

Vacuum and pressure

Learning objectives

Understand that air is made of molecules and that these molecules apply pressure on objects. Study different ways that air puts pressure on objects and how this pressure varies with the amount of air present. Learn that vacuum is the absence of air and study the effect of vacuum on the pressure.

Materials

Per group of students

- 1 kit of vacuum pump with a jar
- 1 balloon, inflated just enough to fit in the jar
- 1 candle

Per class

- 1 lighter
- 1 big rubber band
- 1 computer

Picture of the setup

Activity

This activity takes the form of a quiz where kids are asked multiple choices questions. They discuss in teams to come up with an answer and they try themselves the experiment to see what the right answer is. Sometimes they are told the answer or they watch a video to see what is supposed to happen.

All the questions are on the slides so it's simple to follow. The students can write the right answer on their activity sheet after doing the experiments. It can be fun to have the teams find a name and to keep score.

Here is a summary of what can be good to discuss with the slides:

-*What is air made of ?* Ask the kids what is in air. Try to come up with the idea of molecules. Explain how small they are by asking how many zeros should be put with a 1 to know how many molecules there are in a small object (should be 26 zeros). Ask them what happens when there is no air and where we can find that.

-*How to blow a balloon ?* The kids should come up with blowing air with your mouth and use a pump. Do a demo with the big rubber band with 2 kids inside and 2 kids outside, each pushing towards the band. Add a kid inside and notice that the band expand. The band is like a balloon and the kids are air molecules. Adding kids inside is like blowing the balloon.

-*How to remove air ?* Simply do the question and then show them the answer. You can explain how the pump works after.

-*Balloon in vacuum ?* Ask the question and then the kids try it themselves.

-*Why did the balloon get bigger ?* The kids answer the question and you show the answer. After that, do another rubber band demo where you remove kids outside instead of adding kids inside.

-*Candle in the vacuum ?* The kids answer the question and then they try it. Be sure to light the candles yourself and close the lids before giving the jars to the kids. Explain that the flame dies because it needs air to live, and we remove it with the pump.

-*What happens to the balloon in that case ?* The kids answer and then you try it with the rubber band to see what the right answer is.

-*Water in a vacuum ?* They answer the questions and you show the video to see the answer. Explain that the air inside the water wants to get out and it no can because nothing is pushing on the surface. Ask them if they think the water is hot. It is not.

-*Where do we use pressure ?* Ask them to answer and then tell the that all are right. Ask some kids to explain their answers.

Tips

-Divide the class into group of 3-5 students so they can all try the pump and have animated discussions

-Skip questions if time is restricted (questions 1, 2, 3 are almost essential but the others can be cut as you want)

-Check the pumps before the activity to make sure that they all work

-When doing the big rubber band demos, kids outside may be excited so you can do it yourself instead.

Possible extensions

-Other objects that get bigger in the vacuum jars are marshmallows and shaving cream.

-Another youtube video shows how flies behave in a vacuum jar:

<https://www.youtube.com/watch?v=C4h-AS729JM>

-With long tubes instead of jars you can test the statement that a marble falls at the same time as a feather in a vacuum.

-With an electric pump it may be possible to put a speaker in the jar and notice that the sound doesn't travel in a vacuum.