1. Copper oxide planes are a common feature of high-temperature superconductors. In these planes, copper atoms lie at the vertices of a square lattice of side \(a\). Oxygen atoms lie at the midpoints of the sides of the squares, i.e. halfway between nearest-neighbor copper atoms. For simplicity, let’s ignore all other atoms and assume that there are simply stacked copper oxide layers with separation \(c\) between the layers. (a) What is the unit cell and what is the basis? (b) In \(La_2CuO_4\), the oxygen atoms are actually displaced from the plane in an alternating fashion. In the figure, + atoms are above the plane by \(\delta c\), while − atoms are below the plane by \(\delta c\). What are the unit cell and lattice spacing? What is the basis? What is the reciprocal lattice?


3. Ashcroft and Mermin, chapter 5, problem 1.

4. Ashcroft and Mermin, chapter 6, problem 5