

OCR (A) Physics A-level

PAG 08.2 - Investigating the Relationship Between Pressure and Volume

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.

$$pV = \text{Constant}$$



How is the cross-sectional area of a syringe measured?



How is the cross-sectional area of a syringe measured?

Remove the plunger and then using a micrometer, measure the diameter of the seal. This value can then be substituted into the circular area equation.



Why should the clip used to seal the tubing coming from the syringe be as close to the syringe tip as possible?



Why should the clip used to seal the tubing coming from the syringe be as close to the syringe tip as possible?

The volume of air trapped in the tubing should be as small as possible so that it is negligible in comparison to the volume in the syringe.



Suggest how a mass hanger could be attached to the plunger of the syringe.



Suggest how a mass hanger could be attached to the plunger of the syringe.

A small piece of string can be tied to the plunger to form a loop. The hanger can then hook onto to this loop.



Why should the syringe be clamped
above the region of the plunger's
motion?



Why should the syringe be clamped above the region of the plunger's motion?

Clamping the syringe can distort the barrel and hinder the motion of the plunger. By clamping above the region in which the plunger moves, this problem is avoided. It also ensures that the scale on the syringe isn't covered by the clamp.



Why should the syringe be clamped at a sufficiently high height?



Why should the syringe be clamped at a sufficiently high height?

The syringe should be clamped at a sufficiently high height so that the plunger has space to move downwards as masses are added.



How can the force exerted by the masses be calculated?



How can the force exerted by the masses be calculated?

$$F = mg$$

Force = Mass x Gravitational Field
Strength



How can the pressure exerted by the masses on the air sample be calculated?



How can the pressure exerted by the masses on the air sample be calculated?

Pressure = Force / Cross-Sectional Area
of Plunger

This pressure should then be subtracted from the standard atmospheric pressure.



State the value of the standard atmospheric pressure.



State the value of the standard atmospheric pressure.

101 kPa



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



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

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 constant during the volume change. The temperature must be constant for Boyle's law to hold.



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?



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

If you decrease the pressure on the oil, 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 too large.



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. The value should be read from the bottom of the meniscus to give an accurate value.



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.



Suggest why a straight line may not be produced when plotting a graph of $1/V$ against P .



Suggest why a straight line may not be produced when plotting a graph of $1/V$ against P .

The plunger may have experienced some resistance to its motion as masses were added. This sticking of the plunger, would result in an inaccurate volume value.

