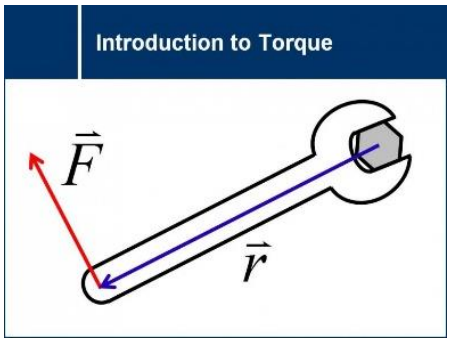
How Can You Throw a Bludger the Farthest?

Physics Camp at Home Activity

Experimenting with:
Forces and Torques

Introduction:

A force is a push or a pull on an object that makes it accelerate (speed up or slow down). Torque is a term that describes the tendency of a force to turn or twist. The strength of the torque force is affected by how far the twisting object is from the central point that it is rotating around (the farther away it is, the greater the torque). The wrench is functional because of this exact physics concept!



Will the wrench twist more strongly if you grab it at the end or if you grab it close to the bolt?

Objective:

In this experiment, you will measure how fast you can throw a ball using a variety of techniques with your body's ability to apply different amounts of force and torque.

Materials:

- 1 tape measure
- 1 ball
    - We recommend a baseball, soccer ball, or softball!
- Pencil

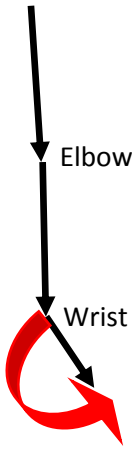
Procedure:

1. For each trial, you will measure how far you can throw a ball. Put out a measuring tape in front of you and stand at the "0" point at the end of the tape. Working with a partner, you will measure the distance from the point where the ball was released to the point where the ball **lands** (not where it rolls to). You should do three trials for each technique.
2. For the first technique, throw the ball by flicking your wrist, but keeping the rest of your arm still.
3. For the second technique, throw the ball by bending your elbow, but keeping your upper arm still.
4. For the third technique, throw the ball using a normal throwing motion (but don't move your body!).
5. For each of the three types of throws, take the average distance by adding the three trials and dividing by 3:

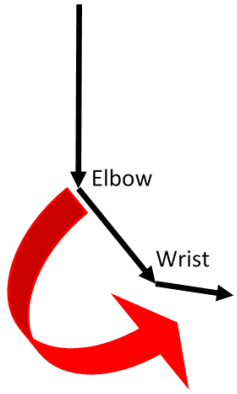
$$\boldsymbol{Average\ distance} = \frac{Trial\ 1\ dist. + Trial\ 2\ dist. + Trial\ 3\ dist.}{3}$$

Torque vectors of each type of throw:

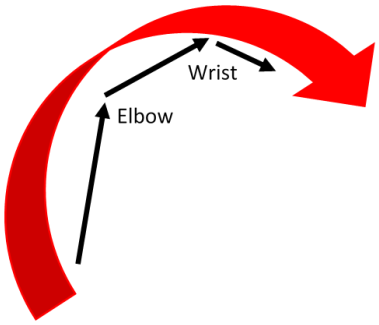
Technique 1:



Technique 2:



Technique 3:



Data Table:

	Trial 1 (meters)	Trial 2 (meters)	Trial 3 (meters)	Avg distance (meters)
1: Flicking wrist				
2: Bending elbow				
3: Normal motion				

Analysis:

1. Rank the techniques from shortest distance to farthest distance.

2. Which technique forced you to use the least torque?

3. Which technique allowed you to use the most torque? Why?

4. What kind of throwing strategies will be most useful on the quidditch pitch for a chaser? What about for a beater? (Think about what kind of skills are most useful for each position).

Extension *(Read directions before starting)*:

If you have extra time, and a stopwatch, you can use a physics formula to solve for approximately how fast you threw the ball! Velocity is a physics term that means how fast something is traveling. The formula for velocity is:

$$v = \frac{d}{t}$$

V= velocity (measured in ft/sec)

D= distance traveled (20ft in our system)

T= the change in time (how long it took to travel 20ft)

Start by using your tape measure to map out the distance of 20 ft. on the ground. Have a partner stand at the 20 ft. mark ready with the stopwatch. On the count of three, throw your ball and have partner start the clock simultaneously. Your partner should stop the clock as soon as the ball crosses the 20ft mark. Now, use the formula above to determine how fast you threw the ball!