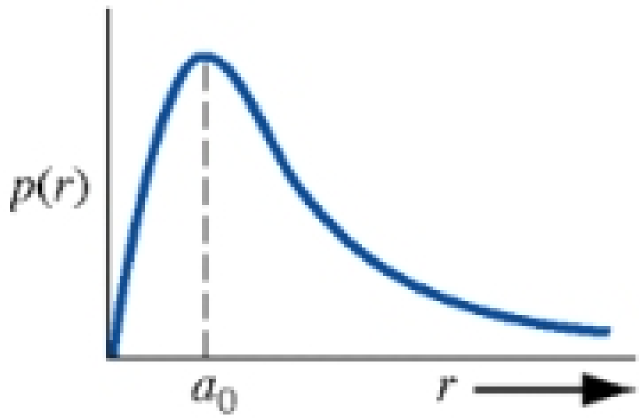
$$V(r) = \frac{-q^2}{4\pi\epsilon_0 r}$$

Allowed and Forbidden Bands



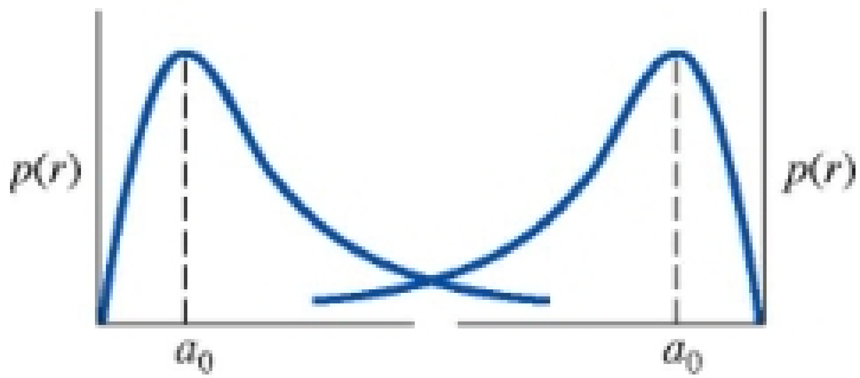
(a)

- The wavefunction of an electron in the lowest energy state of a hydrogen atom

$$\psi_{100} = \frac{1}{\sqrt{\pi}}\left(\frac{1}{a_0}\right)^{3/2} e^{-r/a_0}$$

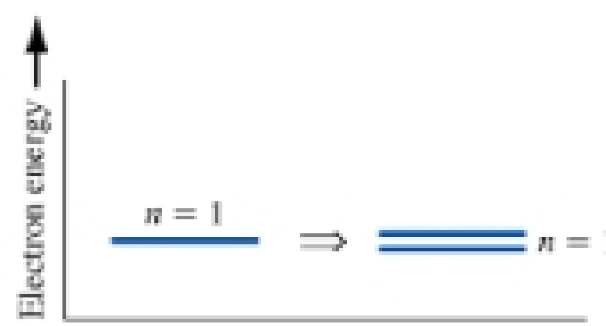
$a_0 = 0.5\,\text{Å}$ Bohr radius

$$E_{100} = \frac{-m_0 e^4}{(4\pi\epsilon_0)^2 2\hbar^2}\left(\frac{1}{n}\right)^2$$



(b)

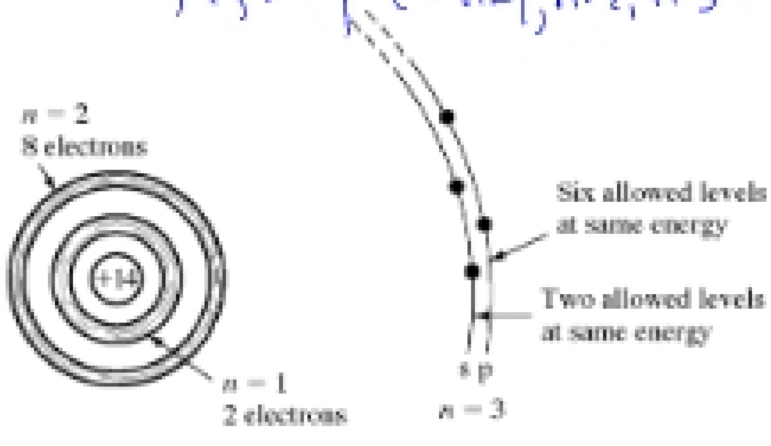
- The wavefunctions overlap as the interatomic distance reduces and the energy level will split into two



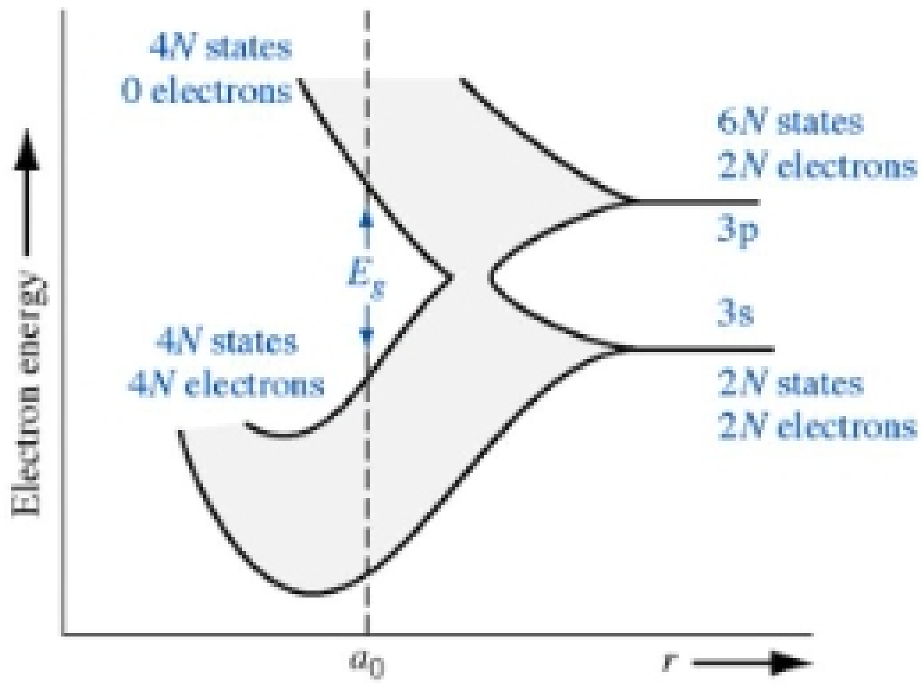
(c)

Allowed and Forbidden Bands

n, l, m | l = n−1, n−2, n−3 ⋯ 0



(a)



(b)

- How many electrons reside per silicon atom ?

  14

- How many are bound tightly to the core ? How many are weakly bound and allowed to participate in chemical reactions?

  n = 1 # of e = 2

  n = 2 # of e = 8

  n = 3 # of e = 4

The Periodic Potential

We will attempt to derive the wavefunction solution to the Schrodinger's Equation for a single, non interacting electron traveling in a one dimensional periodic potential

How does the potential function look in a crystal ?