

WJEC (Wales) Physics A-level

SP3.4a - Estimation of Absolute Zero by Use of Gas Laws

Practical Flashcards

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What does Charles' Law state?



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Charles' Law states that for a constant amount of gas held at a constant pressure, the volume and absolute temperature are directly proportional.

I.e. If $P = \text{constant}$, $V \propto T$



What does Boyle's Law State?



What does Boyle's Law State?

Boyle's Law states that for a constant amount of gas held at a constant temperature, the pressure and volume of the gas are inversely proportional.

I.e. If $T = \text{constant}$, $P \propto 1/V$ and $V \propto 1/P$



Combining Boyle's and Charles' Laws,
what can be said about the relationship
between temperature and pressure?



Combining Boyle's and Charles' Laws, what can be said about the relationship between temperature and pressure?

For a constant amount of gas held in a constant volume, the pressure and absolute temperature of the gas are directly proportional.

I.e. If $V = \text{constant}$, $P \propto T$



What should a graph of volume against absolute temperature look like for an ideal gas?



What should a graph of volume against absolute temperature look like for an ideal gas?

Since, at a constant pressure, the volume and absolute temperature of an ideal gas are directly proportional, a graph of one against the other should produce a straight line that passes through the origin.



What should a graph of volume against Centigrade temperature look like?



What should a graph of volume against Centigrade temperature look like?

A graph of volume against Centigrade temperature should form a straight line, since the two variables are proportional to each other. The line should intercept the x-axis at -273°C .



What should a graph of pressure against absolute temperature look like for an ideal gas?



What should a graph of pressure against absolute temperature look like for an ideal gas?

Since, within a given volume, the pressure and absolute temperature of an ideal gas are directly proportional, a graph of one against the other should produce a straight line that passes through the origin.



Describe the motion of particles at absolute zero.



Describe the motion of particles at absolute zero.

When a substance is at absolute zero, its particles have zero kinetic energy and so are completely stationary.



What is the theoretical volume of an ideal gas at absolute zero?



What is the theoretical volume of an ideal gas at absolute zero?

When at absolute zero, the theoretical volume of an ideal gas is zero.



What is the theoretical pressure of an ideal gas at absolute zero?



What is the theoretical pressure of an ideal gas at absolute zero?

When at absolute zero, the theoretical pressure of an ideal gas is zero.



What is the accepted value for absolute zero in degrees Celsius?



What is the accepted value for absolute zero in degrees Celsius?

Absolute Zero = -273.15°C



How can you obtain a value for absolute zero from a graph of length of air column against temperature?



How can you obtain a value for absolute zero from a graph of length of air column against temperature?

The theoretical value for volume at absolute zero is zero. This will occur when the length of the air column is zero and so a value for absolute zero can be given by the x-intercept of the graph.



How can the x-intercept of a graph be calculated from a line of best fit?



How can the x-intercept of a graph be calculated from a line of best fit?

The line of best fit can be written in the form $y = mx + c$, where m is the gradient and c is the y-intercept. The x-intercept is then given by $-c/m$.



How can you calculate the percentage difference between your value for L and the accepted value?



How can you calculate the percentage difference between your value for L and the accepted value?

$$\left[\frac{\text{Your Value} - \text{Accepted Value}}{\text{Accepted Value}} \right] \times 100\%$$



How should temperature readings be taken using a thermometer?



How should temperature readings be taken using a thermometer?

The liquid should be stirred with a stirrer before taking a reading to obtain an accurate value. The thermometer should be read at eye level to avoid a parallax error.



Why does the length of the trapped air column change when heated?



Why does the length of the trapped air column change when heated?

As the air column is heated, the particles gain kinetic energy and increase in temperature. Since the pressure is constant, this results in the column expanding, and so its length increases.



Why is it important to continually stir the water in the beaker?



Why is it important to continually stir the water in the beaker?

To ensure the temperature of the beaker is constant throughout the beaker. As a result this makes sure that the temperature measured by the thermometer is equal to the temperature of the gas column/gas pressure guage under investigation.



What safety precautions must be taken when working with sulfuric acid?



What safety precautions must be taken when working with sulfuric acid?

Ensure your skin does not come into direct contact with the sulfuric acid and make sure to wear safety glasses. If there is any leakage, let a teacher know immediately.



What safety precautions must be taken when working with hot/boiling water?



What safety precautions must be taken when working with hot/boiling water?

Beakers containing hot water should not be touched with bare hands. Handling such beakers could result in burns. Instead wait until the beaker is at a suitable handling temperature ($<50^{\circ}\text{C}$).

