

Work Sheet 12a - Boyle's law

Introduction

How does the volume of a gas depend on its pressure? If the gas obeys Boyle's law then the pressure multiplied by the volume is a constant, at constant temperature.

$PV = \text{constant}$.

In this Investigation you can check to see if a gas bubble rising up an oil well obeys Boyle's law. The pressure of the gas is proportional to its depth below the surface of the oil. As the bubble rises, the pressure decreases and the bubble expands. You can measure the radius of the bubble at different depths and hence determine the relationship between its volume and the pressure.

Preparation

Before you start, review the Introduction and Study Points sections of the topic. In particular make sure that you understand how pressure varies with depth in a liquid and what is meant by Boyle's law for a gas.

Getting started

Use the controls at the bottom left of the screen to control the sequence. Click Play to watch the bubble rise. Use the Step forward and Step back controls to move the bubble one frame at a time.

To measure the radius of the bubble at a given depth use the mouse to stretch a measuring rule across the bubble's diameter. You must take some care to ensure that your measurements are accurate. Each time you make a measurement, the depth, pressure, radius, volume and the reciprocal of the volume ($1/V$) are entered in the table on the left of the screen.

Interpreting your results

Record the radius of the bubble at each depth.

To determine whether or not the bubble obeys Boyle's law you must plot a suitable graph from your data. If you are not sure what graph to plot review the Study point

on Boyle's law. If you are still unsure, discuss the graph with your teacher. You can click the Print button to print the data table and graph.