

CREEPY METALS

PRE LAB DISCUSSION

Among the properties of all metals are malleability and ductility. These properties make metals very useful to us. Metals can be reshaped or drawn into wire. But these same properties sometimes limit the useful life of a metal product.

The tensile strength of a material is the amount of weight that it will support without breaking. When a metal supports a weight over a period of time it will elongate. This is called *creep*.

This experiment will take several days to complete. It is open ended and the procedure should be altered to allow for availability of space, time, and materials.

OBJECTIVE: To determine the tensile strength and creep in three common metals.

CHEMICALS/EQUIPMENT: aluminum, copper, and iron wire of the same diameter [gauge], bricks or small cement blocks, 2x4 lumber, chairs.

PROCEDURE:

1. Attach one of the wires to two or more bricks or to a cement block. Repeat this for each of the metals being tested, using the same number of bricks or size of block for each wire.
2. Attach the 2x4 lumber across the backs of two chairs that are several feet apart.
3. Attach the wires to the 2 x 4 so that the bricks or block is suspended exactly two feet from the lumber.
4. Place a tape on each wire exactly 6 inches from the top. Then place another tape exactly 12 inches below the first tape.

5. Measure and record the distance between the tapes every 24 hours for several days.

DATA

| METAL | START | DAY 1 | DAY 2 | DAY 3 | CREEP |
|-------|---------------|-------|-------|-------|-------|
| Al | <u>12 in.</u> | _____ | _____ | _____ | _____ |
| Cu | <u>12 in.</u> | _____ | _____ | _____ | _____ |
| Fe | <u>12 in.</u> | _____ | _____ | _____ | _____ |

Set up a graph with days on the horizontal axis and creep on the vertical axis.

Use a different color for each of the three metals.

THINKING SCIENTIFICALLY

1. Which wire showed the greatest creep?
2. Which wire do you think will break first?
3. Using the graph predict how long it will take until the bricks or block held by the aluminum, copper, and iron wires to reach the floor assuming that the wire does not break first.

Al

Cu

Fe

4. Do you think that the amount of creep per day will increase, decrease, or be constant over a long period of time? Explain your answer using the graph.

5. Over time, wires strung between two posts or poles begin to sag. Why?

6. Of the three metals tested, copper is the best conductor of electricity. Utility companies build huge towers to support high voltage transmission lines that may carry electric across several states. What kind of wire is used in these interstate electrical grids and why?

7. What type of wire is used by the electric company to bring electricity into your neighborhood and why?

8. Write out a procedure that you think that can be completed safely in your classroom to test the tensile strength of each type of wire.

EXTRA

9. Repeat this lab procedure using only one of the three metals but this time use three different amounts of bricks. Determine how creep rate varies with weight.