CAIE Physics A-level

Paper 3: Analysis, Conclusions & Evaluation

Flashcards

State the formula for a straight line on a cartesian axis graph.

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$$y = mx + c$$

y - dependant variable

m - gradient

x - independent variable

c - y-intercept

What does the gradient of a graph show?

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Gradient shows how the value of y changes when the value of x changes (dy/dx).

It is a measure of ‘steepness’ of a line.

How is the gradient of a straight-line calculated?

How do you calculate a gradient from a straight-line graph?

Gradient = change in y / change in x

Use a large right-angled triangle to find the change in x for a change in y.

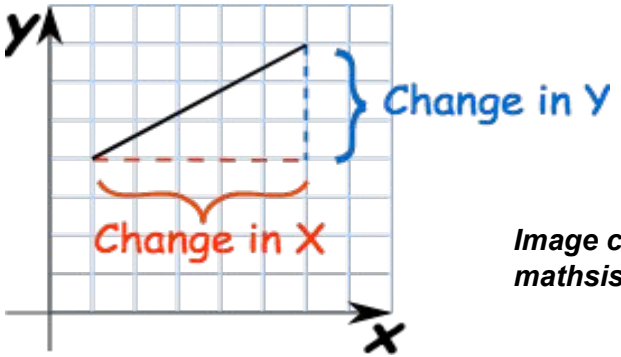
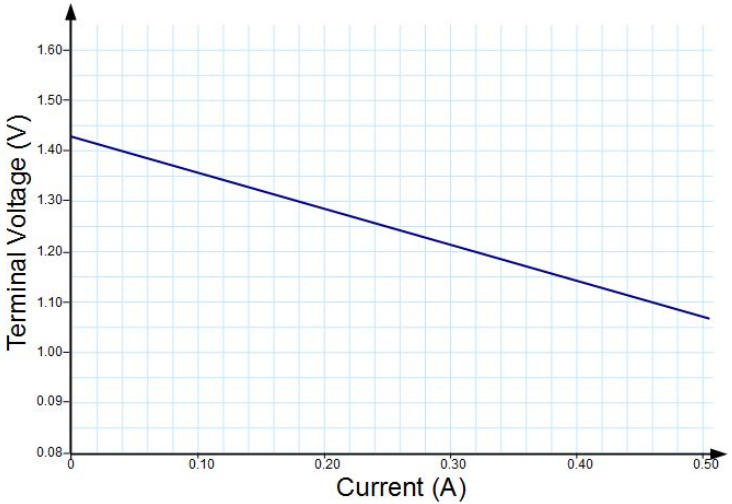


Image courtesy of mathsisfun.com

Describe the gradient of this line.



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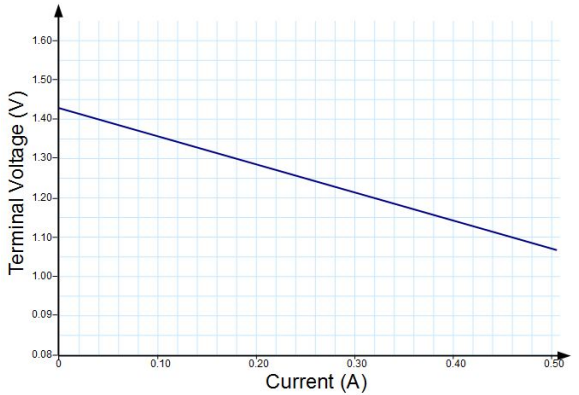

The gradient is negative because it has a downwards slope.

The value of y decreases as the value of x increases.

How can an unknown y-intercept (c) be calculated from a straight-line graph?

How can an unknown y-intercept (c) be calculated from a straight-line graph?

1. Calculate the gradient (m).
2. Rearrange the straight-line equation ($y = mx + c$) for c.
3. Use (y,x) coordinates of any point on the line and the gradient to calculate the y-intercept.

What is meant by ‘uncertainty of a measurement’?

What is meant by ‘uncertainty of a measurement’?

Each measurement is not completely accurate and has bounds of uncertainty in which the true value lies.

e.g. 20 °C ± 2 °C , the true value could be within 18 to 22 °C

What is absolute uncertainty?

What is absolute uncertainty?

Absolute uncertainty is a fixed quantity of uncertainty in a measurement.

e.g. 7.0 ± 0.6 V.

What is percentage uncertainty?

What is percentage uncertainty?

Percentage uncertainty is when uncertainty is expressed as a percentage of the measurement.

e.g. 7.0 ± 8.6% V

How can absolute uncertainty be converted to percentage uncertainty?

How can absolute uncertainty be converted to percentage uncertainty?

$$\% \text{ uncertainty} = \frac{\text{absolute uncertainty}}{\text{meaurement}} \quad [\text{x } 100]$$

What is the difference between a reading and a measurement?

What is the difference between a reading and a measurement?

Readings are taken when a single value is found.

e.g. reading a thermometer

Measurements are taken as the difference between 2 separate reading points. Both the start and end point are judged.

e.g. a ruler

How do you estimate the absolute uncertainty in a reading?

How do you estimate the absolute uncertainty in a reading vs in a measurement?

For a reading, the absolute uncertainty is equal to **half** the smallest scale division.

How do you estimate the absolute uncertainty in a measurement?

How do you estimate the absolute uncertainty in a measurement?

For a measurement the absolute uncertainty is equal to at least **one** scale division.

A measurement is essentially two readings, so its uncertainty is twice the uncertainty in a reading.

How is absolute uncertainty of a set of repeated readings or measurements estimated?

How is absolute uncertainty of a set of repeated readings estimated?

The absolute uncertainty for multiple readings is given as **half** the range of data used.

Unless the range is zero, in which case, the absolute uncertainty of the reading is used.

How can experimental data be used to confirm and support an x-y relationship with a constant?

How can experimental data be used to confirm and support an x-y relationship with a constant?

Plotting the data should produce a graph showing a trend that supports the relationship.

The value of the constant can be confirmed if the percentage difference in values is **lower** than the standard percentage uncertainty for the constant.

How is the percentage difference between two values calculated?

How is the percentage difference between two values calculated?

$$\%\ \text{diff in K values} = \frac{\text{largest K value} - \text{smallest K value}}{\text{smallest K value}} \quad [\times 100]$$

What are experimental ‘limitations’?

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Experimental limitations are parts of the experiment which produce low-accuracy results because they are difficult to perform.

What are some common experiemtnal limitations?

What are some common experimental limitations?

- Too few readings taken to draw a valid conclusions
  - Issues with equipment during the experiment
    - Difficulty in obtaining measurements
  - Human errors in observation or methodology

Why are small values of reading often large sources of uncertainty?

Why are small values of reading often viewed as large sources of uncertainty?

With percentage uncertainty, the smaller the measurement, the larger the uncertainty relative to this and therefore the larger percentage uncertainty.

How can an experiment easily be improved if there is not enough data to draw a valid conclusion?

How can an experiment easily be improved if there is not enough data to draw a valid conclusion?

If too few readings are taken, there is not enough data to draw a valid conclusion. More readings can be taken and a graph plotted to improve the validity of the conclusions.