

611-2325 (35-070) Magdeburg Hemispheres



Introduction: At sea level, the pressure of Earth's atmosphere on the surface is 101.325 kPa, or 14.96 pounds per square inch. This is called air pressure. While we don't notice this force because our bodies are accustomed to it, it can be used in a variety of ways. One way is the Magdeburg Hemispheres.

In 1650, the mayor of the German city of Magdeburg, Otto von Guericke demonstrated his invention for the German emperor. It consisted of two twenty inch iron hemispheres which were designed to mate together. A small valve allowed a vacuum pump of Guericke's design to remove the air. Thirty horses in two teams of 15 were put in in opposite directions and tried to pull the hemispheres apart. They were unsuccessful.

The secret behind the strength of the Magdeburg Hemispheres is the concept of air pressure. Every square inch of them is subjected to 15 pounds of force. Under normal conditions this has no effect. However, nature abhors a vacuum, and air will attempt to fill one if possible. When a vacuum is produced inside the hemispheres, air pressure presses against them, attempting to fill the vacuum. Essentially, 15 pounds of force is placed on every square inch of the two hemispheres, which can quickly add up. This makes it very difficult to pull the hemispheres apart.

Operation: to use your Magdeburg Hemispheres, you will need a vacuum pump. A more powerful pump produces better results, because more air is removed, resulting in a harder vacuum. The kit is designed to be used with a hand pump. However, an electric pump will remove a greater amount of air more quickly.

Start by placing the hemispheres together. You will notice that the one of the mating surfaces has a special silicone-rubber gasket. This gasket helps ensure a better seal without the use of messy vacuum grease.

Now, simply remove the air from the center and use the valve to maintain the vacuum. This valve is a push button variety, meaning it must be held down to remain open. Hold the button down when evacuating the air, and release when the vacuum is sufficient. Disconnect the vacuum hose from the pump and pass the apparatus

around your classroom. You will find that the strongest student will be unable to pull the Magdeburg Hemisphere apart by the handles. In fact, the Magdeburg Hemispheres generate so much force that two adults may be unable to break the vacuum!

When finished, push the button on the valve to allow air back into the hemispheres. This will equalize air pressure, allowing them to be pulled apart.

Be advised that due to the design of the unit, it is impossible to generate a perfect vacuum inside.

Warranty and Parts:

We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Not designed for children under 13 years of age.

May we also suggest:

611-2345 Weight of Air Apparatus: Prove that air has weight by weighing our can before and after evacuating it. The difference is up to 1/2 gram. Includes 1000 mL seamless aluminum can with attached plastic valve and hose. Instructions included. *Requires vacuum pump.*

45-065 Accent Air Pressure Kit: Finally! Everything you need to teach air pressure all in one kit. Comes with Magdeburg Hemispheres, Weight of Air Apparatus, Vacuum Lifter, Pressure Cups, Breaking Board Apparatus, Hand Vacuum Pump, and instructions.

611-2360 Motor Driven Vacuum Pump: Direct drive motor-driven pump comes with built-in gauge. It works from 0 to -30 inches Hg. 1 atmosphere ultimate pressure, 1-stage rotary vane construction. Includes oil level indicator on the side; 11 x 10 x 5". Can be used with Guinea and Feather and Bell in Vacuum.

35-155 Bell in Vacuum: Show that sound waves need air in order to be heard. Place a ringing bell (included with the kit) inside the included bell jar and pump out the air. What will happen to the noise? Remove the air from the Magdeburg Hemispheres and place inside the bell jar. Pump out the air. What will happen to the Magdeburg Hemispheres? *Requires vacuum pump.*