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Description:

The apparatus is designed to demonstrate the principle of inertia v E Á š } v [• ^ } v > Á The ball is placed on top of the acrylic square, which is positioned on top of a post. When the spring is released it strikes the card, pushing it out from under the ball, and the ball falls into the depression.

Use:

After assembling the apparatus, place it on a level surface. IT'S VERY IMPORTANT THE SURFACE IS LEVEL. The card square is balanced on the top of the post, and the ball is balanced on top of the cardboard. When the spring is pulled back and released the card will be propelled away from the post. The ball, which is not attached to the card, will remain in position and fall into the depression in the top of the post. It is also important that the ball be centered over the depression, as it will fall straight down when the card is removed.

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When the spring is pulled back from its resting position, it becomes a source of potential energy. When the spring is released the potential energy is released, causing the spring to move towards its original position. When the spring hits the card the energy is transferred to the card, causing it to move. The card is relatively light, that is it has a small mass, so the energy in the spring is sufficient to move it fairly quickly and for a considerable distance. The ball, on the other hand, remains in its original position. There are two reasons for this. First, the ball has a considerable mass, which resists movement. Second, there is minimal friction between the ball and the card, so that very little of the energy in the spring is transferred to the ball. The ball may be somewhat affected by the movement of the card, but any force which is transferred to the ball will act as a force at the surface of the ball tangent to the surface. Such a force will cause the ball to rotate about the center, causing the ball to roll along the surface of the card. In effect, the ball will move in the opposite direction traveled by the card, at a speed equal to the speed of the card that is moving away from the spring, resulting in the ball remaining in the same position relative to the post.

When speaking of inertia, we are referring to Newton's Laws of Motion, in this case the second law which states:

"The acceleration of a body is inversely proportional to its mass and directly proportional to the force acting upon it." **F=ma**

From this law we can see that, if the force remains the same but the mass increases, the acceleration will decrease. This is the reason that the two bodies acted upon, display different movements. The force from the spring is constant, but the two masses which are acted upon are different. The card, having a relatively small mass, is subjected to a large acceleration. The ball, having a much greater mass, is subjected to a relatively small acceleration.

Demonstrations:

1) Set up the apparatus, and operate it several times, observing the movement of both the ball and card.

2) Set up the apparatus again, but do not place the ball on top of the card. When the apparatus is operated is there any difference in the movement of the card? Does it move a greater distance? Does this say anything about the amount of energy transferred from the card to the ball?

3) Set up the apparatus again, but replace the ball with other objects, such as a washer, a wooden or plastic checker, and a flat lead weight. When the apparatus is operated what happens with the different objects? The following points should be observed:

   (1) A lighter object placed on the card should move more than a heavier object.
   (2) A flat object, which has more frictional contact with the card, should move more than an object with little contact.

   Next, list the various objects and the results of applying force to the card. By arranging the list in order of the weight of the object and also the area of contact, you will be able to draw some simple conclusions about the effects of mass and friction.

4) In some cases, all that is expected will be a general understanding that mass and friction are related to movement. In a more advanced environment, we suggest weighing the various objects, and making a comparison between the movements when acted upon by the spring, to determine the approximate force of the spring.