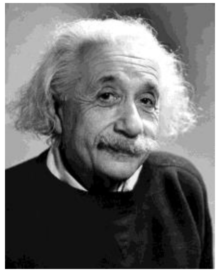
Transition from GCSE to A-level Physics

"Time is relative, it worth depends only on what we do as it is passing"

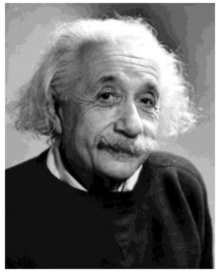


Albert Einstein

Contents of this PowerPoint

Why Physics?

"Try not to become a man of success, but rather try to become a man of value."



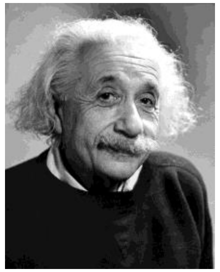
Albert Einstein

Some careers that Physics can lead to

- Geophysicist/field seismologist
- Healthcare scientist, medical physics
- Higher education lecturer or secondary school teacher
- Radiation protection practitioner
- Research scientist (physical sciences)
- Scientific laboratory technician
- Meteorologist
- Engineering
- Product/process development scientist
- Systems developer
- Nanotechnology

Introduction to the course

"Life is like riding a bicycle. To keep your balance you must keep moving"



Albert Einstein

Introduction to the Course

The course is a two year course – OCR Physics A-level

It has three terminal examinations which are used to determine the final grade awarded.

Text books are supplied without extra cost, they are returned at the end of the course.

The modular nature of the course teaching

Module One - is the Practical Assessed Grade experiments, these lead to a Practical endorsement.

Module Two – Foundations of Physics – Is skills needed

Module Three – Forces and Motion

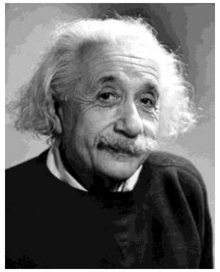
Module Four – Electrons, waves and photons

Module Five – Newtonian world and astrophysics

Module Six – Particles and Medical Physics

Mathematical skills – Using numbers

"Not everything that can be counted, counts and not everything that counts can be counted"



Albert Einstein

Prefixes

Physics deals with quantities from the very large to the very small.

A prefix is something that goes in front of a unit and acts as a multiplier.

Symbol	Name	What it means		How to convert	
P	peta	10^{15}	1000000000000000		↓ x1000
T	tera	10^{12}	1000000000000	↑ ÷ 1000	↓ x1000
G	giga	10^{9}	1000000000	↑ ÷ 1000	↓ x1000
M	mega	10^{6}	1000000	↑ ÷ 1000	↓ x1000
k	kilo	10^{3}	1000	↑ ÷ 1000	↓ x1000
			1	↑ ÷ 1000	↓ x1000
m	milli	10^{-3}	0.001	↑ ÷ 1000	↓ x1000
μ	micro	10^{-6}	0.000001	↑ ÷ 1000	↓ x1000
n	nano	10^{-9}	0.000000001	↑ ÷ 1000	↓ x1000
p	pico	10^{-12}	0.000000000001	↑ ÷ 1000	↓ x1000
f	femto	10^{-15}	0.000000000000001	↑ ÷ 1000	

Using Index notation

In GCSE it is acceptable to give units in this form   m/s

However A-level uses index notation so:

m/s becomes $m\ s^{-1}$ and m/s^2 becomes $m\ s^{-2}$

A space is left between different units but no space between a prefix and units.

Significant figures

1. All non-zero numbers **ARE** significant.
2. Zeros between two non-zero digits **ARE** significant.
3. Leading zeros are **NOT** significant. They're nothing more than "place holders.”
4. Trailing zeros when a decimal is shown **ARE** significant.
5. Trailing zeros in a whole number with no decimal shown are **NOT** significant.

Test your knowledge

s	ms	µs	ns	ps
0.00045	0.45	450	450 000 or 450 $x10^3$	450 x 10^6
0.000000789				
0.000 000 000 64				

Convert your figures into the prefixes required

Test your knowledge

$mm\ s^{-1}$	$m\ ms^{-1}$	$m\ s^{-1}$	ms^{-1}

What do the units and prefixes above mean?

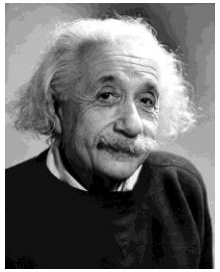
Test your knowledge

Value	Sig Figs	Value	Sig Figs
1066		1800.45	
82.42		2.483×10^4	
750000		0.0006	
310		5906.4291	
3.10×10^4		200000	
3.1×10^2		12.711	

How many significant figures?

Calculations

"It's not that I'm smart, I just stay with problems for longer."



Albert Einstein

Rearranging equations

The most important rule for algebra is: I**f you do something to one side of an equation, you have to do it to the other side too**.

An equation basically says "the stuff on the left hand side of the equals sign has the same value as the stuff on the right hand side of it," like a balanced set of scales with equal weights on both sides.

If you want to keep everything equal, anything you do needs to be done to ***both*** *sides*.

E.G V = I R, what would I be?

$V = I\,R$ Therefore $\frac{V}{R} = \frac{I\,R}{R}$ $\frac{V}{R} = \frac{I\,\cancel{R}}{\cancel{R}}$ $\frac{V}{R} = I$ Or $I = \frac{V}{R}$

R / R cancels R

Gradients

Gradients are a useful tool that show how fast or slow quantities change

To calculate the gradient, pick any two points on the line as far away as possible and draw a large triangle between them.

The gradient is given by:

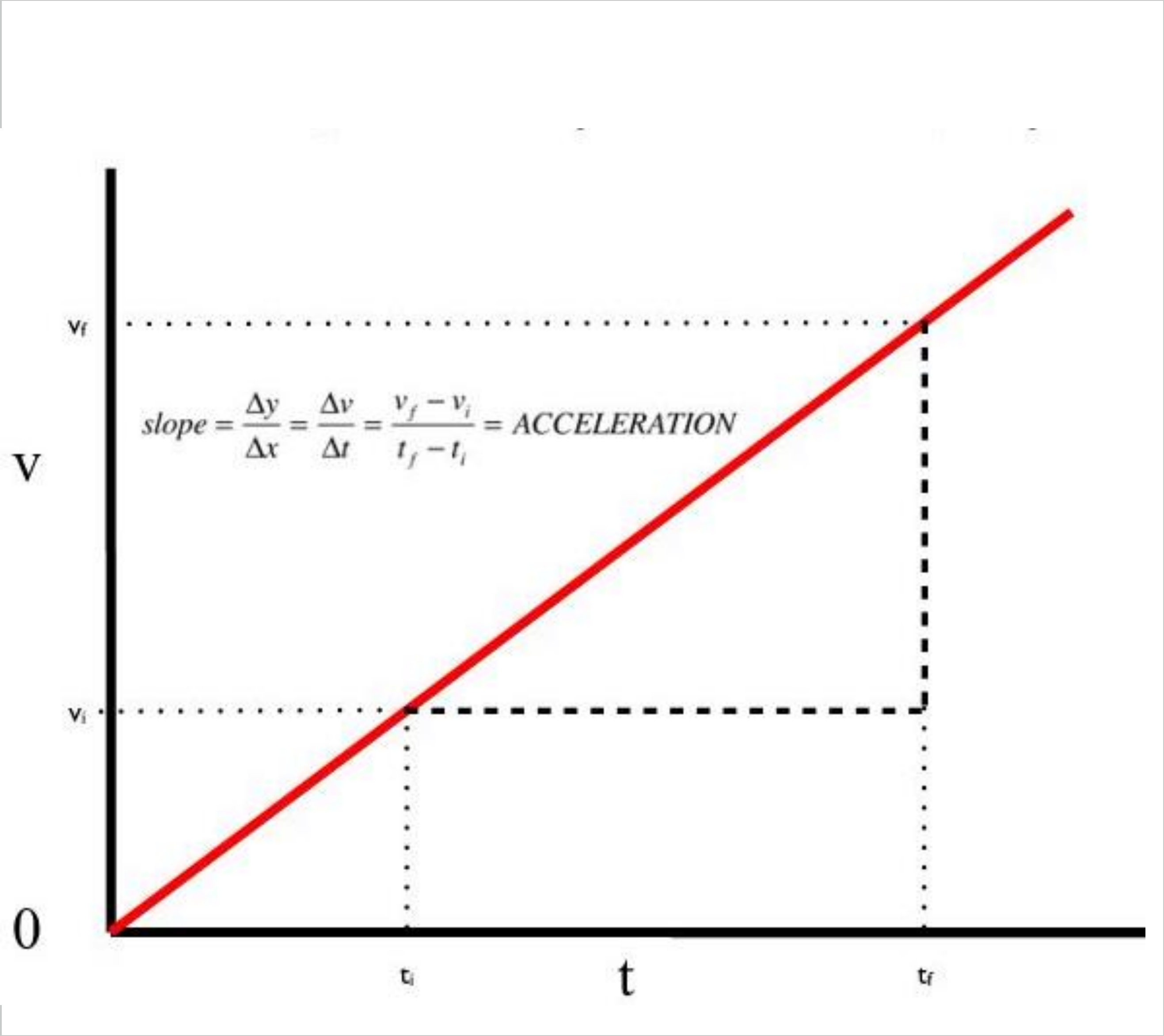
$$gradient = \frac{difference\ in\ y\ values}{difference\ in\ x\ values}$$

Remember – if the line slopes up, the gradient should be positive; if the line slopes down, then the gradient should be negative.

Test your knowledge

Equation	Rearrange equation	
$\varepsilon = V + Ir$	r	
$\rho = \frac{RA}{l}$	A	
$E_P = mgh$	m	
$v^2 = u^2 + 2as$	u	
$T = 2\pi\sqrt{\frac{m}{k}}$	k	

Rearrange the equations above

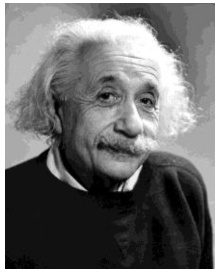


Test your knowledge

How could this gradient be best described?

Experimental skills and terms

"It is theory that decides what can be observed."



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Tabulation

Independent variable

Dependent variable

Unit

Time / s	Distance travelled / cm
0	0
60	46
120	70
180	85
240	94
300	96
360	96
420	96

Values, these should be written to the level of precision allowed by the equipment used.

A / used instead of brackets

Time / s	Distance travelled / cm			
	Attempt 1	Attempt 2	Attempt 3	Average
0	0	0	0	0

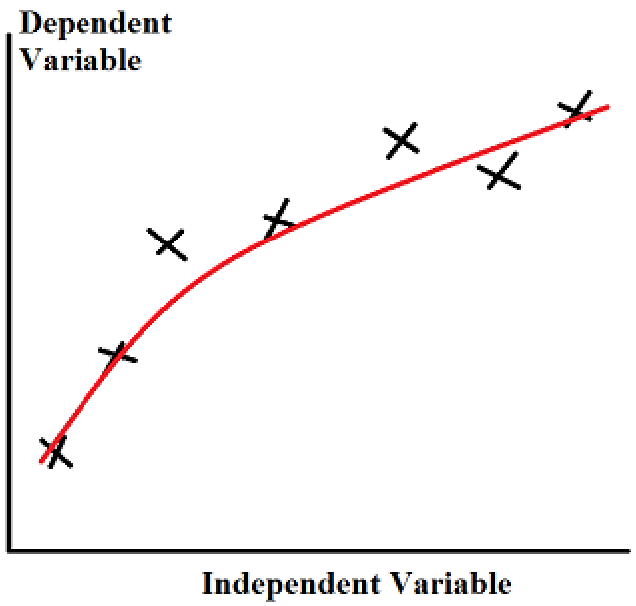
Key Points

Headings should list the variable tested, or the equation being performed and the unit. The unit should NOT be repeated with the values

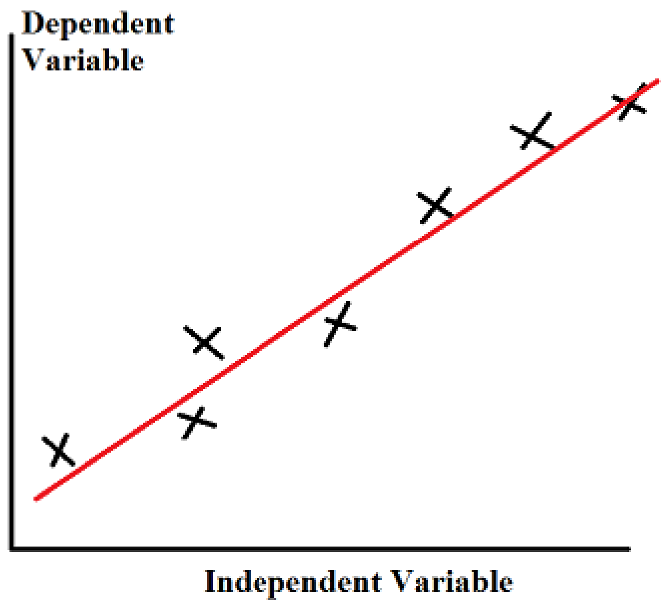
The left hand column would normally record the independent values and the other columns those measured or calculated.

Repeats and average columns should ALL contain both the variable and unit in the heading as shown below.

Graphs skills



When drawing lines of best fit, draw a *smooth* straight or curved line that passes through the majority of the points. If you can, try to have an even number of points above and below the line if it can't go through all points.



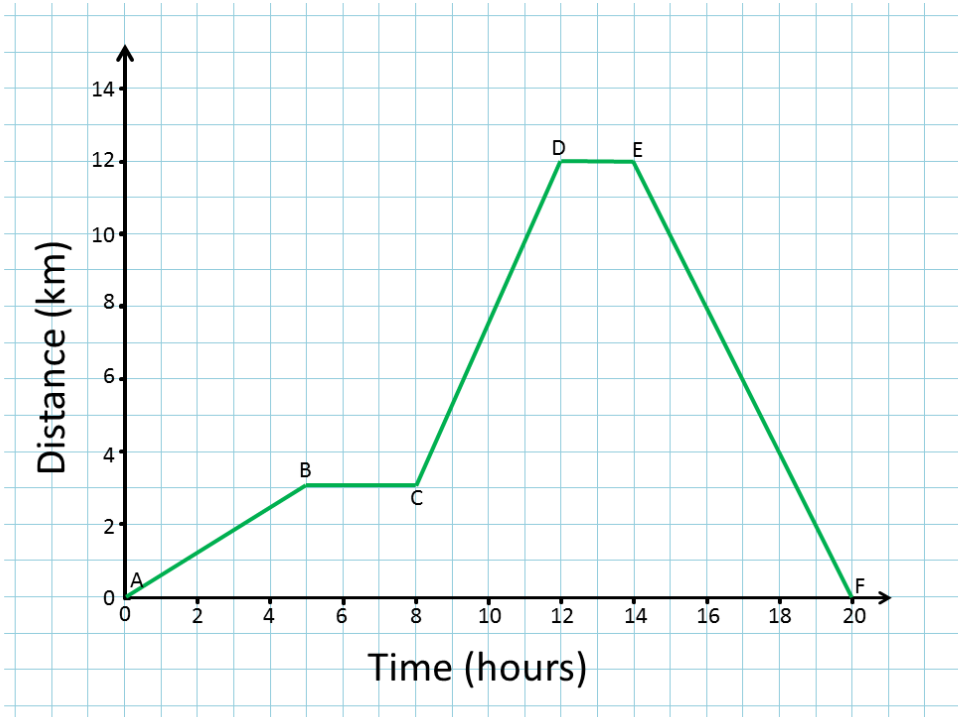
Describing graphs

Usually the x axis plots the independent variable and the y axis plots the dependent variable.

When describing the trend, use the phrase….

"As 'X' increases, 'Y' *increases/decreases* in a *linear/non-linear* fashion."

Substitute the quantities into X and Y, and choose either of the two options to describe the graph.



"Between A and B, as time increases, distance increases in a linear fashion."

Experimental Key terms

Accuracy is the proximity of measurement results to the true value

Precision is both the ability of a measurement to be consistently reproduced and the number of significant digits to which a value has been reliably measured.

Reproducible - A measurement is reproducible if the investigation is repeated by another person, or by using different equipment or techniques, and the same results are obtained.

Repeatable - A measurement is repeatable if the original experimenter repeats the investigation using same method and equipment and obtains the same result.

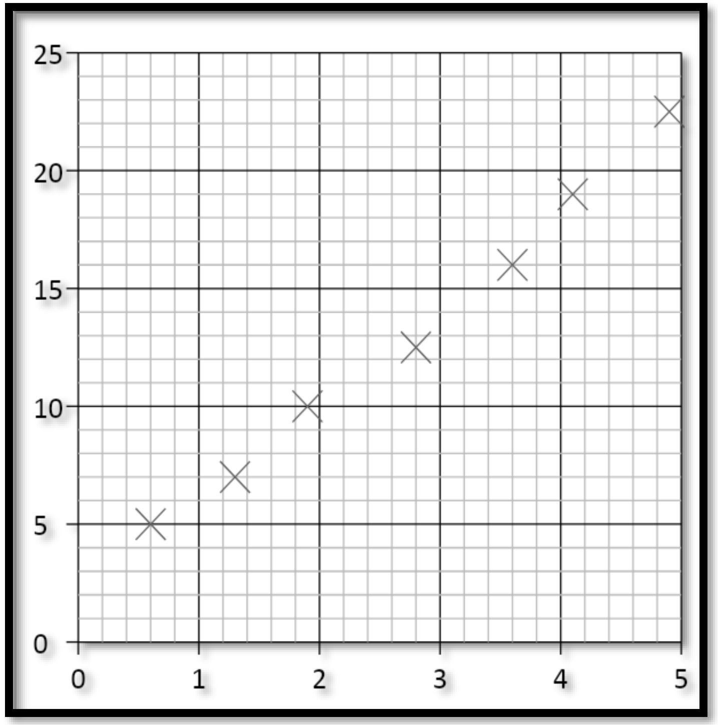
Variable is any factor that can be controlled, changed, or measured in an experiment.

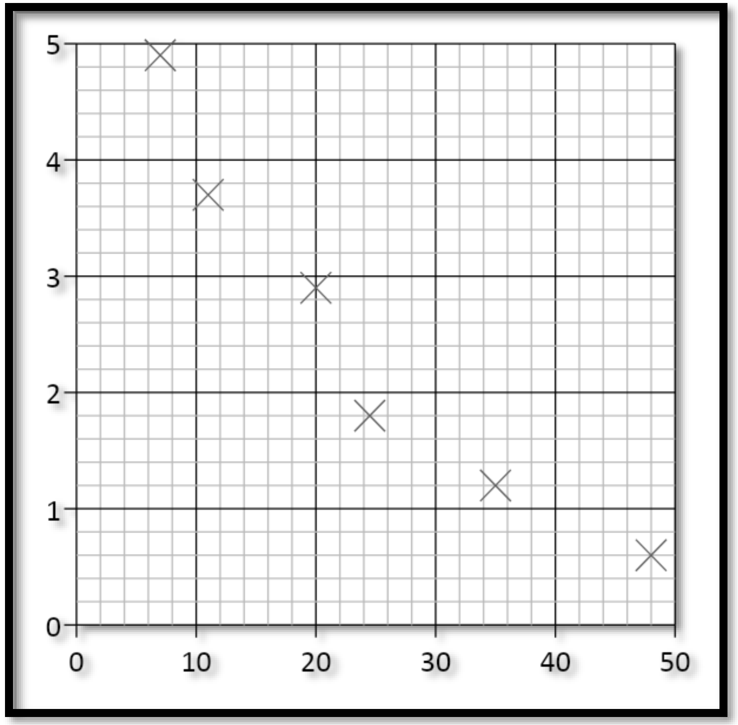
Test your knowledge

Month of the year	Angle of tilt			Average
	20	30	40	
Feb	460	500	480	
Apr	600	620	610	
Jun	710	720	680	
Aug	640	660.00	640	
Oct	480	520	500	
Dec	400	440	420	

What is wrong with the table shown? (Four to find)

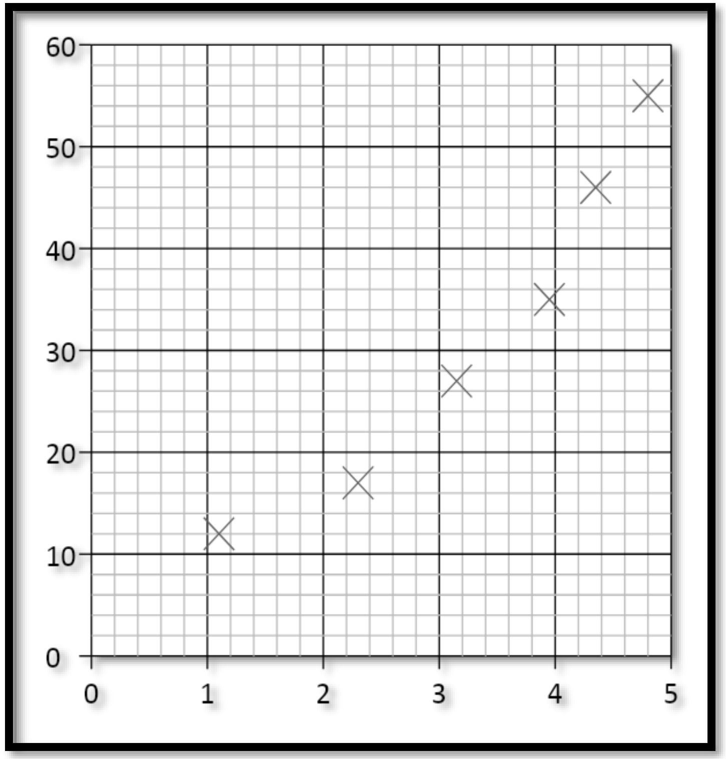
Test your knowledge

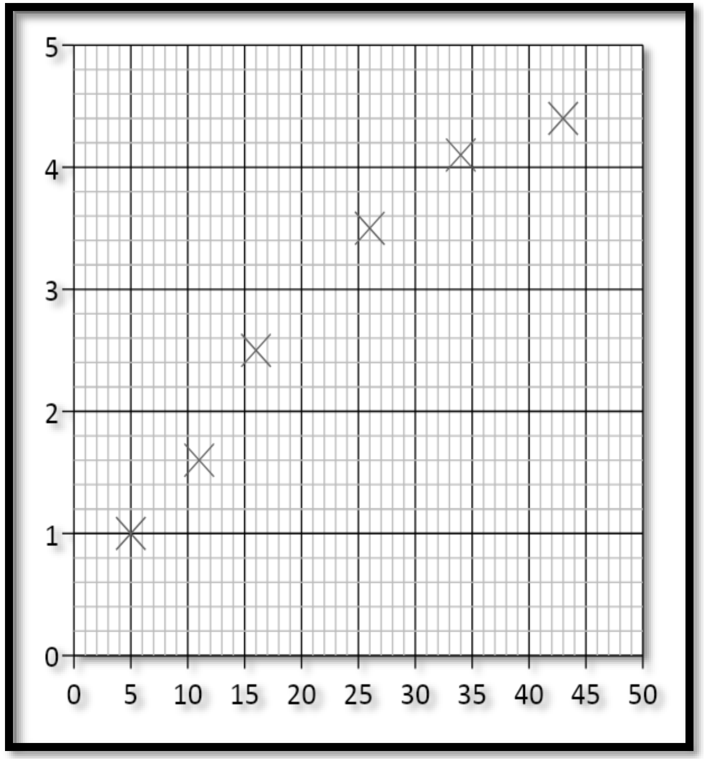




Draw lines of best fit for both of the graphs shown above

Test your knowledge





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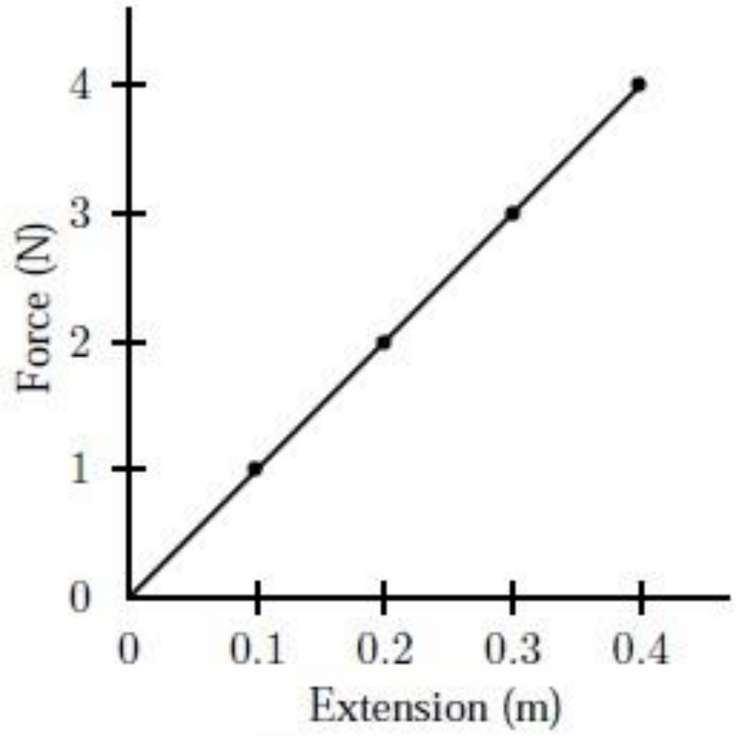
Test your knowledge



What is it about a Hooke's Law graph that makes the trend on the graph more difficult to describe?

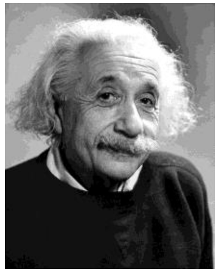
Test yourself

Key term	Definition
Accuracy	The same pattern of results are obtained by another person
Repeatable	the ability of a measurement to be consistently reproduced
Precision	the proximity of measurement results to the true value
Reproducible	The same pattern of results are obtained by a different person

Mix and match the key terms with their definitions

Extra reading and resources

"I love to travel, I hate to arrive."



Albert Einstein

Books and Content relevant to A-level Physics

Head Start to A-level Physics (CGP A-Level Physics)

Essential Maths Skills for AS/A Level Physics

ISBN 978-1471863431

A Student's Guide to Waves by Daniel Fleisch

ISBN 978-1107643260

A Student's Guide to Newton's Laws of Motion by Sanjoy Mahajan

Quantum Physics For Beginners by Michael Rutherford

Helpful websites

Institute of Physics

http://www.iop.org/tailored/students/

The student room

https://www.thestudentroom.co.uk/

New Scientist

https://www.newscientist.com/

Relevant books to read

Books for enjoyment

A short history of nearly everything by Bill Bryson,

ISBN 978178461859

Why does $E=mc^2$? By Professor Brian Cox and Jeff Forshaw

ISBN 9780306817588

What If?: Serious Scientific Answers to Absurd Hypothetical by Randall Munroe

ISBN 9781848549593