

DOIT 8 Experience Torque

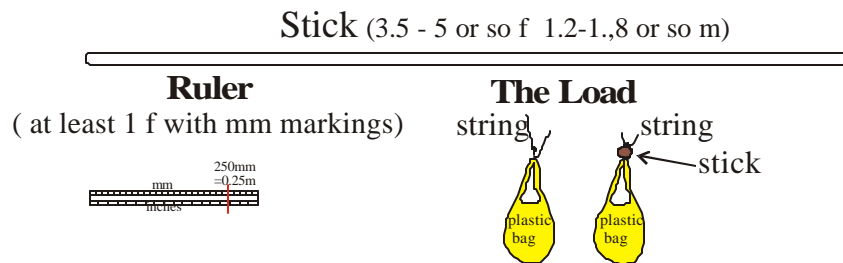
Preface

Torque causes change in rotational motion, similarly as force causes change in linear motion. But that is where the similarity ends. Unlike force which is a simple single entity or item, just a push or a pull, torque is more complicated. A torque has two pieces; a force and a distance from some point of interest. Here you will explore this feature.

Basic Equipment

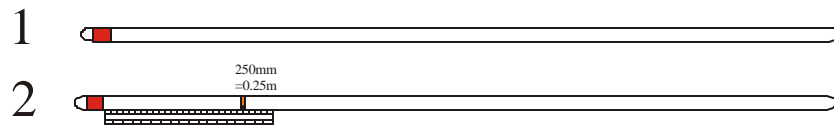
(Note: The preparations need not be as elaborate as described here. These descriptions are primarily for guidance.)

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.

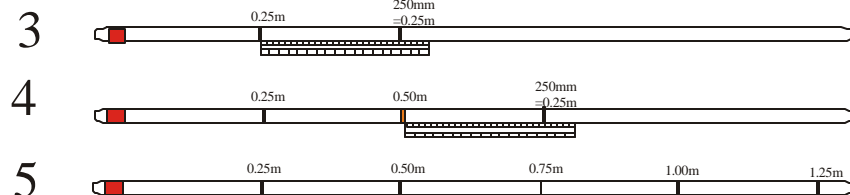


Fixing up the stick

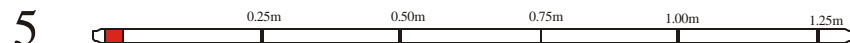
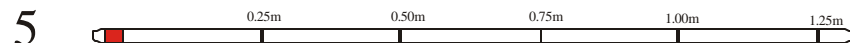
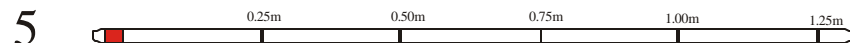
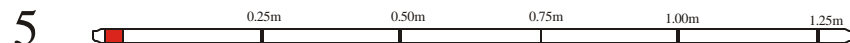
1. Near one end make wide mark to hold the stick. Put tape around it.



2. First placing the end of the ruler at the far edge of your holding mark and make a mark at



250mm (=0.25m). Do this repeatedly, as shown until you reach the end of the stick.

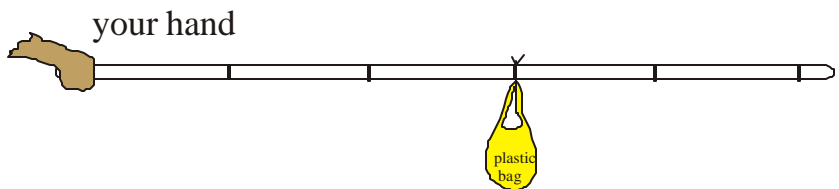


Write the definition of torque.

List Equipment used

Experience 1

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.



Record the weight of the load in Newtons (= mass (kg)*g(9.8m/s²).

For each Load-displacement pair,

- a. record the displacement in meters;
- b. calculate and record the torque in N
- c. record the response to supporting the load-displacement in the horizontal position..

Below is a suggested sample data sheet.

Sample Data Sheet

Load - Item	Load Weight	x	Torque	your experience
1 pound of margerine	454 gm =0.454 kg*9.8m/s ² = 4.45 N	0.25m	4.45Nx0.25m = 1.11Nm	Very easy to support
		0.50m	4.45Nx0.50m = 2.22Nm	Very easy, but a little harder to support.
		0.75m	4.45Nx0.75m = 3.34Nm	somewhat harder.
		1.00m	4.45Nx1.00m = 4.445Nm	

Experience 2

- Tape a moderate load at , say 0.50 m displacement mark.
- Hold the loaded stick horizontally as you did in Experience 1.
- Slowly increase the angle θ .

Record you response to supporting the torque as the angle increase.
Explain quantitatively the reasons your experience.

