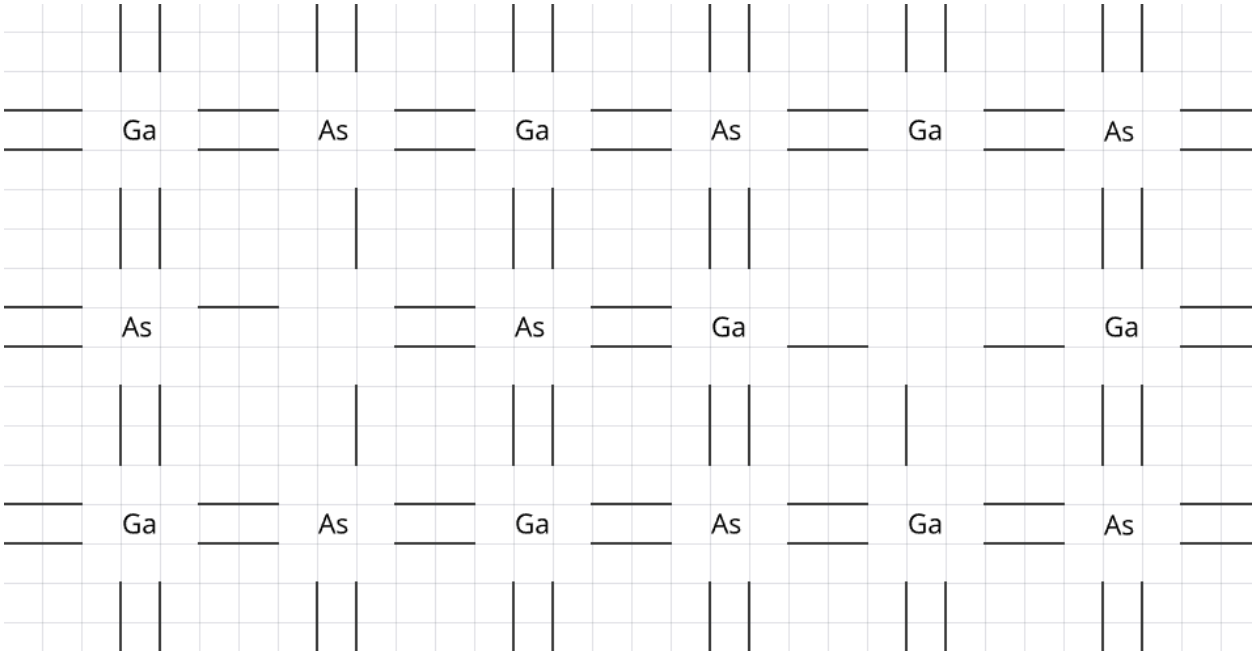
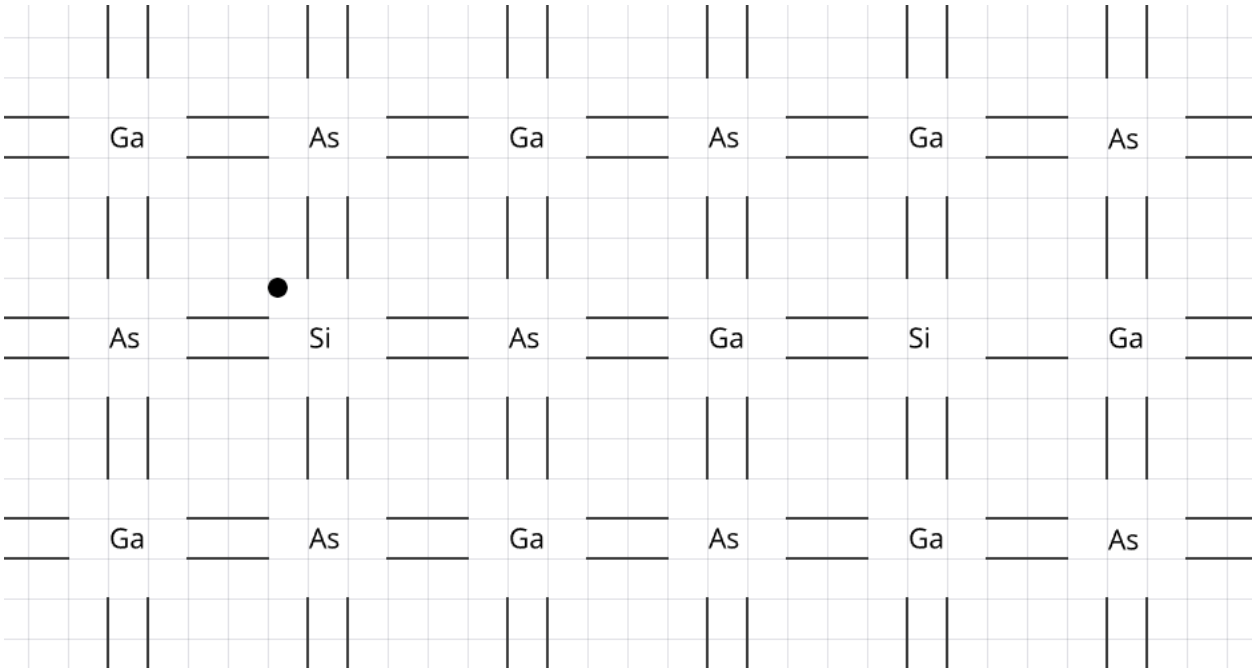
Hayden Fuller
Microelectronics HW1

1. The bonding model for a semiconductor is explained in Figs 2.3 and 2.4 in the textbook.
    a. Draw the bonding model for GaAs depicting the removal of one Ga and one As atom.



    b. Redraw the bonding model showing the insertion of Si atoms into the missing Ga and As sites.



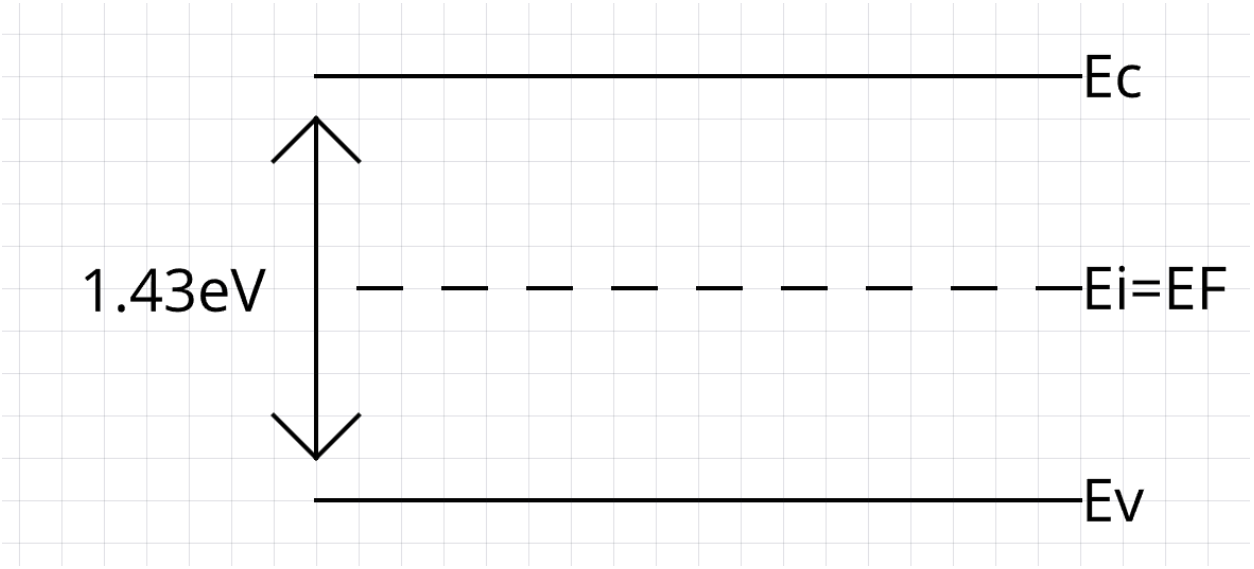
c. Is the GaAs p- or n-type when Si atoms replace Ga atoms? Explain.

p-type, removing Ga removes 3 electrons, adding Si adds 4, leaving you with a free electron, making it a net donor.

d. Is the GaAs p- or n-type when Si atoms replace As atoms? Explain.

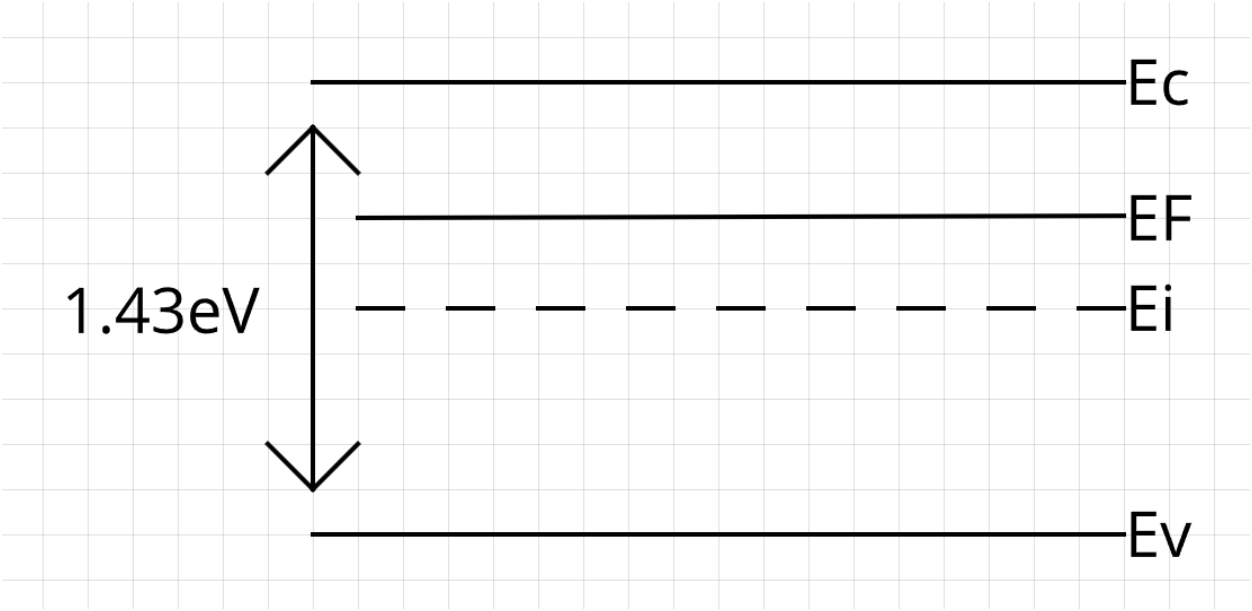
n-type, removing As removes 5 electrons, adding Si adds 4, leaving you with a hole, making it a net acceptor.

e. Suppose it takes an energy amount equal to 1.43 eV to break one of those bonds shown in the figure, draw the band model for GaAs.



f. Draw the band model for GaAs when GaAs is doped with Si on (i) Ga sites and (ii) on As sites. Assume typical values for the ionization energy.

i. Ga



ii. As