# Angular Velocity Experiment Worksheet



**Figure 1. Example data logging experimental setup.**

# Vocabulary/Definitions

|  |  |
| --- | --- |
| **Word** | **Definition** |
| **data logging** | **Using a computer to collect and record data over an extended period of time through the use of a sensor.** |
| **length** | **The measure of how long something is from one end to another.** |
| **period** | **The length of time to complete one cycle.** |
| **gear**  | **A rotating machine with cut teeth.** |
| **gear train** | **A set of gears that is able to transfer rotational motion.** |
| **circumference** | **The distance around a circle.** |
| **degree** | **The unit of measure for a given angle.** |
| **radian** | **The unit of measure for a given angle equal to 57.296 degrees. The measure of a circle is equal to 2π radians = 360°.** |
| **velocity** | **The distance traveled per unit time.** |
| **angular velocity** | **The change in rotation traveled per unit time.** |
| **optimal** | **Best suited for the situation. The best choice, arrangement, result or decision obtainable that meets specific requirements.** |

# Hypothesis

# Materials

* LEGO MINDSTORMS Education NXT base set
* 2 LEGO MINDSTORMS NXT intelligent bricks
* calculator
* ruler
* 2 pieces electrical tape (not black)

To share with the entire class:

* computer with LEGO MINDSTORMS Education NXT Software 2.1
(programming and data logging)

# Procedure

# *Explain and/or sketch your data logging experimental setup.List the steps you followed to construct the device.*

# Data

# *Calculate the angular velocity with the three physics-based equations:*

**circumference = 2\*π \*(radius) (Equation 1)**

**degrees = radians \* (180/π) (Equation 2)**

**angular velocity = degrees/ (time for one period) (Equation 3)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Gear Length** | **Circumference****(radians)** | **Rotations****(degrees)** | **Period****(seconds)** | **Angular Velocity****(degrees/second)** |
| **big:big** |  |  |  |  |
| **medium:medium** |  |  |  |  |
| **small:small** |  |  |  |  |
| **big:medium** |  |  |  |  |
| **big:small** |  |  |  |  |
| **small:medium** |  |  |  |  |

**Now, let’s look at length and gear ratio:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Gear Length** | **Circumference****(radians)** | **Rotations****(degrees)** | **Period****(seconds)** | **Angular Velocity****(Degrees/ seconds)** |
| **4 big** |  |  |  |  |
| **4 medium** |  |  |  |  |
| **4 small** |  |  |  |  |
| **1 big:3 medium** |  |  |  |  |
| **3 big:1 medium** |  |  |  |  |
| **3 big:1 small** |  |  |  |  |
| **1 big:3 small** |  |  |  |  |
| **3 small:1 medium** |  |  |  |  |
| **1 small:3 medium** |  |  |  |  |

# Results

# *What does your data tell you about gears and angular velocity?*

# Conclusions

# *Do your experimental results agree with your hypothesis? Why or why not?*

# Optimal Solution

# *What gear train is optimal for a high angular velocity?*