

DIFFERING STRESS RESISTANCE OF METALS

All metals are somewhat elastic; they can be bent. The shape of a metal object can be changed by impact loads, such as hammering. Some metals bend more easily than others because various metals have different properties. For example, one metal may have more or less resistance to impact or to repetitive loads than another metal.

Questions & Predictions Predict and record answers to these questions. Observe and measure for Evidence & Proof below.

Fig. 1 Do brass and aluminum have the same resistance to impact loads?

Fig. 2 If a metal has a high resistance to impact loads, does it therefore also have a high resistance to repetitive loads?

EVIDENCE & PROOF

Materials:

2 rods or strips each of aluminum and brass, the same width and about .040 in. thick and 14 in. long; bricks or blocks and yardsticks used in Workshop 2; a heavy dispensable book, taped closed; string; ruler; masking tape; hammer; safety glasses, thick gloves.

Process: Follow these steps. Compare your results with your predicted answers to the question.



Caution: Wear safety glasses. Wear thick gloves when picking up the pieces of metal by their sharp edges.

Fig. 1 Measure and mark the center of each metal strip with tape. Construct the apparatus shown in Workshop 2, Fig. 2, but without the wooden board (1B). Place the bricks or blocks exactly 4 in. less than the length of the metal strips apart.

Fig. 2 Lay one of the metal strips over the blocks, shown in Fig. 1. Be sure to center the strip. Hold the book, spine down, over the metal sheet level with the tops of the yardsticks. Drop the book onto the center of the metal strip. Measure the resulting bend, as shown in Fig. 2. To measure bend, turn metal bend-side up on a firm surface. Measure distance from highest point of bend to surface. Repeat for the second metal.

Fig. 3 Test the second pieces of metal for resistance to repetitive loads. Pile the blocks or bricks on top of one another. Bend one metal strip over the blocks as shown in Fig. 3. Try to bend the metal to form a right angle. Then straighten the metal as much as possible. Use a hammer if needed. Examine the bend area for changes. Record what you see. Repeat the process 15 times or until you note clear deformation (change in size or shape) or breakage. Repeat for the second metal.

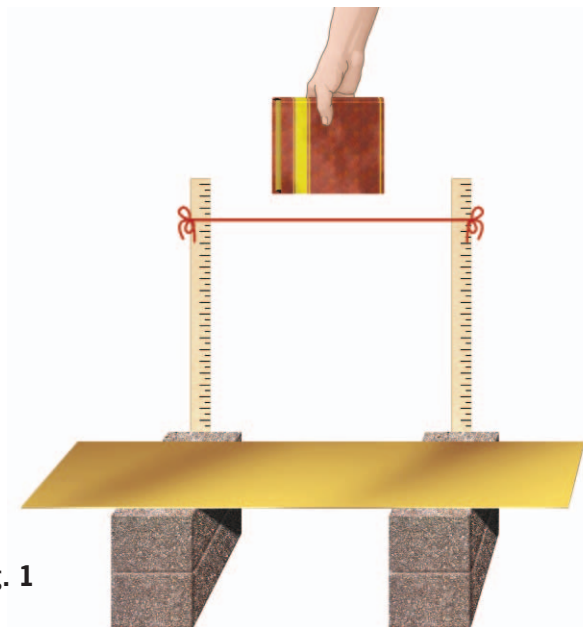


Fig. 1

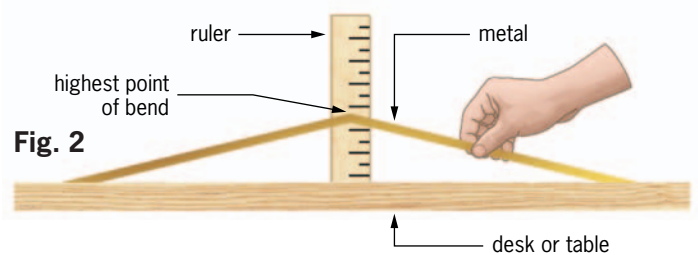


Fig. 2

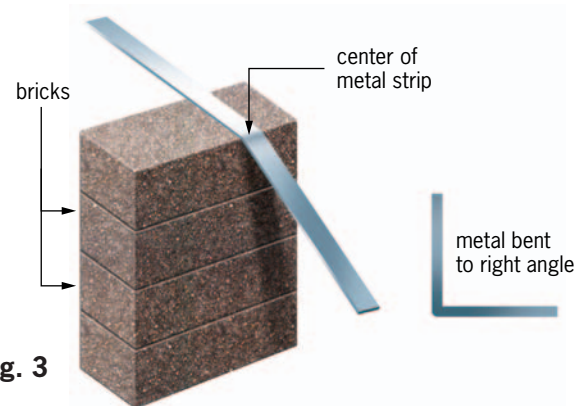


Fig. 3

CONCLUSIONS & INFERENCES

Nicholas is building a model that involves the stretching of a spring to its maximum length over and over. Because Nicholas needs a special size spring, he is going to make one by

wrapping wire around a rod. He has aluminum wire and brass wire of the same thickness. Which should he use? Why?