

## NGSS Correlations

### Harbottle Differential Pressure Demonstration AIR-275

#### Elementary

##### K-2-ETS1-3

Students can use the Harbottle to analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

##### K-ESS2-1

Students can use and share observations of local weather conditions to describe patterns over time. Students can apply knowledge gained from the Harbottle demonstration to understand the power of air pressure and its effects on weather. (See Lesson Ideas)

##### K-ESS3-2

Students can ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather. Students can apply knowledge gained from the Harbottle demonstration to understand the power of air pressure and how Air Pressure is a factor in forecasting weather.

#### Middle School

##### MS-PS2-2

Students can use the Harbottle to plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

##### MS-ETS1-1

Students can use the Harbottle in an investigation to define simple design problems reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

##### MS-ESS2-6

Students can use the Harbottle to develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determines regional climates. (See Lesson Ideas)

#### High School

##### HS-ETS1-2

Students can use the Harbottle in an investigation to design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

##### HS-ESS2-4

Students can apply knowledge gained from the Harbottle demonstration (See Lesson Ideas), to use a model to describe how variations in the flow of energy into and out of Earth systems results in changes in climate.

**3-ESS2-1**

Students can represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. Students can apply knowledge gained from the Harbottle demonstration to understand the power of air pressure and its effects on weather/seasons. (See Lesson Ideas)

**3-PS2-1**

Students can use the Harbottle in a plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

**5-ESS2-1**

Students can develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. Students can apply knowledge gained from the Harbottle demonstration to understand the power of Air pressure and how it interacts on Earth. (See Lesson Ideas)

**Suggested Science Idea(s)**

**K-ESS2-1,  
K-ESS3-2,  
2-PS1-2,  
3-ESS2-1,  
3-PS2-1,  
5-ESS2-1,  
MS-PS2-2,  
MS-ESS2-6,  
and  
HS-ESS2-4**

The Harbottle will help students to feel the power of air pressure. Use it to teach students the 'truths' about air pressure, 'There is no suction!' Students can calculate based on the area of the mat and the standard air pressure to calculate how much force is required to pull the mat up.

### **Common Units of Force and Pressure**

1 atmosphere = 760 millimeters of mercury (Hg)

=  $1.013 \times 10^5$  pascals

= 14.70 pounds per square inch

1 torr = 1 millimeter of mercury (Hg)

**K-2-ETS1-3**

**3-5-ETS1-1**

**HS-ETS1-2**

Students can use the Harbottle in a number of different investigations on air pressure. Use spring scales to acquire quantitative data and make measurements of the pull. With the manipulation of variables, students get real world and inquiry engineering learning opportunities.

\* NGSS is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of, and do not endorse, this product.