

# Measuring Pressure

**Subject Area(s)** Measurement, Physical Science, Science and Technology

**Associated Unit** None

**Associated Lesson** None

**Activity Title** Measuring Pressure

**Header**



**Image 1**

**ADA Description:** Fellow and student

**Caption:** A 6<sup>th</sup> grade student is instructed by a GK12 fellow on how to use the sensor

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**Grade Level** 6 (5-7)

**Activity Dependency** Lego NXT

**Time Required** 45 minutes

**Group Size** 3

**Expendable Cost per Group** US\$0

### **Summary**

Students learn first-hand the relationship between force, area, and pressure. The students use a force sensor, built from a Lego NXT kit, to measure the force required to break through a napkin. The end of the force sensor has an interchangeable tip, allowing for different sized areas to apply the pressure across. Measuring the force, and knowing the area, the students compute the pressure.

### **Engineering Connection**

Pressure is an engineering concept that is often difficult to visualize. It is of paramount importance in fluid mechanics, structural analysis, and most other mechanical engineering fields.

**Engineering Category** = #1 Relating science and/or math concept(s) to engineering

**Keywords** Pressure, Lego, sensors, force

### **Educational Standards**

3.R.1; Use verbal and written language, physical models, drawing charts, graphs, tables, symbols, and equations as representations.

### **Pre-Requisite Knowledge**

Knowledge of force and area. Ability to divide.

### **Learning Objectives**

After this activity, students should be able to:

- Describe the relationship between pressure, force, and area
- Distribute a force over an area to make a material withstand more force.

### **Materials List**

Each group needs:

- 3 Napkins
- Worksheet

To share with the entire class:

- Lego NXT and Lego force sensors

### **Introduction / Motivation**

Pressure is a fundamental concept in science that is often found difficult to visualize or conceptualize. The ability to distribute a force over an area to minimize or maximize the pressure exerted is an important skill in engineering. To clarify the obscure aspects of pressure, completing this lesson will provide the student with a thorough understanding of what pressure is, how it is created, and how to change some variables to increase or decrease pressure.

## Vocabulary / Definitions

Word	Definition
Force	An external event that causes change in the motion of a body
Pressure	The force exerted on a surface divided by the area it is exerted over
Distributed Force	A force that is distributed over an area

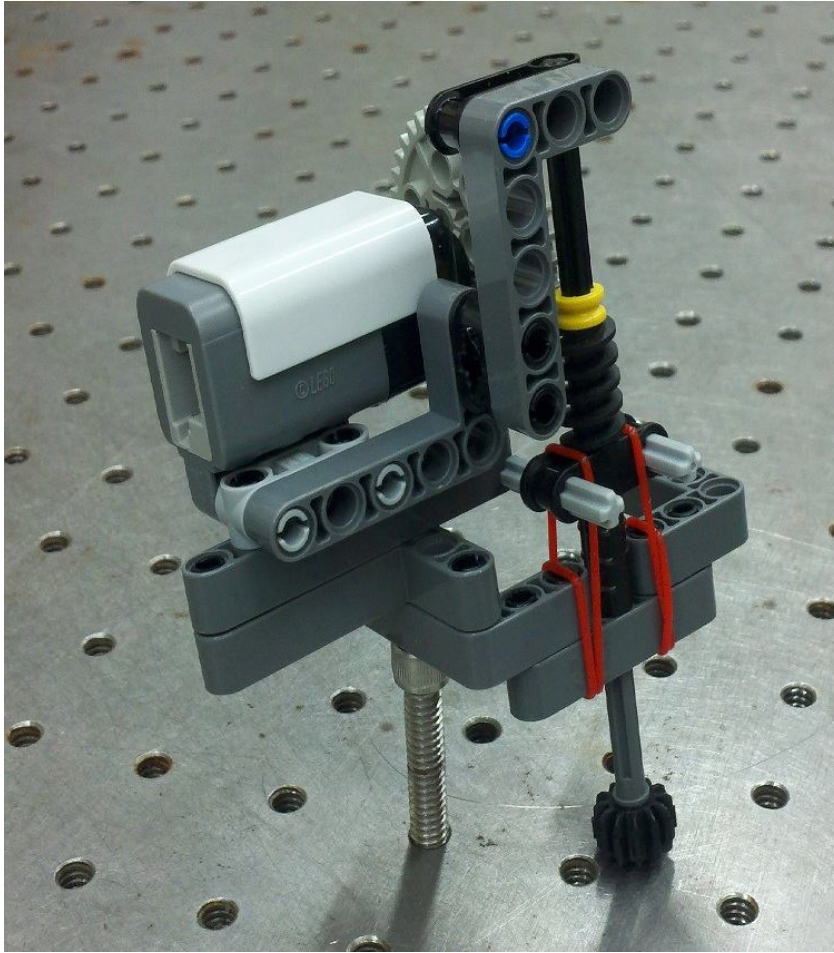
## Procedure

### Before the Activity

- Construct the Lego force sensor as show in figure 1.
- The sensor can be calibrated using placing a mass on it in the vertical upright position, and viewing the displacement. The relation between force and displacement can then be derived. Alternatively, the force sensors can output “Lego Force”, an imaginary unit, without losing any value of the activity.
- Give each group 3 napkins and one worksheet.

### With the Students

- Divide the class into groups of three.
- Introduce the relationship between force and area, and ask the students to hypothesize if a smaller or a larger area will make it easier to puncture the napkin.
- Ask for 2 students to aid in demonstrating the procedure.
  - Have one student hold the napkin, another read the output of the force sensor, while the teacher applies the force to the napkin.
- Instruct the students to repeat the demonstrated procedure in their groups, changing the area on the end of the force sensor for each napkin.
- Each trial should be recorded on the worksheet, noting the force required to puncture the napkin, and the area the force was distributed over.
- Ask the students to explain the results they obtained using the equation for pressure.



1.

**Figure 1**

**ADA Description:** Lego pressure sensor

**Caption:** Figure 1: A pressure sensor comprised of a rotation sensor, rubber bands, and other Lego pieces

**Image file:**

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## Attachments

### Assessment

#### Pre-Activity Assessment

*Descriptive Title:* Pre-evaluation

#### Activity Embedded Assessment

*Descriptive Title:* Worksheet

#### Post-Activity Assessment

*Descriptive Title:* Post-evaluation

**Activity Extensions**

Measuring force

Measuring air pressure

**Additional Multimedia Support**

Presentation

**Contributors** Jeffrey Laut

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**Supporting Program** GK-12 Fellows Grant

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