LECTURE 1. MOMENT OF FORCE

1. Purpose:

- Calculate the moment of force
- Control the condition of Static equilibrium of an object

2. Equipment

For this lab you will be using these equipments:

- 1 Support base
- 3 Knife edge clamp
- 1 Weight set
- 2 Weight hangers
- 1 Meter stick

3. Background

This practical investigation validated the law of moments in simple situations.

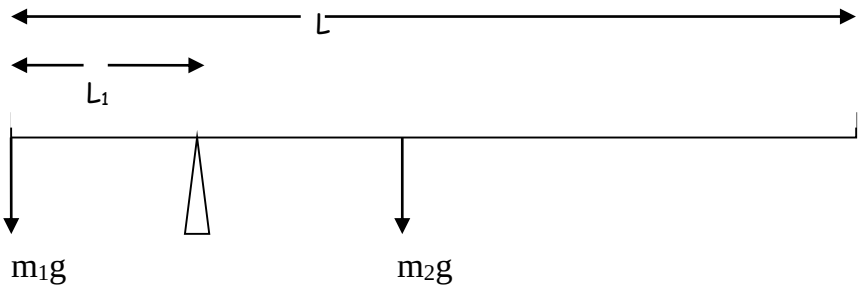
- The moment of a force F about a point O is given by the product FL where L is the perpendicular distance from O to the line of action of the force.

$$M = F \cdot L$$

- Counterclockwise moments are usually taken as positive, clockwise moments as negative.

$$M_1 = M_2 \Leftrightarrow F_1 \cdot L_1 = F_2 \cdot L_2$$

- The sum of the clockwise moments about any point O equals the sum of the counterclockwise moments about the same point, providing the body is in equilibrium.



4. Procedure

Step 1. Attach a 500 g mass to one of the clamps a the 40cm mark (10 cm from the balance point).

Step 2. Attach a 300 g mass to the opposite clamp. Adjust the position of the clamp until the meter stick balances.

Step 3. Calculate the counterclockwise torque on the left side of the balance point. Torque is equal to the product of the force (in newtons) and the lever arm through which that force acts (in meters). To determine the force in newtons, multiply the total mass (including the clamp) on the left side by 9.8 m/s^2, the approximate value of acceleration due to gravity.

Step 4. Calculate the clockwise torque on the right side by the same method. Compare the magnitude of the two torques, bearing in mind the uncertainty of the measurements made due to the uncounted mass of the meter stick.

Step 5. Repeat steps 1-4, using different initial masses and distances to compare clockwise and counterclockwise torques.

5. Discussion of results

The calculated values of the clockwise and counterclockwise torques in the above activity should be close enough to recognize that they are probably equal. The relationship can be summarized in the equation:

$$F_1 \cdot L_1 = F_2 \cdot L_2$$

Students using proportional thinking skills should quickly recognize the relationship between a force and the distance of that force from the balance point. Some students may want to ignore the weights of the two clamps when calculating the magnitude of the force, particularly if their weights are equal. It may be helpful to compare calculations with and without these weights added to point out the discrepancy in proportionality. Ask students to suggest some of the many applications of torque. The triple beam balance used in the laboratory is a familiar example.

LECTURE 1. MOMENT OF FORCE

REPORTS

Name:

Class:

1. Purpose:……
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2. Results.

Data table 1: Calculation, $M_1 = M_2$

S. No.	m_1 (kg)	F_1 (N)	L_1 (m)	M_1 (N.m)	m_2 (kg)	F_2 (N)	L_2 (m)	M_2 (N.m)	$\delta = \frac{\lvert M_1 - M_2 \rvert}{M_2}$

Data table 2: Experiment

S. No.	m_1 (kg)	F_1 (N)	L_1 (m)	M_1 (kg.m)	m_2 (kg)	F_2 (N)	L_2 (m)	M_2 (kg.m)	$\delta = \frac{\lvert M_1 - M_2 \rvert}{M_2}$

3. Discussion of results

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