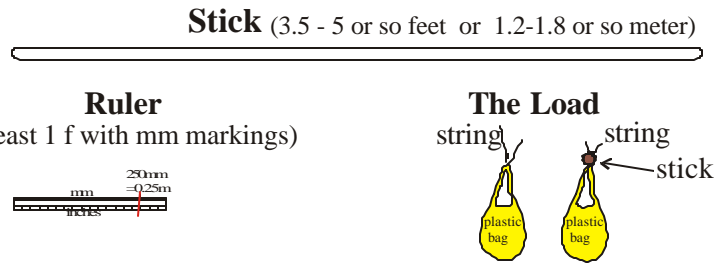


# DOIT 9 Experience Moment of Inertia $I_0$

## Basic Equipment

1. A thin stick from 3.5 to 5 feet or 1.2 to 1.8 meters long like a broomstick, a mop handle or a 1 in wide x 1 inch thick stick.
2. A ruler at least 1 foot long with mm markings.
3. Plastic bag to hold the load tied as illustrated. Small bags are better than large ones.



4. (Optional) A cheap diet scale to for weighing. But, sticks of margarine or butter, unopened cellophane wrapped cheese or other items where the weight on the packaging is very small compared to the weighed contents. These have the weight of the contents in pounds(or ounces) and gram. But their packaging is usually a most a percent, or two, of the total, hence an error of only a couple of percent.

**THESE CAN BE THE SAME ITEMS USED IN “EXPERIENCE TORQUE”.**

## Fixing up the stick

1. Find the center of mass of the stick by finding the point at which it balances, as shown in Fig. 1. Wrap tape around this point.



2. Mark this point. Start from the center of the new tape, mark off 0.15 m, 0.30 m, 0.45 m and 0.60 m on both sides of the stick as shown in Fig 2 and 3.

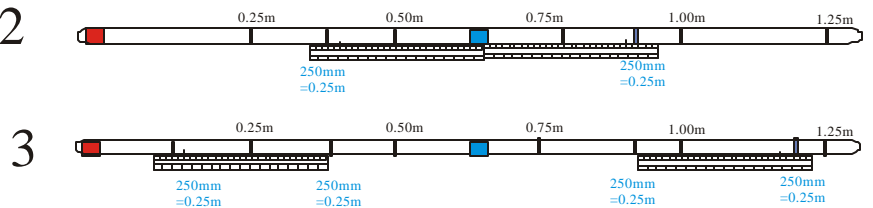
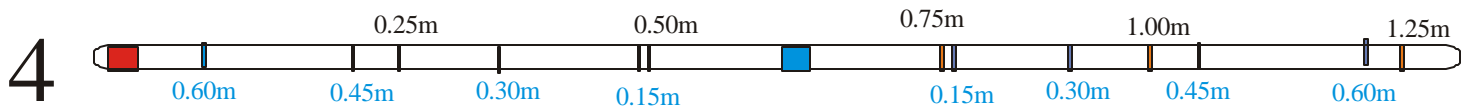
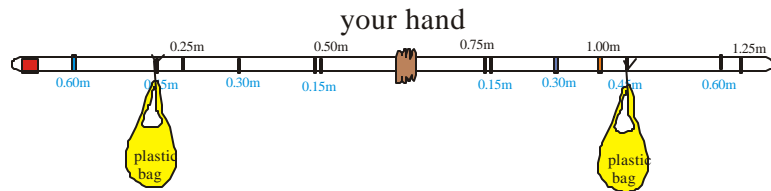
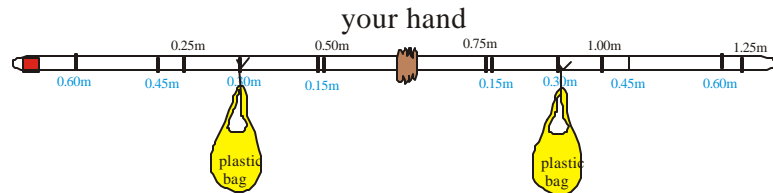
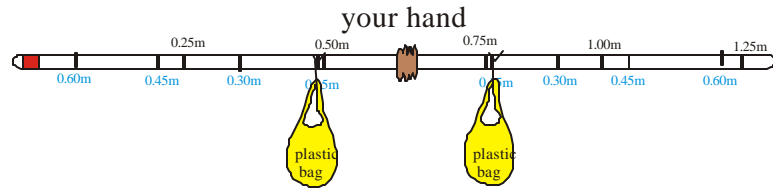


Figure 4, below, shows the final look of the stick that is prepared for both this experiment and “Experience Torque”



## The Experience

1. Put a load on the stick.
2. Move the load close to your hand.
3. Hold the stick horizontally
4. Then move the load to various displacements marked on the stick, such as at 0.25m, 0.50m, 0.75m and 1.00m.
5. Repeat 4, above, with two more different loads at same displacements.



4. Tie equal weights at the two 15 cm marks one on each side of the center. The weights might be two 5 p sack of potatoes, two 1 p boxes of sugar.
5. Hold the loaded stick try gently rotating by a few degrees. Record your feelings.
6. Move the weights to the two 30 cm marks. Do 5 again.
7. Move the weights to the two 45 cm marks. Do 5 again.
8. Use two new weights that are equal to each other but different from the first set. Do 5 to 7 again.

**Write the definition of Moment of Inertia.**

**List Equipment used**

### Sample Data Sheet

Item and weight	position	$I_o = \sum m_i r_{io}^2$	comment
potato sack 5 p = 2.27 kg	30 cm =0.3m	$2 \times (2.27 \text{kg} \times (0.3 \text{m})^2)$ $= 0.409 \text{ kg m}^2$	very hard to rotate
sugar 1 p= 0.453 kg	15 cm = 0.15m	$2 \times (0.453 \text{kg} \times (0.15 \text{m})^2)$ $= 0.0204 \text{ kg m}^2$	very, very easy to rotate