

INVESTIGATION 1

Notes for the Instructor

PURPOSE

To have students become familiar with the structure of graphite prior to the demonstration of the oxidative intercalation of this structure to illustrate the enhancement of electrical conductivity by removing electrons from a filled energy band.

METHOD

The students are provided with a model or preferably they are asked to construct a model of graphite using the Solid State Model Kit available from ICE. It is suggested that the students only construct that portion of the model identified by the dotted lines that define the unit cell.

ANSWERS TO THE FOLLOW-UP QUESTIONS

1. Each carbon atom has four nearest neighbors.
2. The nearest neighbors are arranged in a trigonal planar arrangement
3. For the graphite unit cell:
$$\begin{array}{r} 8 \text{ corner atoms} \times 1/8 = 1 \\ 2 \text{ face atoms} \times 1/2 = 1 \\ 4 \text{ edge atoms} \times 1/4 = 1 \\ \underline{1 \text{ interior atoms} \times 1 = 1} \\ = 4 \text{ atoms total} \end{array}$$
4. See diagrams on page 67 of the manual that accompanies the Solid State Model Kit.
5. The fact that carbon only forms three bonds and not four means that there is a single delocalized valence electron that acts as a charge carrier when excited. The extra electron can move energetically to a nearby empty band above it. This question will probably require some class discussion and should be used nevertheless in conjunction with the intercalation demonstration (Demonstration 4).