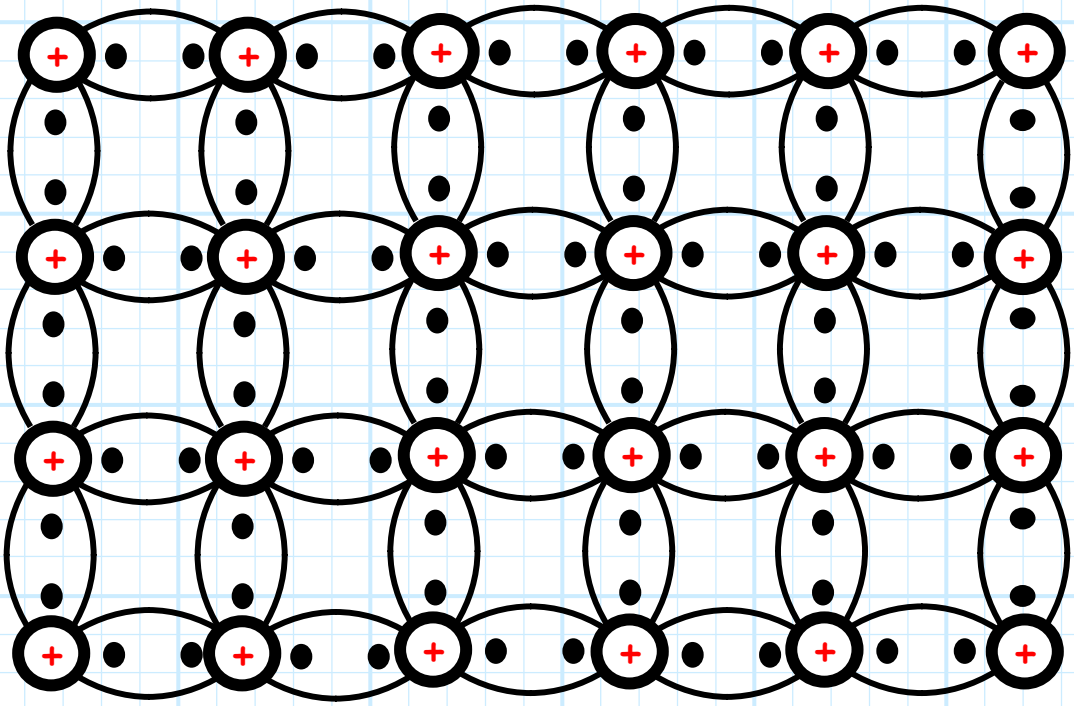
Intrinsic Silicon

Silicon has **4** electrons in an outer valence shell that requires **8** electrons!

Each Si atom therefore forms a **covalent bond** with 4 other Si atoms—they **complete** their outer valence shell by "sharing" electrons.

A Silicon **crystal lattice** is created!



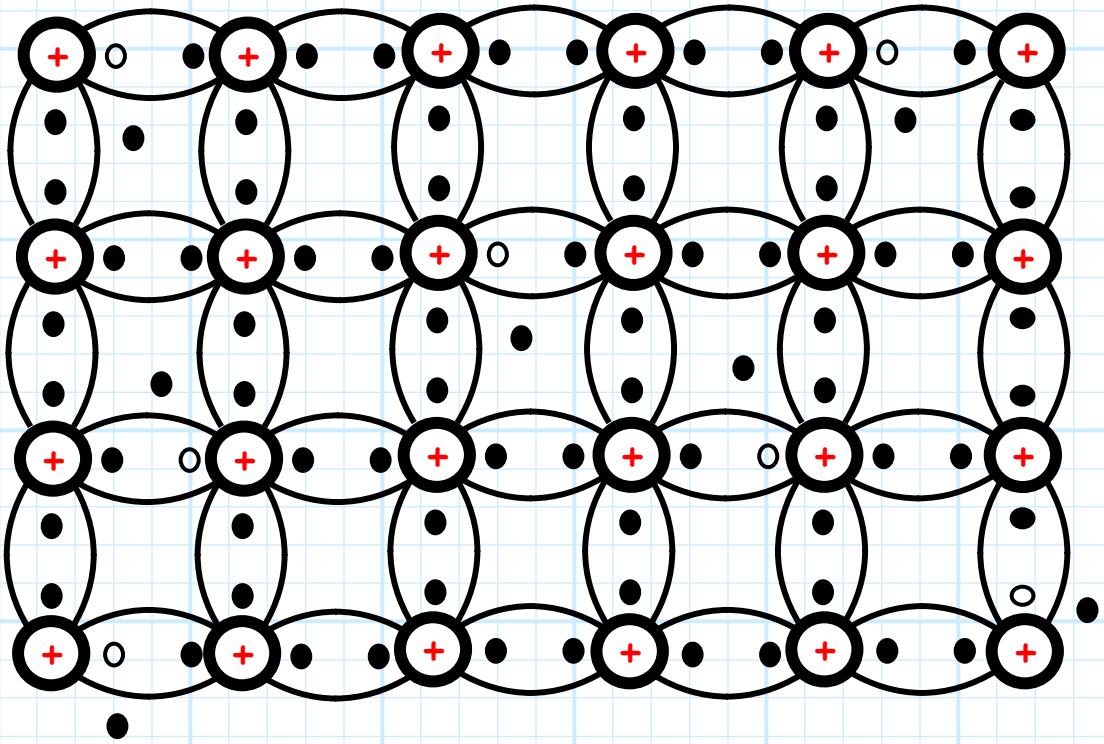
● = electron

BUT, thermal agitation **breaks** covalent bonds.

→ Electrons break free from lattice !!

A **hole** is left where the **bound** electron used to be.

We now have both **free electrons** and **holes** existing in Silicon.



o = hole

* The warmer the Silicon, the more free electrons (and thus holes) are produced. We can therefore define a **particle density**, defined as either holes/unit volume, or free electrons/unit volume.

* In pure Silicon, the number of holes **equals** the number of free electrons.

* Note however, silicon is electrically **neutral**. In other words, the **net charge density** within the material is **zero**, as the number of electrons equals the number of protons (in the nucleus).