

Edexcel Physics A-level

CP14 - Investigate the Relationship Between Pressure and Volume of a Gas

Practical Flashcards

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State Boyle's Law.



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When kept at a constant temperature, the pressure and volume of an ideal gas are inversely proportional.

$$pV = \text{Constant}$$



State the value of the standard atmospheric pressure.



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101 kPa



Describe the relationship that should be found when a graph of $1/V$ against P is plotted.



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Pressure and volume are inversely proportional so the graph of $1/V$ against P should be a straight line that passes through the origin.



Why should the volume be changed slowly when carrying out this experiment?



Why should the volume be changed slowly when carrying out this experiment?

The volume should be changed slowly so that the temperature remains approximately constant during the volume change. The temperature must be constant for Boyle's law to hold.



What piece of apparatus can be used to measure the pressure in a sealed tube?



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A Bourdon gauge can be connected to the tube and pump to measure the pressure.



What piece of apparatus can be used to increase the pressure applied on the oil?



What piece of apparatus can be used to increase the pressure applied on the oil?

A pump, such as a tyre pump, can be used to increase the pressure applied to the oil.



What happens to the air trapped by the oil when the pressure exerted on the oil increases?



What happens to the air trapped by the oil when the pressure exerted on the oil increases?

As the pressure on the oil increases, the air is compressed and its volume decreases.



How can the volume of the air be measured?



How can the volume of the air be measured?

If the sealed tube has a length scale, the length of the column of air can be multiplied by the circular area of the tube. This area can be obtained by measured the diameter of the tube using a micrometer, and substituting this into the circular area equation.



Why would it not be suitable to take volume measurements for decreasing pressures rather than increasing pressures?



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If the pressure on the oil was decreased, the oil level would lower and the volume of the air would increase. Some oil, however, will cling to the sides of the tube, resulting in volume readings that are larger than the true volume of the oil.



Describe the technique for measuring the height of the oil.



Describe the technique for measuring the height of the oil.

Measurements should be taken at eye-level to the oil surface. For accurate results, values should be read from the bottom of the meniscus.



Explain why the air column length can be used instead of the volume to prove Boyle's law in this experiment.



Explain why the air column length can be used instead of the volume to prove Boyle's law in this experiment.

In this experiment we are looking to prove that P and V are inversely proportional. V is directly proportional to the column length ($V=AL$) and so L can be used to prove the relationship, without calculating volume.



How can the value of the constant be determined?



How can the value of the constant be determined?

When plotting a graph of P against $1/V$, the constant will be given by the gradient of the straight line.



What safety precautions should be taken when carrying out this experiment?



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The apparatus could break under high pressures and so safety goggles should be worn throughout. A safety screen could also be used to provide further protection.

