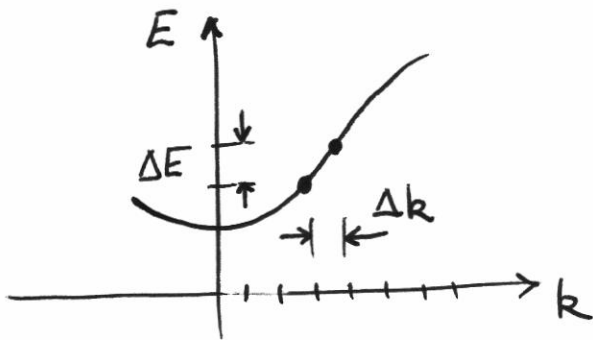


Quiz: Estimation question

For a crystal to be transparent, the bandgap must be larger than a critical value. What is this critical value?

I'm looking for a number in units of eV.

Analytical Derivation of density of states, $g(E)$



States are evenly spaced in k .

$$k = 0, \frac{2\pi}{Na}, \frac{4\pi}{Na} \dots \text{etc (periodic B.C.s)}$$

$$\Delta k = \frac{2\pi}{L} \quad \text{where } L \text{ is the length of the system.}$$

States are not evenly spaced in energy

$$\Delta E = \frac{dE}{dk} \Delta k, \quad \text{depends on the slope.}$$

(2)

Density of states is the inverse of ΔE

i.e. More states per unit energy when ΔE is small

$$g(E) = \frac{4}{\Delta E} \quad \leftarrow +k\uparrow, +k\downarrow, -k\uparrow, -k\downarrow$$

Every time I go up by ΔE there are 4 additional states in the system.

$$= \frac{4}{\frac{dE}{dk} \Delta k}$$

$$= \frac{4}{\frac{dE}{dk} \frac{2\pi}{L}}$$

$$= \frac{2L}{\pi} \left(\frac{dE}{dk} \right)^{-1}$$