



## Ball & Ring Demonstration

## Instructions

Everyone knows that applying heat to an object increases its temperature. But what really is going on when the temperature of an object increases?

Temperature can actually be thought of as the amount of energy that an object possesses. Increasing its temperature will add energy to the object. When an object gains more energy, the molecules inside that object generally become more excited. This can result in an object vibrating, glowing expanding or a combination of all three.

Applying heat to most all solids will result in some sort of expansion of that solid. The amount of expansion is determined by the amount of heat applied, the time over which the heat is applied and the material that is being subjected to the heat.

Different materials will expand at different rates. This rate is referred to as the coefficient of expansion of that particular type of metal. For example iron will expand  $.000012\text{cm}$  per centigrade for every cm of length. Therefore iron's coefficient of expansion is  $.000012$ . But keep in mind that the material expands in all directions. So not only does it expand length wise but thickness wise also.

Begin by setting up your heat source on the table in a secure manner. This heat source can be an alcohol lamp, torch, hot plate, etc. Hold the ball and rod by the handle only. As you place the ball into the heat source, the rod can become very hot.

Hold the ring unit by the handle, in one hand, and hold the ball unit by the handle in the other hand. Without forcing it, slide the ball through the ring's opening. The ball and ring set is precision made so scratching either the ball or the inside of the ring can prevent the ball from passing through the ring smoothly.

## **Operation**

Begin by heating the ball. After about thirty seconds to one minute of applying heat (this depends on your heat source) try gently, but quickly sliding the ball through the ring. What happens? You should find that the ball would not pass through the ring.

Now, give the ring time to cool and once again try passing the ball through the ring. As the ball cools you will find that it reduces in size enough to allow the ball to pass through once again.

Before you perform the next experiment, try predicting what will happen when the ring is heated. Then perform the experiment as before, only this time heat the ring. What happened? Why?

Make sure that both the ring and ball are cooled to room temperature before putting the set away.

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