IOP Scotland Teacher Network

This event will start shortly

Assignment Higher Physics

Monday 4 September 2023 7:30 pm

IOP Institute of Physics
Scotland

IOP Scotland Teacher Network

Please complete this short evaluation form:
https://forms.office.com/e/UXY7uqKpuv

Completing this evaluation is important to help ensure continued support for IOP activities and to ensure they meet your needs.

IOP Institute of Physics
Scotland

Higher Assignment

- Complete recipe sheet or topic suggestions? - cannot give too much assistance
- What is appropriate at Higher Level ?
- One or two experiments?
- Enough results to produce a good graph?

- Timings - prelim time?

Still to come..

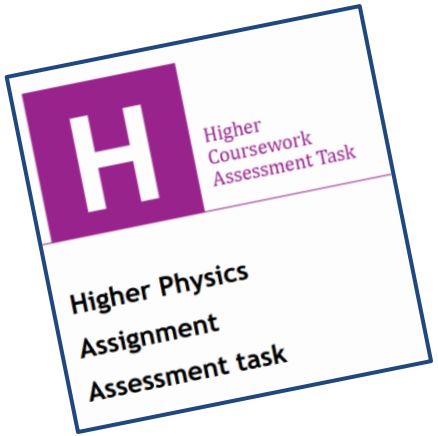
- Possible topics
- Practice investigations

Tonight!

IOP Institute of Physics
Scotland

SQA Coursework Assessment Task – your first port of call!

Very detailed - since 2019
-Instructions for teachers and lecturers
-Marking Instructions
-Instructions for candidates



RECAP

Instructions

Teachers and lecturers must exercise their professional respor
report submitted is the candidate's own work.

It is recommended that no more than 8 hours is spent on the v

A maximum of 2 hours is allowed for the report stage.

Teachers and/or lecturers must ensure candidates understand
task. The instructions for candidates outline the requirements
teachers and/or lecturers must give these to candidates at the
altered or supplemented by centre-devised materials.

It is not permitted **at any stage** to provide candidates with a t

Research stage

The research stage is conducted under some supervision and c
assessment' section.

https://www.sqa.org.uk/files_ccc/HigherCATPhysics.pdf

IOP Scotland Teacher Network

Programme:

- **Potential experiments for assignments**
- **Some other points to note**

SQA Higher Assignment

The assignment has two stages:

- research
- report

8 hours of which a maximum of **2 hours** is allocated to the reporting stage

SQA Higher Assignment

The assignment offers challenge by requiring candidates to apply skills, knowledge and understanding in a context that is one or more of the following:

- ✓ **unfamiliar**
- ✓ **familiar but investigated in greater depth**
- ✓ **integrating a number of familiar contexts**

So anything goes!

Practical Ideas - Must be able to generate **Numerical Graphable Data**

Probably best to stick to these as standards. If you notice several are the same expt but with different titles!

ODU	P&W	Electricity
Measuring g $s = \frac{1}{2}at^2$	**Finding Planck's constant**	**EMF by different methods** $E = V + Ir$ **or** $R = \frac{E}{I} - r$
Measuring g $v^2 = 2as$	λ By diffraction $d\ sin\theta = m\,\lambda$	Switch on voltage
Measuring g $g \sin\theta = a$	**Inverse Square law (lasers don't, lights do)**	**Thermistors (timing)**
Veryfying Equations of motion, weighing the Earth	**Finding refractive index or critical angle**	**Capacitors (C=Q/V)**
	v sound by interference	**AC v DC**
	Wavelength of microwaves by interference	**I & f in a capacitor circuit c.f. I & f in a resistor circuit**

Practical Ideas- check out the SQA past papers!

ODU	P&W	Electricity
Measuring g pendulum (AH?)	Op amps in inverting mode	**Capacitors** • **Area of plates** • **Distance between plates**
	Op amps and bandwidth	
	F on a I carrying wire	
	Out-of-balance Wheatstonestone bridge as two potential divider circuits	
	Mosfet board	

https://physicsflashrepo.ovh/

potential

Ideas!

H Experiments - Unit 1 - Mechanics and Properties of Matter

Click on Activity Below	Title	Aim of Experiment
Activity 01	Measurement of Acceleration	To calculate the acceleration of a trolley moving down a slope
Activity 02A	Measurement of Acceleration	To measure the acceleration of a trolley moving down a slope
Activity 02B	Measurement of Acceleration	To find the relationship between the angle of slope and acceleration
Activity 03	Measurement of Acceleration	To measure the acceleration due to gravity
Activity 04	Resultant of two forces	To compare the resultant of two forces with the single force which produces the same effect
Activity 05A	Velocity – time graphs	To obtain the velocity – time graph for a ball thrown upwards and caught
Activity 05B	Velocity – time graphs	To obtain the velocity – time graph for a ball thrown upwards and allowed to bounce
Activity 06A	Velocity – time graphs	To obtain the velocity – time graph for a trolley pushed up a slope and allowed to roll back down
Activity 06B	Velocity – time graphs	To obtain the velocity – time graph for a trolley pushed up a slope, allowed to roll back down and bounce against a buffer
Activity 07	Equations of motion	To calculate the acceleration due to gravity using $s = ut + 1/2\ at^2$
Activity 08	Projectiles	To find the horizontal speed of a projectile
Activity 09	Lifts	To calculate the acceleration of a lift
Activity 10	Work done	To calculate the work done by the force of friction acting on a trolley moving down a slope
Activity 11	Momentum (Inelastic collisions)	To compare the total momentum before and after a collision
Activity 12	Momentum (Elastic collisions)	To compare the total momentum before and after a collision
Activity 13	Explosions	To compare the total momentum before and after an explosion
Activity 14	Impulse	To calculate the average force exerted by a club on a golf ball
Activity 15	Impulse	To compare different times of contact for different balls bouncing on a hard surface
Activity 16	Impulse	To compare force – time graphs for different collisions
Activity 17A	Densities of solids and liquids	To measure and compare the densities of solid and liquid substances
Activity 17B	Density of air	To measure the density of air
Activity 18A	Pressure and depth in fluids	To i
Activity 18B	Pressure and depth in fluids	To in

Home | N4 | N5 | H | AH | H Experiments | AH Experiments | Motion Grapher | Physics 2.15 - Animations | Int 1 | Int 2

Miscellaneous | Freezeray | Links to other Animations | Known Issues | Feedback | Privacy

H Experiments - Unit 2 - Electricity and Electronics

Click on Activity Below	Title	Aim of Experiment
Activity 01	Electric Field patterns	To investigate the electric field patterns around two point charges and two parallel plates.
Activity 02	The Cathode Ray Tube	To investigate the path of the electron beam in a cathode ray tube.
Activity 03	e.m.f. and internal resistance with parallel circuits	To determine the internal resistance of a battery
Activity 04	Internal resistance of a cell	To determine the internal resistance of a cell.
Activity 05	The balanced Wheatstone Bridge	To find the resistances of unknown resistors.
Activity 06	The out-of-balance Wheatstone bridge	To investigate the relationship between the current through the limiting resistor and the change in resistance of one the resistors in the Wheatstone Bridge.
Activity 07	The out-of-balance Wheatstone bridge – applications	To investigate several applications of the Wheatstone bridge in the out-of-balance condition.
Activity 08	Alternating current – peak and r.m.s.values	To establish a relationship between peak and equivalent direct (r.m.s.) values of voltage.
Activity 09	Calibration of a signal generator.	To measure the output frequency of a signal generator using an oscilloscope.
Activity 10	Charge and potential difference for a capacitor	To investigate the relationship between the voltage across a capacitor and the charge stored on its plates.
Activity 11	Charging and discharging characteristics for a capacitor	To observe the variation of the current through, and the p.d. across the capacitor during the charge and discharge cycles.
Activity 12	Response of resistance in a variable frequency a.c.circuit.	To establish a relationship between the current through a resistor and the frequency of the a.c. supply.
Activity 13	Current and frequency in a capacitive circuit.	To establish a relationship between the current in a capacitive circuit and the frequency of the a.c. supply.
Activity 14	Uses of capacitors – a flashing neon lamp.	To show the principle of operation of a flashing neon lamp.
Activity 15	Uses of capacitors – d.c. power supply.	To show the effect of capacitors in the production of a smooth d.c. supply from an a.c. supply.
Activity 16	Using a potentiometer	To use a potentiometer to select a range of voltages
Activity 17	The Inverting Amplifier	To investigate the Op-Amp in the inverting mode
Activity 18	Saturation	To investigate the saturation voltage of the Op-Amp

H Experiments - Unit 3 - Radiation and Matter

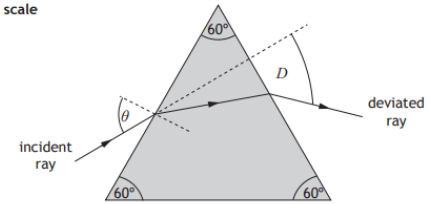
Click on Activity Below	Title	Aim of Experiment
Activity 01A	Interference of microwaves	To investigate a microwave interference pattern and to find the wavelength of microwaves.
Activity 01B	Interference of microwaves	To find the wavelength of microwaves from an interference pattern caused by reflected waves.
Activity 02	Interference of sound	To investigate an interference pattern produced by two sources of sound.
Activity 03A	Interference of laser light	To observe an interference pattern produced by laser light.
Activity 03B	Measurement of wavelength	To measure the wavelength of laser light from measurements taken from an interference pattern.
Activity 04	Comparison of white light spectra	To compare the spectra produced when white light passes through (a) a prism and (b) a grating.
Activity 05	Refractive index of a perspex block	To measure the refractive index n of a perspex block.
Activity 06	Critical angle of a perspex block	To measure the critical angle θc of a perspex block.
Activity 07	Variation of light intensity with distance from a point source of light	To investigate the relationship between the intensity of light and the distance from the light source.
Activity 08	The photoelectric effect	To compare the effect of white light and u.v. radiation on charged electroscopes.
Activity 9	Emission spectra	To calculate the acceleration of a trolley moving down a slope
Activity 10	Laser beam diameter	To measure the beam diameter at various distances from a laser.
Activity 11	Forward and reverse-biased p-n junctions	To measure the variation of current with applied p.d. for a forward and reverse-biased p-n junction.
Activity 12	Photodiode – photovoltaic mode	To measure the frequency of an a.c. supppply using a photodiode in photovoltaic mode.
Activity 13	Forward and reverse-biased photodiode	To investigate the relationship between the current and applied p.d. for a forward and reverse-biased photodiode.
Activity 14	The switching action of an n-channel enhancement MOSFET	To investigate the relationship between the input p.d. and the output p.d. for a MOSFET, and to determine the switching p.d.
Activity 15	Half-value thickness	To measure the half-value thickness of lead for gamma rays

MARKS

12. A student carries out an investigation to determine the refractive index of a prism.

A ray of monochromatic light passes through the prism as shown.

not to scale



The angle of deviation D is the angle between the direction of the incident ray and the deviated ray.

The student varies the angle of incidence θ and measures the corresponding angles of deviation D.

The results are shown in the table.

Angle of incidence θ (°)	*Angle of deviation* D (°)
30·0	47·0
40·0	38·1
50·0	37·5
60·0	38·8
70·0	42·5

(a) Using the square-ruled paper on *Page thirty-five*, draw a graph of D against θ. 3

(b) Using your graph state the two values of θ that produce an angle of deviation of 41·0°. 1

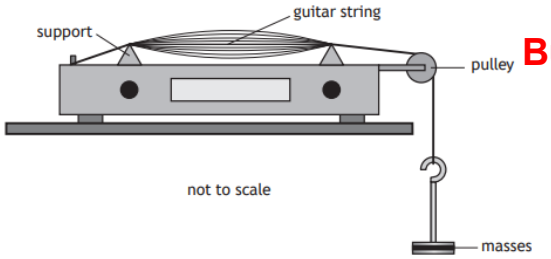
2015 Q12

(c) Using your graph give an estimate of the minimum angle of deviation D_m. 1

MARKS

14. A student investigates the factors affecting the frequency of sound produced by a vibrating guitar string.

The guitar string is stretched over two supports and is made to vibrate as shown.



not to scale

Check out ideas from past papers

But don't use as a source

2017 Q15

The frequency f of the sound produced by the vibrating string is given by the relationship

$$f = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$$

where T is the tension in the string
L is the distance between the supports
μ is the mass per unit length of the string.

(a) The tension in the string is 49·0 N and the mass per unit l string is $4{\cdot}00 \times 10^{-4}$ kg m^{-1}.

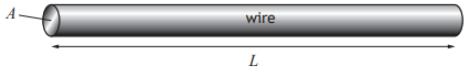
The distance between the supports is 0·550 m.

Calculate the frequency f of the sound produced.

Space for working and answer

2016 Q14

15. A wire of length L and cross-sectional area A is shown.



The resistance R of the wire is given by the relationship

$$R = \frac{\rho L}{A}$$

where ρ is the resistivity of the wire in Ω m.

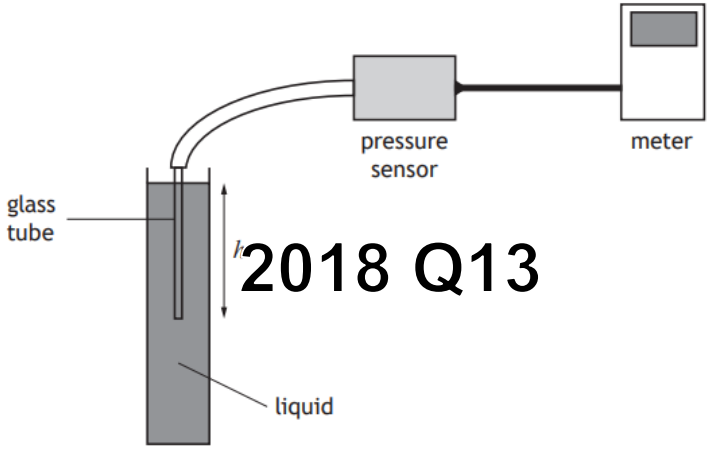
(a) The resistivity of aluminium is $2{\cdot}8 \times 10^{-8}$ Ω m.

Calculate the resistance of an aluminium wire of length 0·82 m and cross-sectional area $4{\cdot}0 \times 10^{-6}$ m^2. 2

Space for working and answer

IOP Institute of Physics
Scotland

13. A student sets up an experiment to investigate the pressure due to a liquid as shown.



2018 Q13

The pressure due to a liquid is given by the relationship

$$p = \rho g h$$

where p is the pressure due to the liquid in pascals (Pa),

g is the gravitational field strength in $N\,kg^{-1}$,

ρ is the density of the liquid in $kg\,m^{-3}$,

and h is the depth in the liquid in m.

(a) The student initially carries out the investigation using water.

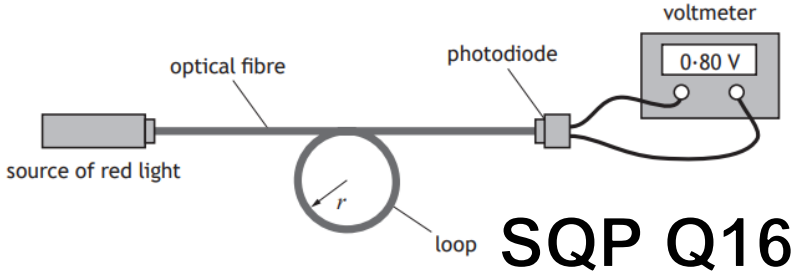
The density of water is $1{\cdot}00 \times 10^3\,kg\,m^{-3}$.

Calculate the pressure due to the water at a depth of 0·35 m.

Space for working and answer

16. A group of students carries out an experiment to investigate the transmission of light through an optical fibre.

Red light is transmitted through a loop of optical fibre and detected by a photodiode connected to a voltmeter as shown.



SQP Q16

The photodiode produces a voltage proportional to the irradiance of light incident on it.

The students vary the radius, r, of the loop of the optical fibre and measure the voltage produced by the photodiode.

The results are shown in the table.

Radius of loop (mm)	*Voltage* (V)
5	0·48
10	0·68
15	0·76
20	0·79
30	0·80
40	0·80

(a) Using the square-ruled paper provided on *page 38*, draw a graph of these results.

One experiment v two

One experiment	Two experiments
Time to write up (**max** 2 hours)	Two attempts at graphing
Find additional DATA (table or graph)	You are the second source
Reduces stress on students	Less time searching the web, not limited by finding data
More able to write up	data from two related experiments must gather extracts for underlying physics
Only one chance to mess up!	You will be awarded the mark if one of the two descriptions is acceptable.
Gather extracts to support the candidate description of underlying physics	

One experiment + data source or two experiments but must be the same aim
U.S 2023 appear to push for two experiments but is this right for your students?

Notes

RESEARCH

- 5 measurements, 5 repeats? Depends on the time to collect repeats ΔR for 6-12 readings **Remember candidates should repeat measurements not take 5 sets of readings at once!**
- Scale reading uncertainty for each measurement
- Data could be a table or a graph something that allows your aim to be verified.

REPORT

- Do not use ifs in your aim where your answer could be yes- see full MI
- Do not use or show a relationships in your aim where your answer might not be able to show a relationship
- An extract must be a direct copy, which can be a printout, photocopy or handwritten (word for word) and must not be annotated. There is no size limit on an extract, but it must be an extract and not the full document.
- Your extracts can include any formulae or relationships you may need but must not include sample calculations.
- During the report stage you will need to show your understanding by writing your description of the physics relevant to your aim using your own words.
- It is important that you record where you get your data or extracts from in enough detail

Rules

RESEARCH

- Not sending students to websites, so print off the method sheets first
- No feedback to be given on their research, only **for health and safety and protection of kit**
- Research only from websites, journals and/or books. NOT student notes
- Research can be completed at home
- Individual

REPORT

- Almost exam conditions
- No feedback to be given
- **2 hours max (plus any additions in line with written paper)**
- Research only from websites, journals and/or books. NOT student notes
- Research can be completed at home
- Individual

To take in

- This can be used to check off student work and make sure candidates are only taking in to the write-up what is allowed

https://www.mrsphysics.co.uk/higher/wp-content/uploads/2023/12/H-What-I-can-take-in.docx

HIGHER PHYSICS ASSIGNMENT REPORTING STAGE

The reporting stage is conducted under tight conditions

- *You should be able to be seen by your teacher*
- *display materials that might provide assistance are removed or covered*
- *You must have no access to email the internet or mobile phones*
- *You must work on your own and in silence*
- *Your teacher cannot provide assistance of any description*

NAME:	

The only materials you are allowed during the reporting stage are listed in the table.

Tick these off and place them in the polypocket.

This polypocket and its contents must stay with your teacher, it is not allowed home or out of class.

Item	tick
Instruction sheets for candidates which must not have been altered	
Experimental Method sheet	
Your raw data, (including any scale reading uncertainties), which may be tabulated; the table must not have additional blank or pre-populated columns for mean and derived values	
Numerical and/or graphical data from an internet/literature source, which must not include sample calculations	
a record of the source of data from the internet/literature (reference)	
extracts from internet/literature sources to support the description of the underlying physics, (this must not be a draft or include sample calculations)	

"Focus on What You Can Do in The Here And Now." "Stay calm" All the best from your teacher.

Higher Assignment - Useful Links

SQA Higher Physics Coursework Assessment Task
https://www.sqa.org.uk/files_ccc/HigherCATPhysics.pd

https://www.understandingstandards.org.uk/Subjects/Physics/Higher/Assignment

Some ideas for practical work
https://www.mrsphysics.co.uk/higher/assignments-from-2018/

https://www.youtube.com/watch?v=PAXVkcJLTKk&list=PLuzo1XZjZIcUkRFoPBx84W_RrJW3pjHnA&index=17

www.sserc.org.uk/wp-content/uploads/2017/07/Practical_physics_guide.pdf

Detailed marking can be shared in advance but not during report writing

RECAP

Section	Max mark	Expected response and marking instructions
7 Conclusion (1 mark)		
	1	**A valid conclusion that relates to the aim and is supported by all the data in the report.** Where no aim has been stated, do not award this mark.
8 Evaluation (3 marks)		
	3	**Evaluation of the investigation.** Award 1 mark for each valid evaluative statement supported by appropriate justification, to a maximum of 3 marks. The evaluative statements could relate to experimental procedures, results, uncertainties or data from an internet/literature source. A maximum of 1 of these marks is available for an evaluation of **data** from an internet/literature source.
9 Structure (1 mark)		
	1	**A clear and concise report with an informative title.** The structure of the report does not need to follow the structure suggested in the marking instructions or instructions for candidates, but should flow in a logical manner.

https://www.sqa.org.uk/files_ccc/HigherCATPhysics.pdf

Graphs..

A scatter graph is the only appropriate format for presentation of data in this section. Graphs must be based on the candidate's experimental data.

Mark computer-generated graphs in the same way as hand-drawn graphs.

Graphs should be of ***a size that allows the scaling and labelling of the axes,*** and the accuracy of the plotting of the data points, to be readily checked.

It may not be possible to check the accuracy of plotting if data points are excessively large, minor gridlines are omitted or the candidate has not used graph paper.

Where a candidate has graphed data from two experiments, both graphs should be marked, and the mark associated with the higher-scoring graph awarded.

https://www.sqa.org.uk/files_ccc/HigherCATPhysics.pdf

Uncertainties..

- Award 2 marks if the candidate includes **all** appropriate scale reading uncertainties and correctly calculates random uncertainties.
- Award 1 mark if the candidate includes **all** appropriate scale reading uncertainties ***or*** correctly calculates random uncertainties.

https://www.sqa.org.uk/files_ccc/HigherCATPhysics.pdf

References..

A citation and reference for a source of internet/literature data or information.

The candidate must cite the internet/literature source within the body of the report and give the reference later in the report.

Source	Reference
Website	Full URL for the page(s) with date accessed The URL 'www.bbc.co.uk (Feb 2018)' is not acceptable, but https://www.bbc.co.uk/education/guides/z9499j6/revision (Feb 2018) is acceptable.
Journal	Title, author, journal title, volume and page number
Book	Title, author, page number and either edition or ISBN

If the candidate includes data from a single experiment, the reference must be to the source of the internet/literature data relevant to the experiment.

If the candidate includes data from two experiments, the reference must be to a source of information gathered to assist with the description of the underlying physics.

https://www.sqa.org.uk/files_ccc/HigherCATPhysics.pdf

RECAP

IOP Institute of Physics Scotland

Candidate Guide (pages 20 -26) “Read it or greet!”

Report stage

Producing the report

- The report must be all your own work.
- When producing your report, you will be supervised at
- You have 2 hours to complete your report.

- You must include a reference to a source of data/information.
  - If you carried out a single experiment, your reference must data obtained from the internet/literature, which is relevan data.
  - If you carried out two experiments, your reference must be information gathered to support your description of the und
- You must cite the internet/literature source within the body of t relevant data/information.

Section	Description	Marks
Title and structure	An informative title and a structure that can easily be followed.	1
Aim	A description of the purpose of your investigation.	1
Underlying physics	A description of the physics relevant to your aim, which shows your understanding.	3
Data collection and handling	A brief description of an approach used to collect experimental data.	1
	Sufficient raw data from your experiment.	1
	Data from your experiment, including any mean and/or other derived values, presented in a table with headings and units	1

RECAP

https://www.sqa.org.uk/files_ccc/HigherCATPhysics.pdf

IOP Institute of Physics Scotland

Candidate Guide - From course report

“Assignment

There is evidence that candidates who follow the ‘instructions for candidates’ section of the coursework assessment task manage to access the majority of available marks.”

https://www.sqa.org.uk/files_ccc/2019HCourseReportPhysics.pdf

CAT change log pages….

Published: June 2020 (version 3.0)

History of changes

Version	Description of change	Date
2.0	'Instructions for teachers and lecturers' section: ♦ 'Instructions' sub-section: — clarification that instructions for candidates must not be altered or supplemented by centre-devised materials ♦ 'Choosing the topic' sub-section: — information added that there must be a range of topics available for candidates to choose from and that teachers/lecturers must minimise the numbers investigating the same topic within a class ♦ 'Experimental research' sub-section: — candidates can be given only a basic list of instructions for the experimental procedure and must decide on range, interval and number of repeats for themselves	September 2019

RECAP

https://www.sqa.org.uk/files_ccc/HigherCATPhysics.pdf

IOP Institute of Physics Scotland

Course Report 2019

Course report 2019

Subject	
Level	Higher

Assignment

The assignment performed in line with expectations.

https://www.sqa.org.uk/files_ccc/2019HCourseReportPhysics.pdf

IOP Institute of Physics Scotland

Course Report 2019

Centres should continue to ensure that candidates have a choice of assignment and that if candidates are only performing one experiment, they have an opportunity to find data from literature sources. Whole classes or cohorts investigating the same topic is not acceptable. Centres are encouraged to give candidates opportunities to take part in a wide range of practical work before choosing a topic for investigation. Centres should ensure that candidates can cite and reference their sources correctly. While a formal citing and referencing system isn't required, candidates should be strongly encouraged to follow a system such as the Vancouver referencing system. Candidates should be made aware that they need to conclude all of their data, both practical and literature. Where a candidate's experimental data does not agree with their literature data, their conclusion should reflect this. Centres should ensure that candidates are provided with opportunities to develop the necessary skills to evaluate their data and experimental procedures.

Course Report 2019

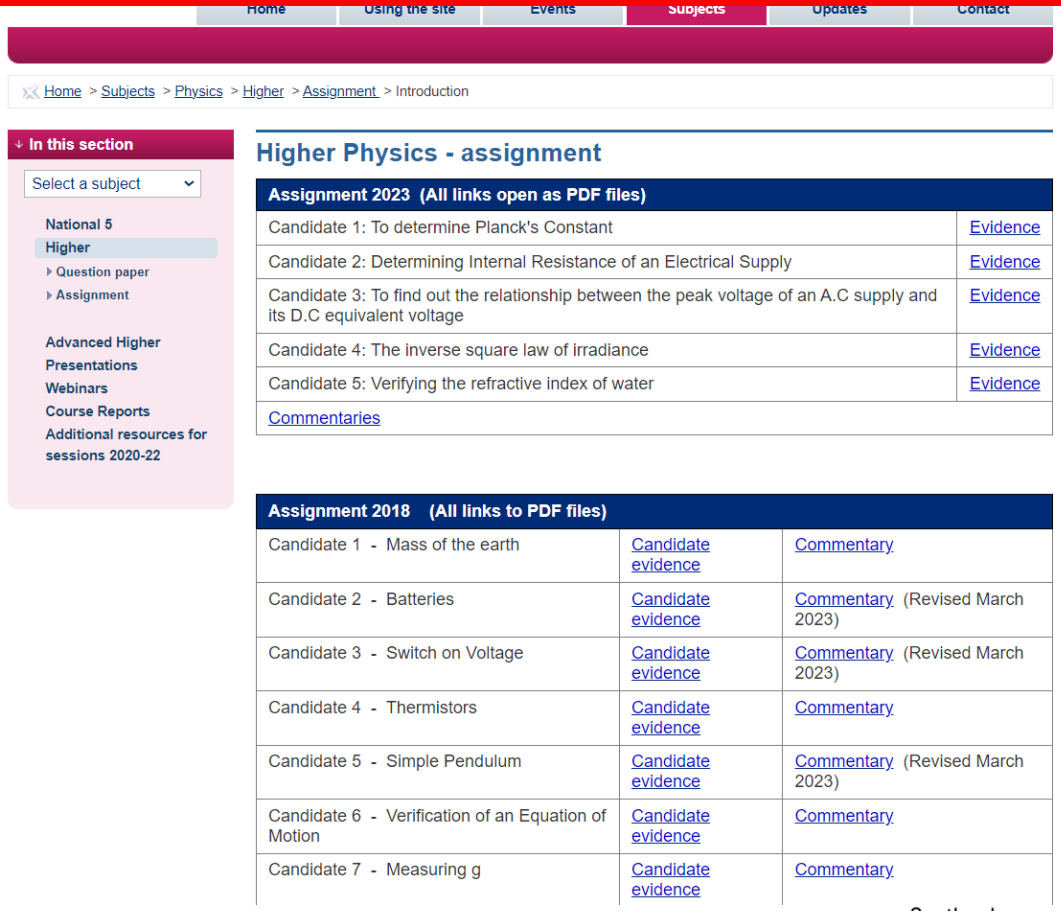
When referencing their secondary data, many candidates did not cite their source as well as reference it. When candidates referenced an internet source, a number did not give the date when the site was accessed. Many candidates did not write a conclusion that referred to all of their data. Candidates were often only stating a conclusion about their own experimental data. Some candidates ignored their experimental data and concluded using only their literature source. In the evaluation section, candidates did not always supply a justification for their evaluation. For example, candidates should make it clear why a suggested experimental change would produce an improvement in their data. Some candidates are continuing to evaluate the reliability of their literature source. This does not gain any marks in the revision to the assignment. There is one mark available for evaluating the data from the literature source but not for evaluating the source itself.

https://www.sqa.org.uk/files_ccc/2019HCourseReportPhysics.pdf

RECAP IOP Institute of Physics Scotland

Understanding Standards -updated

https://www.understandingstandards.org.uk/Subjects/Physics/Higher/Assignment



Home | Using the site | Events | Subjects | Updates | Contact

Home > Subjects > Physics > Higher > Assignment > Introduction

In this section

Select a subject

- National 5
- Higher
  - Question paper
  - Assignment
- Advanced Higher
- Presentations
- Webinars
- Course Reports
- Additional resources for sessions 2020-22

Higher Physics - assignment

Assignment 2023 (All links open as PDF files)	
Candidate 1: To determine Planck's Constant	Evidence
Candidate 2: Determining Internal Resistance of an Electrical Supply	Evidence
Candidate 3: To find out the relationship between the peak voltage of an A.C supply and its D.C equivalent voltage	Evidence
Candidate 4: The inverse square law of irradiance	Evidence
Candidate 5: Verifying the refractive index of water	Evidence
Commentaries	

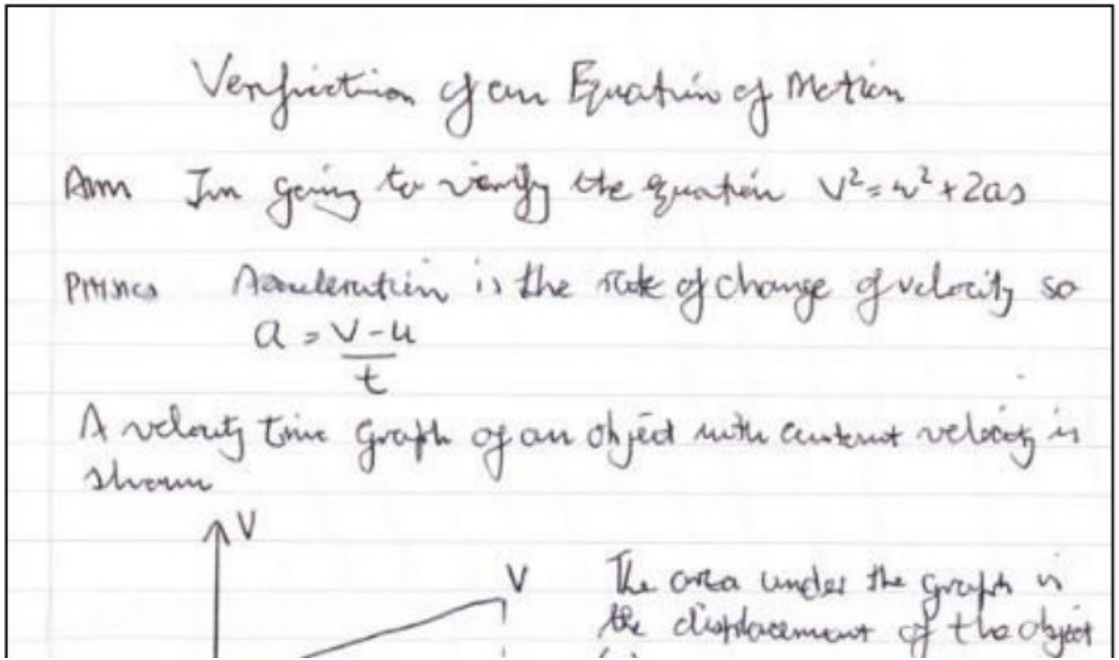
Assignment 2018 (All links to PDF files)		
Candidate 1 - Mass of the earth	Candidate evidence	Commentary
Candidate 2 - Batteries	Candidate evidence	Commentary (Revised March 2023)
Candidate 3 - Switch on Voltage	Candidate evidence	Commentary (Revised March 2023)
Candidate 4 - Thermistors	Candidate evidence	Commentary
Candidate 5 - Simple Pendulum	Candidate evidence	Commentary (Revised March 2023)
Candidate 6 - Verification of an Equation of Motion	Candidate evidence	Commentary
Candidate 7 - Measuring g	Candidate evidence	Commentary

hysics

Scotland

Understanding Standards - candidate evidence

Candidate 6 evidence (Verification of an Equation of Motion)



Verification of an Equation of Motion

Am I'm going to verify the equation $v^2 = u^2 + 2as$

Physics Acceleration is the rate of change of velocity so

$$a = \frac{v - u}{t}$$

A velocity time graph of an object with constant velocity is shown

RECAP

https://www.understandingstandards.org.uk/Higher_images/physics/PhysicsHigherAssignment2018-19Candidate6.pdf

Understanding Standards - candidate evidence

Commentary on candidate 6 evidence (Verification of an Equation of Motion)

The evidence for this candidate has achieved the following marks for each section of this course assessment component.

Section	Expected response	Maximum mark	Mark awarded	Commentary
1 Aim	An aim that describes clearly the purpose of the investigation.	1	1	The candidate's aim clearly describes the purpose of the investigation.
2 Underlying physics	An account of physics relevant to the aim of the investigation.	3	2	The candidate has defined acceleration and has correctly derived the relationships $s = ut + \frac{1}{2}at^2$ and $v^2 = u^2 + 2as$ This is at an appropriate level. The symbols used are not defined but are standard symbols. To be a good account, the candidate could have described how the apparatus measures speed and acceleration, and compared $v^2 = 2as$ to the equation fo a straight line, highlighting the significance of the gradient and intercept.

RECAP

https://www.understandingstandards.org.uk/Higher_images/physics/PhysicsHigherAssignment2018-19Commentary6.pdf

IOP Institute of Physics Scotland

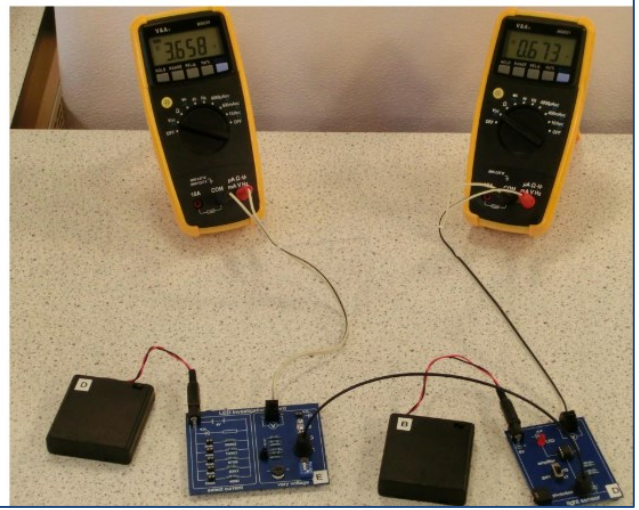
Possible investigations - Photos, no aims!

Possible Higher Assignment topics

LEDs. Wavelength of light emitted (Possible internet data?)

Background physics

Apparatus
Planck's constant apparatus
Voltmeter
Ammeter
Power supply



RECAP

https://docs.google.com/document/d/1h7QbHqPmqXKRM1teDUmu6TlEUilhyWibhKv6aaxoRnQ/edit

IOP Institute of Physics Scotland

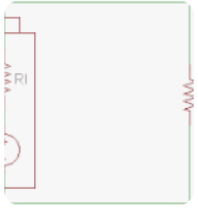
Image searches - “all” vs “image search”

Google

internal resistance results

About 804,000,000 results (0.40 seconds)

If we connect a load across the battery, the voltage across the terminals drops. This drop in voltage is caused by the internal resistance of the battery. We can calculate the internal resistance if we take readings of the open-circuit voltage and the voltage across the battery's terminals with a load attached.



SparkFun Learn
https://learn.sparkfun.com › tutorials › internal-resistance

Measuring Internal Resistance of Batteries - SparkFun Learn

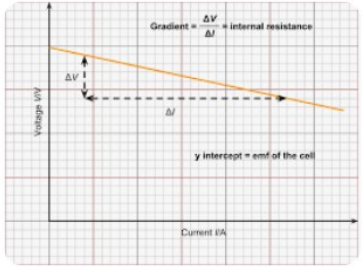
About featured snippets • Feedback

People also ask

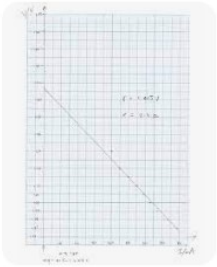
What is the result of the internal resistance of a cell?

What is the conclusion of the internal resistance experiment?

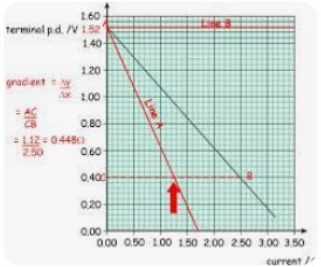
What is the average internal resistance of a 1.5 V cell?



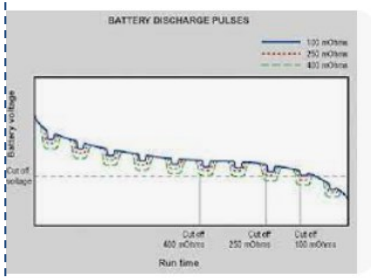
Mr Toogood Physics
Mr Toogood Physics - EMF and inte...



NUSTEM
EMF and Internal Re...

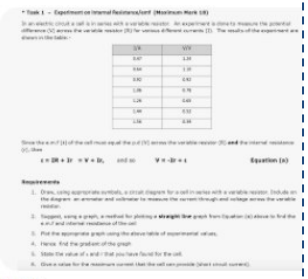


A Cyberphysics Page
A Cyberphysics Page



Battery University
ow does Internal Resistance affect ...

NUSTEM
EMF and Internal Resist...



Chegg
Experiment on Internal Resistan

IOP Institute of Physics
Scotland

If time permits - practice assignment?

Slope force - two ways?

Higher Assignment preparation

All read instruction for candidates (10 mins)

Look at specimen reports from SQA

Give all class topic "Forces on a slope" and a protractor etc.

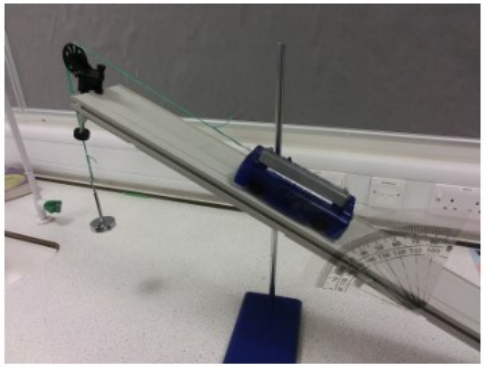
Class to use textbook(page 28) or website ex

Carry out practical and obtain raw data.

RECAP

Demonstrate second experiment using hanging mass.

With results



Allow class to discuss both experiments including possible evaluation points and uncertainties before report stage.

Write up report individually in test conditions on lined paper and graph paper with

- candidate guide,
- both sets of raw data and
- textbook page and website excerpts.
- Peer review sheet (not allowed in assessed write up)

https://docs.google.com/document/d/1X4SoI7RbQi1OUj5Jk4-VEKWDvwzfIbQD9APUSj3uw-Q/edit

Slope force - Specimen results exemplify uncerts

A	B	C	D	E	F	G	H	I	
Slope force using hanging weight results									
Mass (g)	Angle 1 (degrees)	Angle 2 (degrees)	Angle 3 (degrees)	Average angle (degrees)	Max	Min	ARMU (unrounded (degrees))	ARMU (degrees)	F[
100	11	12	11	11	12	11	0.33	0	
150	17	16	17	17	17	16	0.33	0	
200	24	25	23	24	25	23	0.67	1	
250	28	30	28	29	30	28	0.67	1	
300	34	36	35	35	36	34	0.67	1	
350	47	44	42	44	47	42	1.67	2	

RECAP

https://docs.google.com/spreadsheets/d/1PLqTGRVccGMFebCJp-2Ny9Nabgo8jVKfULMd3-Sn1zg/edit#gid=0

Raw Data – what can go in!

distance	Irradiance (units)				
(m)					average
0.200	57.0	65.8	55.2	57.9	59.0
0.250	38.2	36.4	39.7	38.4	38.2
0.300	25.6	24.9	25.4	25.8	25.4
0.400	14.9	15.5	15.5	16.2	15.5
0.600	7.8	7.5	7.6	7.7	7.7
0.800	5.3	5.2	5.3	5.0	5.2
1.000	4.0	3.5	3.2	3.4	3.5

Can't take calculated values in e.g. averages

distance	Irradiance (units)			
(m)				
0.200	57.0	65.8	55.2	57.9
0.250	38.2	36.4	39.7	38.4
0.300	25.6	24.9	25.4	25.8
0.400	14.9	15.5	15.5	16.2
0.600	7.8	7.5	7.6	7.7
0.800	5.3	5.2	5.3	5.0
1.000	4.0	3.5	3.2	3.4

This is what can be taken in, notice there are no blank unpopulated tables

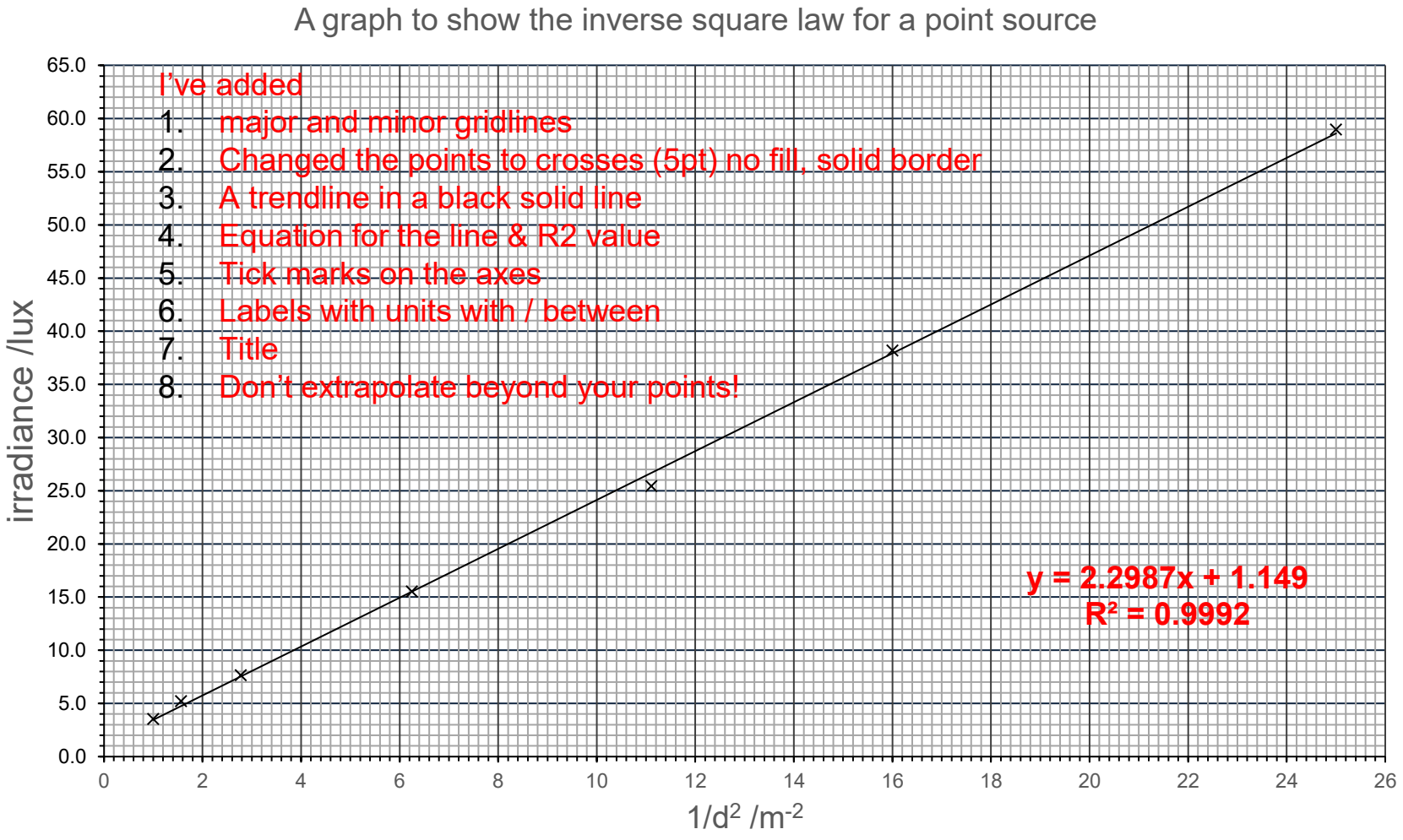
Students can have plotted a graph during the experimental phase, but this must not be taken in to the reporting stage. Good practice to do this for any experiment

Possible table (after write-up)

An example of a final table but sample calculations should be given in the analysis to show how these were calculated Control+tilda accent grave (the key above the tab) reveals the formula in a table

distance	$1/d^2$	Irradiance (lux)					ΔR	% uncertainty
(m)	(m^{-2})					average	(lux)	(%)
0.200	25.0	57.0	65.8	55.2	57.9	59.0	2.7	4
0.250	16.0	38.2	36.4	39.7	38.4	38.2	0.8	2
0.300	11.1	25.6	24.9	25.4	25.8	25.4	0.2	1
0.400	6.25	14.9	15.5	15.5	16.2	15.5	0.3	2
0.600	2.78	7.8	7.5	7.6	7.7	7.7	0.1	1
0.800	1.56	5.3	5.2	5.3	5.0	5.2	0.1	1
1.000	1.00	4.0	3.5	3.2	3.4	3.5	0.2	6

distance	$1/d^2$	Irradiance (lux)					ΔR	% uncertainty
(m)	(m^{-2})					average	(lux)	(%)
0.2	=1/(A3*A3)	57	65.8	55.2	57.9	=AVERAGE(C3:F3)	=(MAX(C3:F3)-MIN(C3:F3))/COUNTA(C3:F3)	=H3/G3*100
0.25	=1/A4^2	38.2	36.4	39.7	38.4	=AVERAGE(C4:F4)	=(MAX(C4:F4)-MIN(C4:F4))/COUNTA(C4:F4)	=H4/G4*100
0.3	=1/A5^2	25.6	24.9	25.4	25.8	=AVERAGE(C5:F5)	=(MAX(C5:F5)-MIN(C5:F5))/COUNTA(C5:F5)	=H5/G5*100
0.4	=1/A6^2	14.9	15.5	15.5	16.2	=AVERAGE(C6:F6)	=(MAX(C6:F6)-MIN(C6:F6))/COUNTA(C6:F6)	=H6/G6*100
0.6	=1/A7^2	7.8	7.5	7.6	7.7	=AVERAGE(C7:F7)	=(MAX(C7:F7)-MIN(C7:F7))/COUNTA(C7:F7)	=H7/G7*100
0.8	=1/A8^2	5.3	5.2	5.3	5	=AVERAGE(C8:F8)	=(MAX(C8:F8)-MIN(C8:F8))/COUNTA(C8:F8)	=H8/G8*100
1	=1/A9^2	4	3.5	3.2	3.4	=AVERAGE(C9:F9)	=(MAX(C9:F9)-MIN(C9:F9))/COUNTA(C9:F9)	=H9/G9*100


A graph to show the inverse square law for a point source
I've added
1. major and minor gridlines
2. Changed the points to crosses (5pt) no fill, solid border
3. A trendline in a black solid line
4. Equation for the line & R2 value
5. Tick marks on the axes
6. Labels with units with / between
7. Title
8. Don't extrapolate beyond your points!
y = 2.2987x + 1.149
R² = 0.9992
irradiance /lux
1/d² /m⁻²
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
0
2
4
6
8
10
12
14
16
18
20
22
24
26

Using Excel for SQA work

1. https://www.mrsphysics.co.uk/advanced/project-2019/
2. https://www.mrsphysics.co.uk/bge/using-excel/
3. https://www.mrsphysics.co.uk/advanced/wp-content/uploads/2020/06/Excel-Tables-Hookes-Law-AH-EXTENSION-2020.pdf (last one goes up to AH, but parts are ok for higher)

Uncertainties

You must include scale reading uncertainties for all the measurements you have made in your experiment, and calculate the random uncertainty in your repeated measurements.
If you carried out two experiments, you should include the uncertainties in the measurements from both experiments. Both sets of uncertainties will be marked, and you will be awarded the mark for the better set.

Make sure the examples you use are for SQA at Higher Level. Other methods might be equally correct but won't get students the marks!

https://www.mrsphysics.co.uk/higher/uncertainties/
https://www.youtube.com/watch?v=5oH6qR5iFvA

Uncertainties

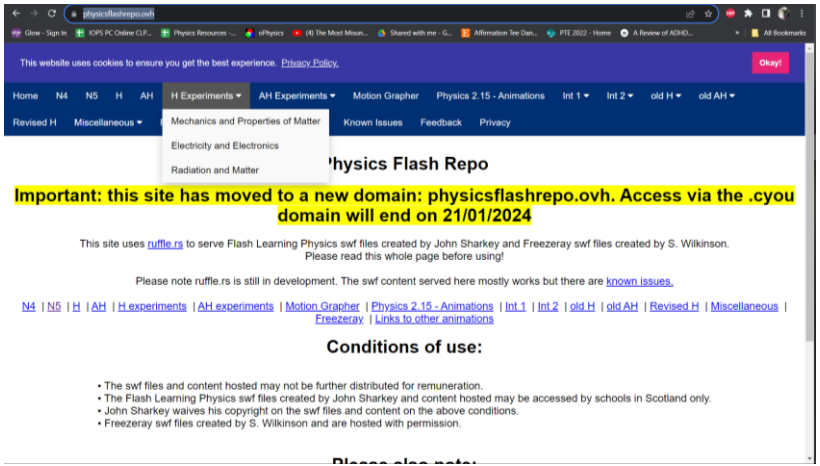
This was a great little table given in resources for the 2000 Higher Still Higher. I think this still works to show scale reading uncertainties

Uncertainties must be stated for all the measuring instruments used. For most experiments a mean should also be calculated together with the approximate random uncertainty.

Please use the table below to help you record your uncertainties.

	Scale reading uncertainty	comment	% uncertainty [if needed]	random uncertainty [if needed]
(name of x)	± (value) unit	half smallest scale division		see readings table, $\frac{\text{max - min used}}{\text{No. of readings}}$
(name of y)	± (value) unit	one in last digit		Not done, only two readings taken

Some of the References I couldn't show you in the talk!



- https://www.understandingstandards.org.uk/Subjects/Physics/Higher/Assignment
- https://www.focuseducational.com/a-level-physics-required-practicals/
- https://filestore.aqa.org.uk/resources/physics/AQA-7407-7408-SUG-P2.PDF
- https://physicsflashrepo.ovh/
- https://www.mrsphysics.co.uk/higher/wp-content/uploads/2023/09/A-GUIDE-TO-Assignments-2023.pdf

IOP Scotland Teacher Network

Please complete this short evaluation form:

https://forms.office.com/e/SauaTs3UAs

Completing this evaluation is important to help ensure continued support for IOP activities and to ensure they meet your needs.

IOP Institute of Physics Scotland

IOP Scotland Teacher Network - Online

Early Career Teacher TeachMeet
19:30-20:30, Wednesday, 13 December 2023

Using AI in Physics Education
16:30-17:30, Wednesday, 17 January 2024

Alternative Pathways in Physics
19:30-20:30, Wednesday, 31 January 2024

49th Stirling Physics Teachers Meeting

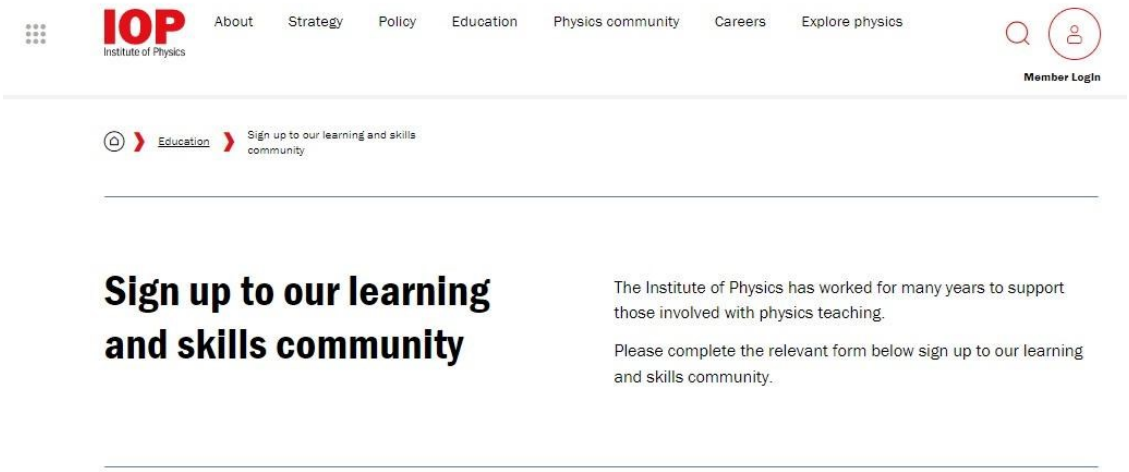
23 May 2024

Stirling Court Hotel, Stirling, Scotland

IOP New Contact List

Register for our new email list:

www.iop.org/education/sign-up-learning-skills-community



IOP Institute of Physics
Scotland