

incline, friction on the surface of the incline. You can increase the force on the plane by decreasing this friction. There would be less friction, for example, if you put the crate on a dolly with wheels and rolled it up the inclined plane instead of sliding it.

### Wedge

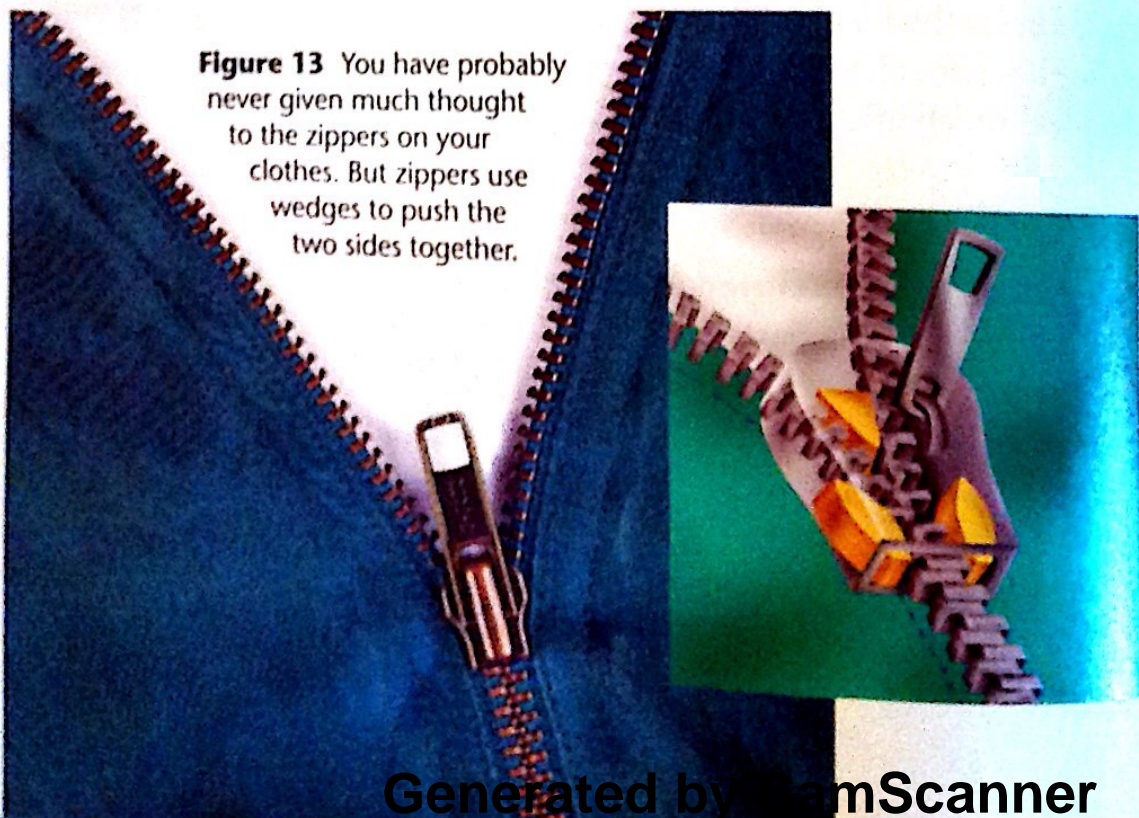
If you've ever sliced an apple with a knife or seen someone chop wood with an ax, you are familiar with another simple machine known as a wedge. A wedge is a device that is thick at one end and tapers to a thin edge at the other end. It might be helpful to think of a wedge as an inclined plane (or two inclined planes back to back) that can move. As in the case of the inclined plane, the longer and thinner a wedge is, the less input force is required to do the same work.

In a wedge, instead of an object moving along the inclined plane, the inclined plane itself moves. For example, when someone uses an ax to split wood, the person applies an input force to the ax handle. The ax handle exerts a force on the thicker end of the wedge. That force pushes the wedge down into the wood. The wedge in turn exerts an output force that pushes down through the wood, splitting it in two.

A zipper is another device that depends on the wedge. Have you ever tried to interlock the two sides of a zipper with your hands? It is almost impossible to create enough force with your fingers to join the two rows of teeth. But when you close a zipper, the part that you pull contains small wedges that multiply your input force. The result is a strong output force that either closes or separates the two sides of the zipper.



**Figure 12** A large force is required to split a log in two. But with the use of a wedge, a small force is multiplied to do the job.



**Figure 13** You have probably never given much thought to the zippers on your clothes. But zippers use wedges to push the two sides together.