1F20.10 Inertia Ball

**SUMMARY:** Show the principle of inertia, that the inertia of a mass is its resistance to an acceleration. This also demonstrates the rate of change of a force, called the Jerk function.

**DESCRIPTION:**

This demo can be performed using one string or two strings. Using one string demonstrates inertia, or the resistance to the rate of change of acceleration. When performed using two strings, inertia with the jerk function, or the rate of change of the force on the string with time.

**EQUIPMENT:**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inertia ball.</td>
<td>Mechanics A.</td>
</tr>
<tr>
<td>Inertia ball string.</td>
<td>Mechanics A.</td>
</tr>
<tr>
<td>Rod and round clamping plate with hole in center.</td>
<td>General use.</td>
</tr>
<tr>
<td></td>
<td>In ring stand drawer.</td>
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<tr>
<td>Rubber mat</td>
<td>General use.</td>
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</tbody>
</table>

**SETUP NOTES:**

**ONE STRING:**

A heavy weight hangs from a cotton string. If the string is raised slowly, it will not break. If it raised suddenly, the string will break.

**TWO STRINGS:**

A 1.7 kg ball hangs from a 6.8 kg cotton string. A second string with a handle hangs off the bottom of the 1.7 kg ball.

Hold the bottom string and pull slowly to break the top string.

Hold bottom string and pull quickly to jerk the string and break the bottom string.

The ball is suspended by one string from a support above a protective shelf. The other string attaches to the bottom of the ball, passes through a hole in the shelf, and ties to a handle. The demonstrator grasps the handle on the bottom string. Pulling slowly on it causes the top string to break, whereas pulling quickly with a jerk on it causes the bottom string to break.

Use the string 15 lb. cotton string; McMaster-Carr, Cotton String, #1929T12. It is sold in a 2.5 lb. spindle. and it has a 15 lb breaking strength.
Additional Resources:

Video for option using one string:

Video for option using two strings:

P. LeCorbeiller, A Classical Experiment Illustrating the Notion of “Jerk,” AJP 14, 64-65 (1946).
Jack M. Wilson, More jerks, TPT 27, No. 1, January 1989 Pages 7 - 7 T. R.
Stefan J. Linz, Nonlinear dynamical models and jerky motion, APJ 65, 523-526 (1997)

Updated by JZ 5/15/2017