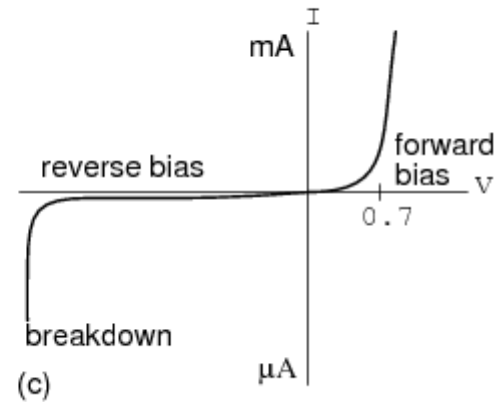
http://www.electronics-tutorials.ws/diode/diode_3.html



(a)

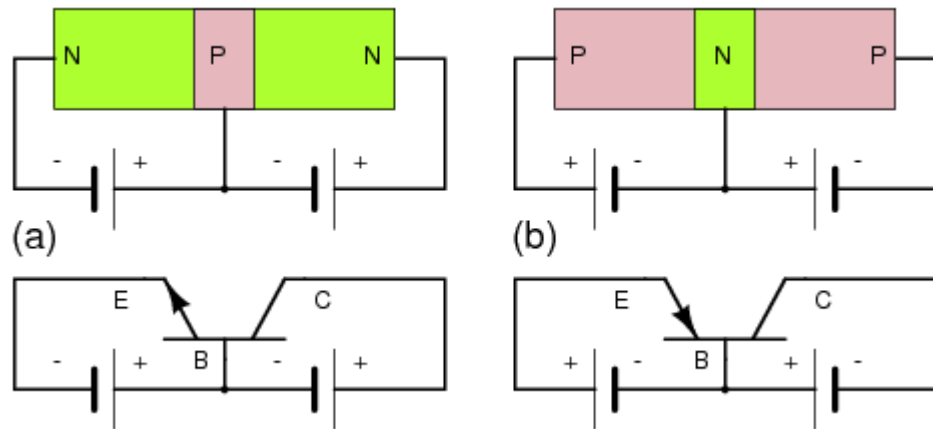


(b)



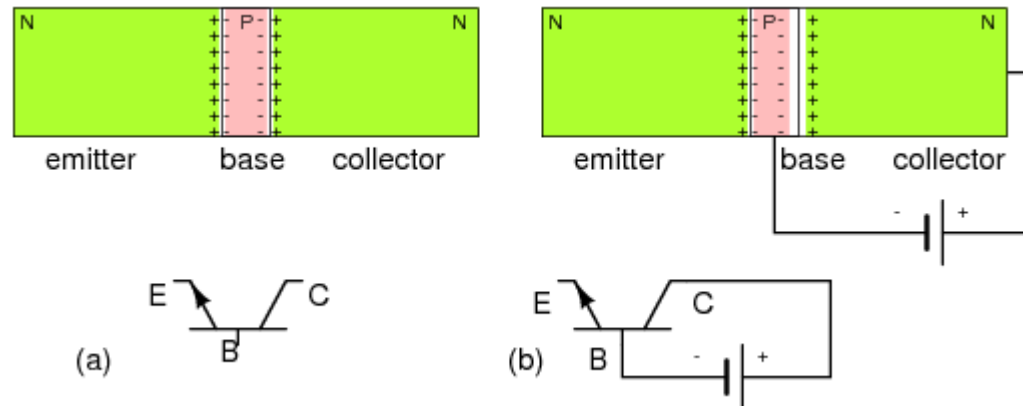
(c)

Transistore bipolarra (BJT)

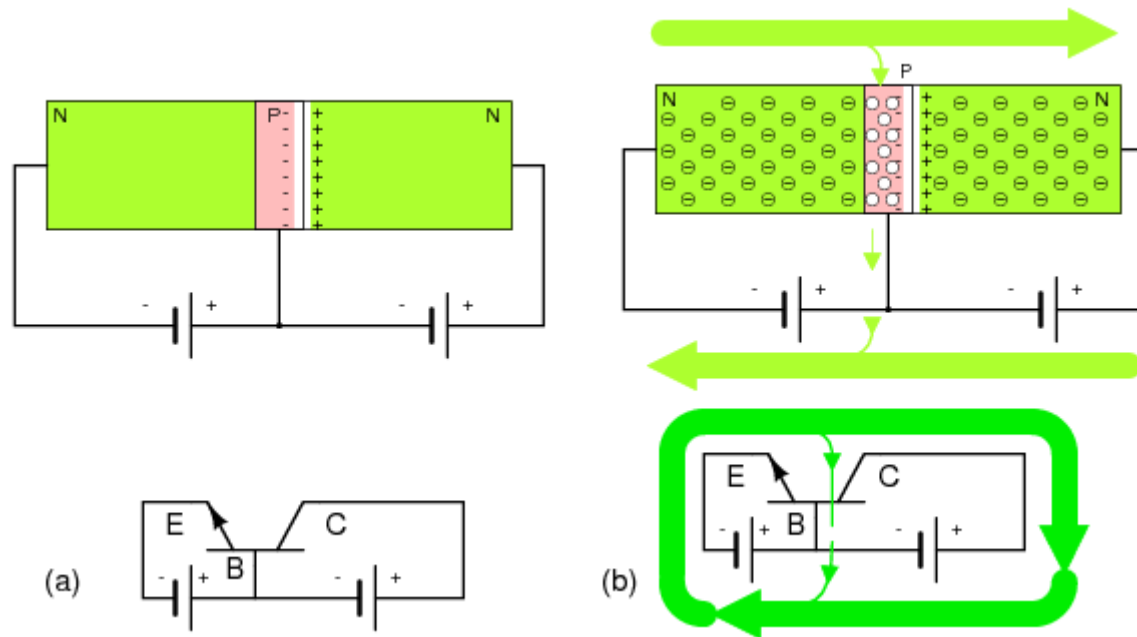


<http://www.youtube.com/watch?v=ZaBLiciesOU>

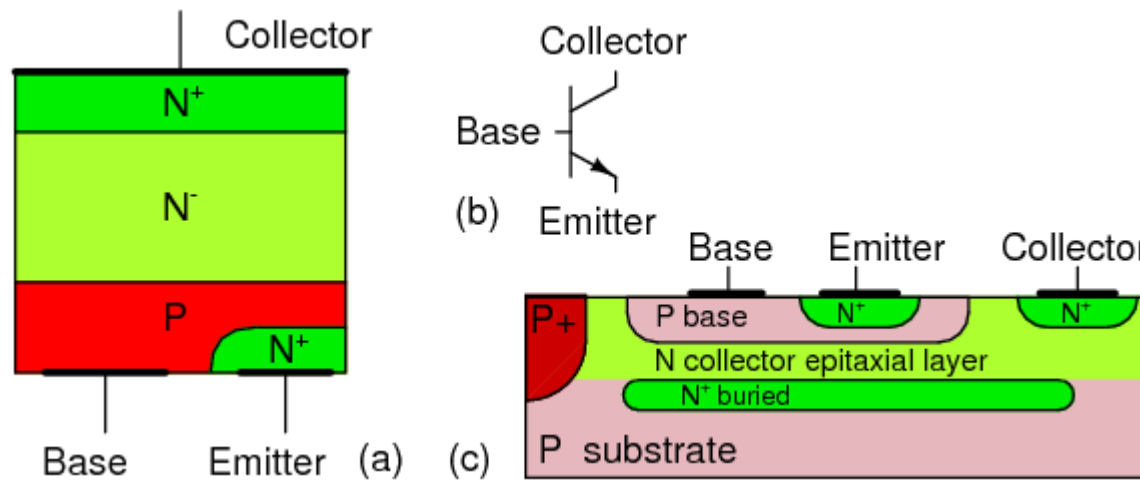
Transistore bipolarra (BJT)



Transistore bipolarra (BJT)

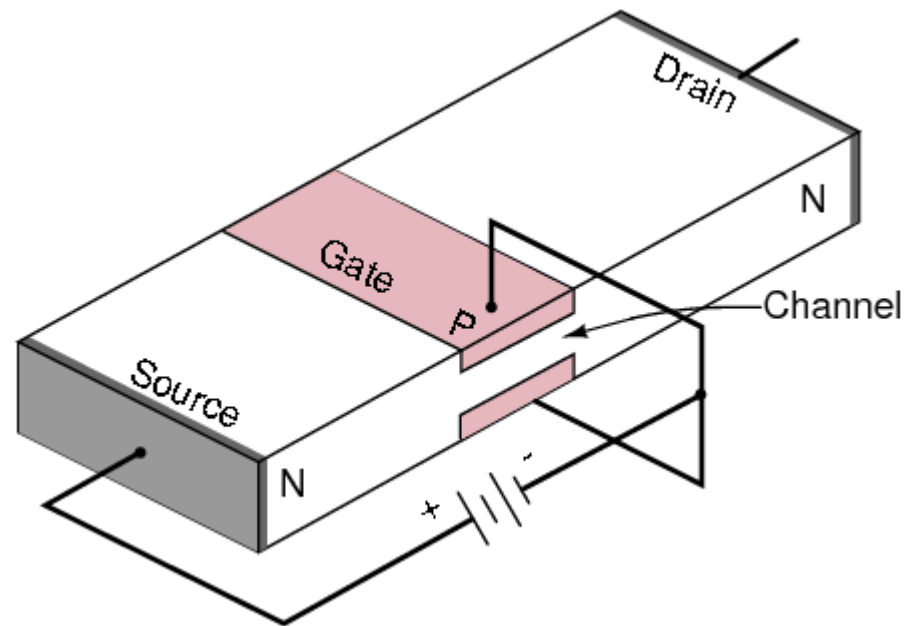


Transistore bipolarra (BJT)

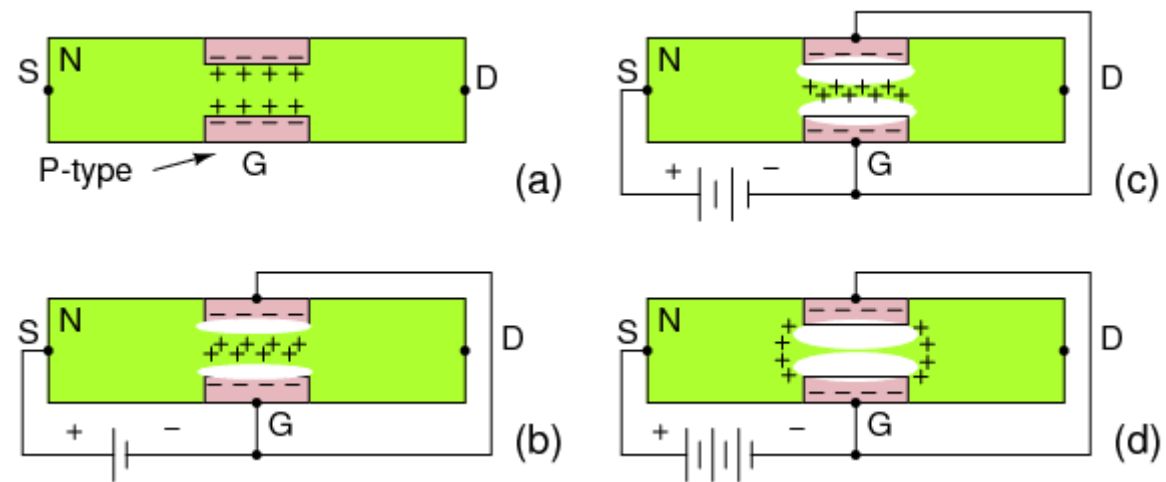


Eremu efektuzko transistoreak (FET)

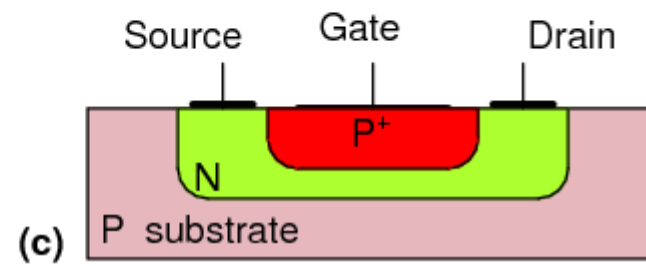
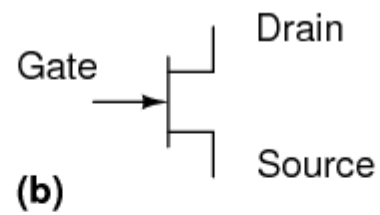
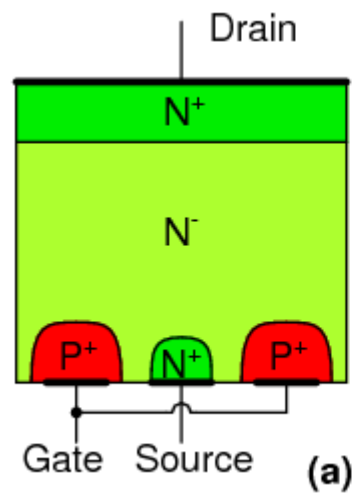
JFET:



JFET



JFET



FETMOS transistor

