

# Self-Assessment: Bonding and Molecules

## Weekly Homework Quiz

### Problem #1

- (a) Draw the energy level diagram that shows that the linear combination of atomic orbitals from two atoms of oxygen (O) results in the formation of the stable molecule,  $O_2^{2-}$ . The molecular orbitals in  $O_2^{2-}$  increase in energy according to the sequence  $\sigma_{2s}$ ,  $\sigma_{2s}^*$ ,  $\sigma_{2p_z}$ ,  $\pi_{2p_{x,y}}$ ,  $\pi_{2p_{x,y}}^*$ ,  $\sigma_{2p_z}^*$ .
- (b) Indium phosphide (InP) is a semiconductor with a band gap,  $E_g$ , of 1.27 eV. Calculate the value of the absorption edge of this material. Express your answer in meters.

## Problem #2

Chemical analysis of a silicon (Si) crystal reveals boron (B) at a level of 0.0003 atomic percent.

- (a) Assuming that the concentration of thermally excited charge carriers from the Si matrix is negligible, calculate the density of free charge carriers (carriers/cm<sup>3</sup>) in this Si crystal.

- (b) Draw a schematic energy band diagram for this material and label the valence band, conduction band, band gap, and the energy level associated with the B impurity.

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