

The Physics Experiments of Robert Wichard Pohl (1884–1976)

For decades, Robert Wichard Pohl taught his famous lectures of introductory physics in the old lecture hall of the Physics Institute at Goettingen University. These lectures became the foundation for three volumes entitled „Introduction into Physics“. Now, using Professor Pohl's original instruments in the same lecture hall in which he taught, this set of videos captures his extraordinary ingenuity and once more brings to life Pohl's great experimental skills.



Behn's tube

Video title: Behn's tube

Signature: C 14853

Series title: The Physics Experiments of Robert Wichard Pohl (1884-1976)

Abstract: A balloon filled with a gas lighter than air will rise. This is explained as evidence that the pressure in the heavier air decreases more rapidly with increasing height than that of the lighter gas inside the balloon. Direct evidence for this difference is presented here using a glass tube with two openings at its ends through which natural gas burns. With the tube held horizontally, the two flames burn identically in size. When the tube is tilted, however, the upper flame is seen to burn much larger than the lower one.

Source: Pohl's Einführung in die Physik - Mechanik, Akustik und Wärmelehre. Lüders, Klaus; Pohl, Robert Otto (Hrsg.) 19. Aufl., 2005, Springer Berlin Heidelberg New York; p. 145

Key words: Mechanics, ideal gas, buoyancy, balloon, barometric pressure

Goal of the experiment: A balloon filled with a gas lighter than air will rise. This is explained as evidence that the pressure in the heavier air decreases more rapidly with increasing height than that of the lighter gas inside the balloon. Direct evidence for this difference is presented in this experiment.

Experimental setup: A glass tube has two openings at its ends through which natural gas (methane) escapes. It is lit after all air has been displaced from the tube, to avoid burning of the gas inside the tube. The tube can be tilted to the right and to the left.

Experiment: With the tube held horizontally, the two flames burn identically in size. This shows that the same amount of gas escapes from both openings, and hence that the pressure difference between the air and the gas is the same at both openings. When the tube is now tilted by as little as 10 cm, the upper flame is seen to burn much larger than the lower one, indicating different gas flows. The reason for that must be that the pressure difference between air and gas is greater at the upper opening than at the lower one. While it is known that in every gas the pressure decreases with increasing height (barometric pressure gradient), the observation made here shows clearly that the pressure must decrease more rapidly in the heavier air than in the lighter gas.

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