The scenario

Subject (field/title)	Atmospheric pressure/ Magdeburg hemispheres
Length of movie	1:35
Main Goals	Fluid statics. Presentation of the existence of atmospheric pressure.
Detailed Goals	To familiarize students with a historical experiment proving the existence of atmospheric pressure and vacuum. The film presents the experience with the Magdeburg hemispheres. It illustrates how large are the forces exerted by atmospheric air on us and the surrounding bodies.
Structure and description of the experiments	
1. Introduction	Description: We live at the bottom of an ocean of air. There is a layer of atmosphere above us. The last traces of the presence of air begin to disappear at a distance of 500-2000 km above the Earth's surface, in the exosphere. Below 5 km above sea level, 50% of the mass of all atmospheric air is located. The column of air exerts an aerostatic pressure on the Earth's surface, depending on its height, air density and gravitational acceleration. In addition, air molecules in constant motion collide with bodies, exerting pressure on them. The air around us exerts atmospheric pressure on our bodies.
2. Main topic	Description: Repetition of the experiment carried out by the mayor of Magdeburg, Otto von Guericke. In May 1654, the German inventor, the mayor of Magdeburg - Otto von Guericke - conducted one of the most important experiments in the history of science. In the presence of the Prussian prince Frederick William, proving the existence of atmospheric pressure and vacuum. He put together two brass hemispheres with a diameter of about 42 cm. Then he pumped the air out of the resulting sphere. In order to tear these hemispheres, sixteen horses had to be used (the noise accompanying the tearing of the hemispheres resembled a cannon shot), while the reintroduction of air into the interior of the sphere meant that the hemispheres could easily be separated by one man.
Part 1	
	Tools : • *Magdeburg hemispheres with a diameter of about 12 cm,* • *Vacuum pump.* **Description** : One of the hemispheres is connected through the valve with a hose to the vacuum pump. We put both hemispheres together. We let them go. Unfortunately, the hemispheres separate.

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	We connect the hemispheres again, close the valve attached to one of the hemispheres and start the vacuum pump. We pump out the air between the hemispheres, holding the hemispheres together for a few seconds. We release the hemispheres. The hemispheres form a whole, they do not separate, they remain compressed. We close the valve and disconnect the hemispheres from the vacuum pump. We're trying to separate them. The kit can be given to students to try to separate the hemispheres. We open the valve, the hemispheres separate themselves without using force. **Questions** : What is atmospheric pressure? How to find out about the existence of atmospheric pressure? Why do hemispheres remain compressed when we pump out the air between them? What holds the hemispheres together and makes them difficult to separate? What happens when we open the valve that allows air to enter the center of the hemispheres? What is the value of atmospheric pressure? Where and when can we hear about the value of atmospheric pressure? What was the historical experiment with the Magdeburg hemispheres? How can we measure atmospheric pressure? Where do we use atmospheric pressure in everyday life? **Conclusions:** The atmosphere exerts pressure on us and all bodies. The pressure exerted by the atmospheric air on hemispheres is so great that even a strong man cannot separate the hemispheres. Between the hemispheres, after the air is pumped out, a lower pressure is created (if the air between the hemispheres is completely pumped out, there would be a vacuum between them), atmospheric pressure presses the hemispheres together.
3. Summary and notes	**Application:** The video can be used at the beginning of a lesson as an introduction to a lesson about atmospheric pressure. What is the behavior of the hemispheres after the air between them has been pumped out? The video can be used as an illustration of a historical experiment during the actual part of the lesson. The film can be used during the repetition of the material.

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	The film can be an introduction to a discussion about: Atmospheric pressure values, normal: The atmospheric pressure value is 1013.25hPa (760mmHg). Is it a large or small value? About the use of pressure in everyday life. About changes in atmospheric pressure and their impact on people's well-being. About hypotension and hypertension. About the weather: high and low pressure. On air circulation and winds. On the dependence of atmospheric pressure on height. On Pressure Measurement and Torricelli's Experiment . We can also repeat the experiment performed by Otto von Guericke by using two suction cups to carry the glass. They play the role of classic "Magdeburg hemispheres". The use of suction cups allows you to perform the experiment without using a vacuum pump. Each of the suction cups is equipped with a handle, which closing (folding both handles together) causes the rubber surface of the suction cup to become concave. Between the suction cups, the volume increases, the pressure decreases. To demonstrate the existence of atmospheric pressure, the two suction cups are placed against each other with their rubber surfaces. Then we close the handles. This causes an empty space between the suction cups (with a good approximation we can say that there is a vacuum). The suction cups are now the equivalent of the Magdeburg hemispheres put together and the air pumped out. Such folded suction cups-hemispheres can be easily disconnected by opening the handles. The pressure exerted by the atmospheric air is so great that even a strong man cannot separate the suction cups. **Level:** elementary school

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