

Properties of rubber balloons

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Birthday parties are incomplete without balloons. Intriguingly, Michael Faraday made balloons in 1824 not for display but rather to carry out gas laws investigations. By experimenting with balloons especially in a laboratory like ours, we can learn more about the behavior of rubber-like materials.

You are encouraged to investigate how the pressure within the balloon changes as the balloon is filled with air and subsequently, as it is removed. We require you to first predict, and then obtain the pressure variation inside the balloon as it happens in real time. Our data logger, the PhysLogger, and its associated pressure sensor called PhysBar allows one to achieve this. Once this pressure-time curve has been fetched, one needs to then identify the various pressure distinct regions and investigate what is happening in each of these regions. Use the reference and the accompanying explanation notes to complete this activity. In this think-aloud activity, we expect you write down your findings and musings on the balloon's pressure in your notebooks.

1 Procedure

The setup is shown in Figure 1. The balloon is connected to a mechanical pump by pneumatic pipes. Two variable valves are placed utilizing t-junction pneumatic connectors. Their purpose is to inflate or deflate the balloon. The balloon's internal pressure is measured by connecting the pressure sensor PhysBar to the balloon with another t-junction. Physbar is also connected to the PhysLogger, which is in turn connected to a computer. The PhysLogger Desktop app on the computer makes it convenient to record and display the evolution of pressure during the inflation and deflation phases with respect to time.

After inflating it to a specific volume or for a pre-determined amount of time, open the deflation valve to allow the gas to escape from the balloon. The curve of pressure against time is simultaneously being plotted on the computer. After the balloon is fully deflated, the deflation valve is closed, and the saved data can be processed further.

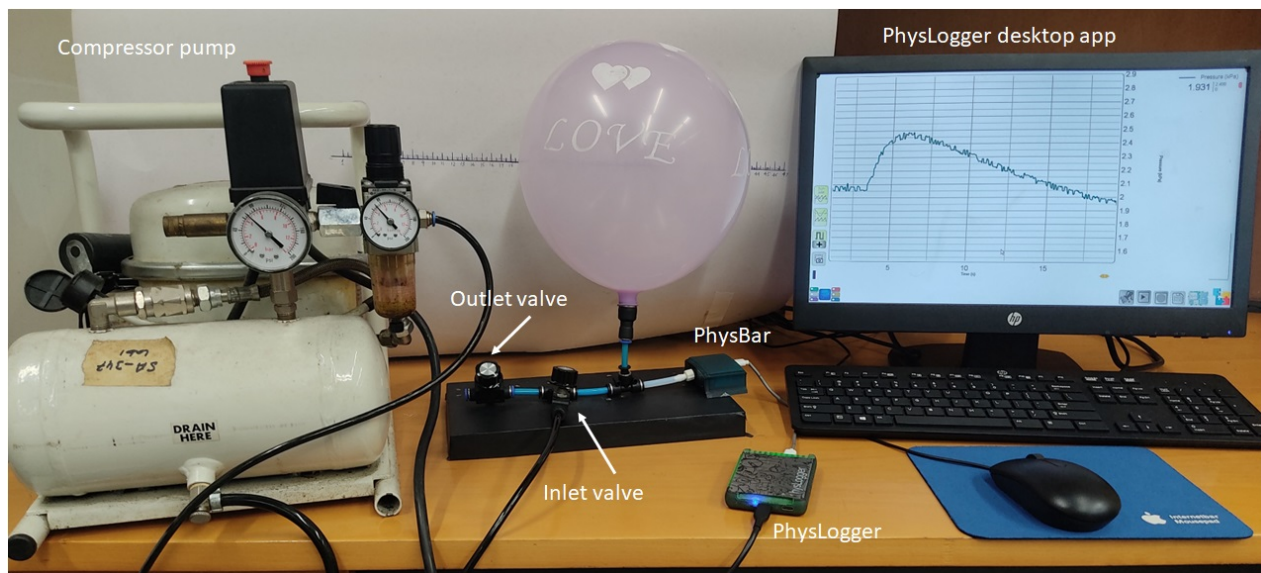


Figure 1: The setup used to study the pressure response of the balloon.

References

- [1] <https://www.mwmresearchgroup.org/the-science-of-balloons-part-1.html>.