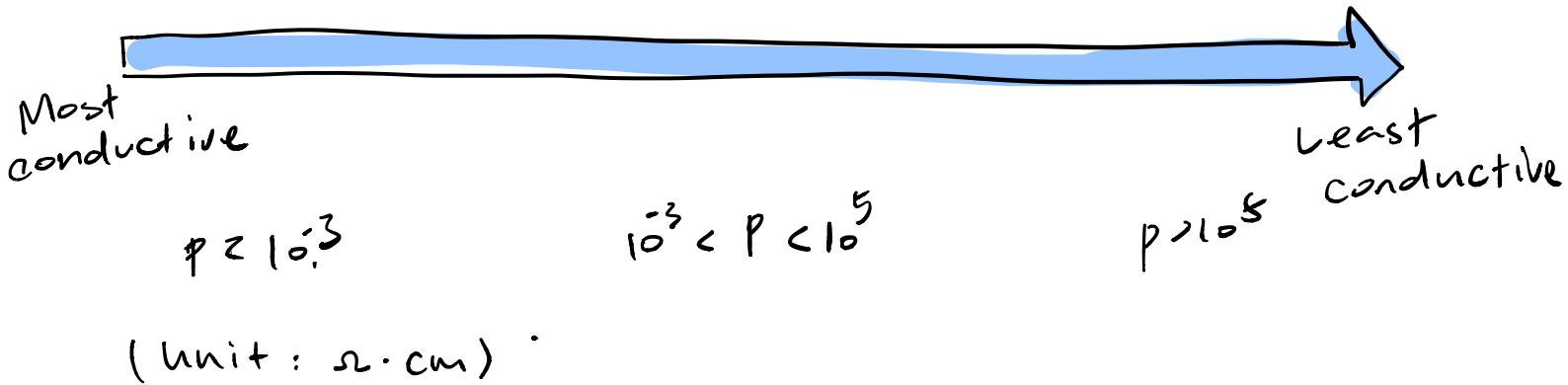


Resistivity.

Conductors

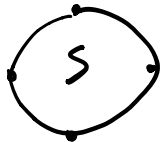
Semiconductors

Insulators

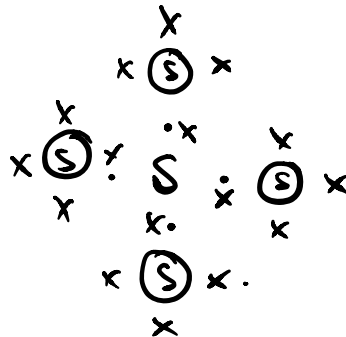


Covalent Bond Model

Most of the useful semiconductor properties occur in high purity, single crystal form.



Each Silicon Atom has 4 outer shell electrons, so its valency is 4. It could form covalent bonds with 4 other Silicon atoms.



When at 0K (absolute 0) all bonds are filled and outer shells of the silicon atoms are fixed. When temperature increases, some bonds are broken, freeing small amount of electrons.

The density of these small electrons is known as .
the intrinsic carrier density n_i (cm^{-3}).

which could be determined by

$$n_i = BT^3 \exp\left(-\frac{E_G}{kT}\right) \text{ cm}^{-6}$$

semi-conductor bandgap energy in eV.

Material dependent parameter
 $1.08 \times 10^{31} \text{ K}^{-3} \cdot \text{cm}^{-6}$
for Si

Boltzman's constant
 $(8.62 \times 10^{-5} \text{ eV/K})$

absolute temperature, K.