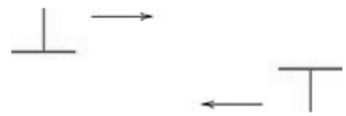
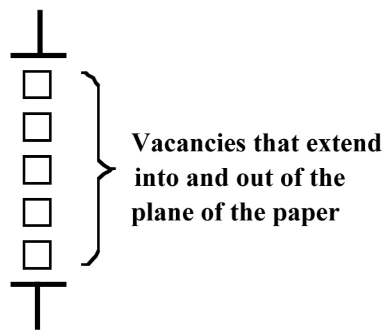
8.2 *Consider two edge dislocations of opposite sign and having slip planes that are separated by several atomic distances as indicated in the following diagram. Briefly describe the defect that results when these two dislocations become aligned with each other.*



Solution

When the two edge dislocations become aligned, a planar region of vacancies will exist between the dislocations as:



8.4 *For each of edge, screw, and mixed dislocations, cite the relationship between the direction of the applied shear stress and the direction of dislocation line motion.*

Solution

For the various dislocation types, the relationships between the direction of the applied shear stress and the direction of dislocation line motion are as follows:

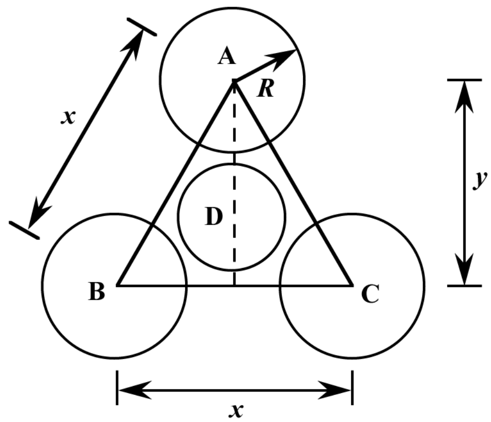
edge dislocation—parallel

screw dislocation—perpendicular

mixed dislocation—neither parallel nor perpendicular

(*a*)

The centers of the three corner atoms, denoted by A, B, and C lie on this plane. Furthermore, the (111) plane does not pass through the center of atom D, which is located at the unit cell center. The atomic packing of this plane is presented in the following figure; the corresponding atom positions from the Figure (*a*) are also noted.



(*b*)

Inasmuch as this plane does not pass through the center of atom D, it is not included in the atom count. One sixth of each of the three atoms labeled A, B, and C is associated with this plane, which gives an equivalence of one-half atom.

In Figure (*b*) the triangle with A, B, and C at its corners is an equilateral triangle. And from Figure (*b*), the area of this triangle is $\frac{xy}{2}$. The triangle edge length, x, is equal to the length of a face diagonal, as indicated in Figure (*a*). And its length is related to the unit cell edge length, a, as

$$x^2 = a^2 + a^2 = 2a^2$$

or

$$x = a\sqrt{2}$$

For BCC, $a = \frac{4R}{\sqrt{3}}$ (Equation 3.4), and, therefore,

$$x = \frac{4R\sqrt{2}}{\sqrt{3}}$$