



## Marshmallows under Pressure

### Overview:

You may not realize it, but we all live under pressure, atmospheric pressure that is. Atmospheric pressure is the force exerted on us by the weight of air molecules in the atmosphere.

We usually don't notice atmospheric pressure, because there is air in our bodies pressing outwards creating an equilibrium. In this experiment, we will force the air out of a glass flask containing a few marshmallows and then let the air back in, which will allow us to observe air pressure's surprising strength. We will use a pressure sensor to monitor the air pressure within the flask.

### Equipment

- einstein™ tablet+, MiLAB
- Pressure sensor (150 – 1150 mbar)
- Manual vacuum pump
- Sensor cables
- 250 ml suction flask
- Rubber stopper with a hole for the flask extender
- Tubing
- Syringe extender with valve
- Several marshmallows

## Experiment procedure

1. Launch MiLAB 
2. Connect the pressure sensor to the device
3. Connect the pressure sensor to the syringe extender
4. Make sure only the Pressure sensor (150-1150 mbar) is selected
5. Select Rate  and set the sampling rate to 10 /sec
6. Select Duration  and set the duration to 200 sec
7. Use the tubing to connect the manual pump to the flask via the side tube
8. Make sure the valve is closed to air entering the flask
9. Select Run  to begin recording data
10. Use the manual pump to expel the air from the flask, monitor the change with the Pressure sensor and observe the marshmallows
11. Turn the valve to let the air back in the flask and observe the marshmallows

## The Science

Why did the marshmallows expand and then shrink? In the process of making the marshmallows, numerous tiny air bubbles are trapped within creating outward pressure counterbalancing the outside air pressure. When we decrease the air pressure around the marshmallow, the internal pressure from these bubbles can push outwards unimpeded. When the external pressure returns, the equilibrium is reestablished. A similar effect would occur if we sent the marshmallows into outer space, since air pressure there is zero (complete vacuum).