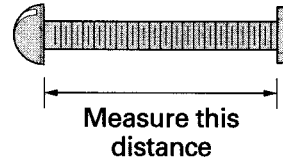


Plane Pretenders

Science Screws (or nuts and bolts) are really inclined planes in disguise.

Stuff 3 nuts and matching bolts; sharp pencil; ruler (preferably with millimeter marks); marker



What to Do

1. Take one of the bolts and a sharp pencil. Place the bolt on the table, and put the tip of the pencil in the groove of the bolt near the top. Rotate the head of the bolt while holding the pencil point firmly in the groove. Continue to rotate the head of the bolt, and observe the motion of the pencil. Determine how many grooves the bolt has.
2. In the first step, you determined that the bolt has one continuous groove. Now look at the bolt from the side. Count the number of raised ridges in the entire bolt (these are called crests). Measure the length of the bolt (where the ridges are) in millimeters. Divide the number of ridges by the length of the bolt to get the "threads per millimeter" for the bolt. This is called the pitch.
3. Find the matching nut. Screw the nut onto the bolt all the way to the head of the bolt. With the marker, draw a line on the edge of the head of the bolt and the nut where the two meet.
4. Unscrew the nut five complete turns. The marker lines will help you keep track of the turns.
5. Measure the distance from the bottom of the head of the bolt to the top of the nut in millimeters.
6. Unscrew the nut five more complete turns. Measure the distance between the head of the bolt and the nut. Continue making five turns and then measuring the distance until the nut is off of the bolt.
7. Repeat the entire activity using the other two matching nuts and bolts.

What's Going On Here

Imagine that you are a tiny flea climbing up the side of the bolt. You would be climbing up a winding hill with a constant slope. If you could flatten out the winding hill, it would look just like an inclined plane or ramp. The flea has an easier time climbing the screw by winding around it than walking straight up its side. So a screw or bolt is really an inclined plane. When the nut is

screwed off the bolt, it moves a much greater circular distance around the bolt compared to the actual length of the bolt. Bolts or screws have different numbers of threads per millimeter. Bolts that have a smaller number of threads per millimeter can be compared to inclined planes with larger slopes.

