

Torque Simulator

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/torque/>

Name: _____ Date: _____

Learning objectives

- Compute torque from force and lever arm.
- Apply the condition for rotational equilibrium.
- Explain the role of the angle between force and arm.

Variables to change

- Force magnitude
- Distance from pivot
- Angle of force

Procedure

1. Apply a force at a set distance from the pivot and note the torque.
2. Move the force farther from the pivot and observe the torque.
3. Change the angle of the applied force toward parallel with the arm.
4. Balance two torques on opposite sides of the pivot.

Observations

Record torque versus distance and angle, and the condition when the system balances.

Questions

1. Write the torque equation.
2. How does moving the force farther from the pivot affect torque?

3. At what angle does a force produce maximum torque? Zero torque?
4. State the condition for rotational equilibrium.
5. Why is a door handle placed far from the hinges?

Answer key (instructors)

- **1.** $\tau = r \cdot F \cdot \sin\theta$, where θ is the angle between the force and the lever arm.
- **2.** Torque increases in proportion to the distance (lever arm).
- **3.** Maximum at 90° (perpendicular); zero at $0^\circ/180^\circ$ (along the arm).
- **4.** The sum of clockwise torques equals the sum of counterclockwise torques (net torque = 0).
- **5.** A longer lever arm gives more torque for the same push, making the door easier to open.

Torque $\tau = rF \cdot \sin\theta$ measures a force's turning effect; it grows with lever arm and is largest when the force is perpendicular. A body is in rotational equilibrium when opposing torques balance to zero.