Edexcel International AS/A Level

IAL PHYSICS

Event Code: YPH11-201O3
Module 3: Assessment

First teaching in 2018, first assessment 2019

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Aims and objectives

- In this training, you will:

  - understand the Assessment Objectives for the qualification
  - understand the question types for the qualification
  - understand the mark schemes for the qualification
  - practise using the mark schemes using exemplar student work
  - learn about the support provided by Pearson around assessment and exemplars.

Introductions

- The type of school you work in
- One thing you are hoping to get out of this session

How is the content assessed?

Unit 1: Mechanics and Materials	Unit 2: Waves and Electricity	Unit 3: Practical Skills in Physics I
Externally assessed Written exam: 1h 30m 80 marks 40% of IAS 20% of IAL The paper may include multiple-choice, short open, open-response, calculations and extended-writing questions.	Externally assessed Written exam: 1h 30m 80 marks 40% of IAS 20% of IAL The paper may include multiple-choice, short open, open-response, calculations and extended-writing questions.	Externally assessed Written exam: 1h 20m 50 marks 20% of IAS 10% of IAL This unit will assess students' knowledge and understanding of experimental procedures and techniques developed in Units 1 and 2. The paper may include short-open, open-response, calculations and extended-writing questions.

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How is the content assessed?

Unit 4: Further Mechanics, Fields and Particles	Unit 5: Thermodynamics, Radiation, Oscillations and Cosmology	Unit 6: Practical Skills in Physics II
Externally assessed Written exam: 1h 45m 90 marks 40% of IA2 20% of IAL The paper may include multiple-choice, short open, open-response, calculations and extended-writing questions.	Externally assessed Written exam: 1h 45m 90 marks 40% of IA2 20% of IAL The paper may include multiple-choice, short open, open-response, calculations and extended-writing questions.	Externally assessed Written exam: 1h 20m 50 marks 20% of IA2 10% of IAL This unit will assess students' knowledge and understanding of experimental procedures and techniques developed in Units 4 and 5. The paper may include short-open, open-response, calculations and extended-writing questions.

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What are the Assessment Objectives?

Assessment objectives and weightings

		% in IAS	% in IA2	% in IAL
AO1	Demonstrate knowledge and understanding of science.	34–36	29–31	32–34
AO2	(a) Application of knowledge and understanding of science in familiar and unfamiliar contexts.	34–36	33–36	34–36
	(b) Analysis and evaluation of scientific information to make judgements and reach conclusions.	9–11	14–16	11-14
AO3	Experimental skills in science, including analysis and evaluation of data and methods.	20	20	20

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Relationship of assessment objectives to units for the International Advanced Subsidiary qualification

Unit number	Assessment objective (%)			
	AO1	AO2(a)	AO2(b)	AO3
Unit 1	17–18	17–18	4.5–5.5	0.0
Unit 2	17–18	17–18	4.5–5.5	0.0
Unit 3	0.0	0.0	0.0	20
Total for International Advanced Subsidiary	34–36	34–36	9–11	20

Relationship of assessment objectives to units for the International Advanced Level qualification

Unit number	Assessment objective (%)			
	AO1	AO2(a)	AO2(b)	AO3
Unit 1	8.5–9.0	8.5–9.0	2.25–2.75	0
Unit 2	8.5–9.0	8.5–9.0	2.25–2.75	0
Unit 3	0	0	0	10
Unit 4	7.3–7.8	8.4–8.9	3.6–4.0	0
Unit 5	7.3–7.8	8.4–8.9	3.6–4.0	0
Unit 6	0	0	0	10
Total for International Advanced Level	32–34	34-36	11-14	20

What types of questions are asked?

Papers on the content units (1, 2, 4 and 5) will include a mixture of different question styles, including:

- multiple-choice questions
- short open questions
- calculations
- open response questions
- extended writing questions.

Papers on the practical skills units 3 and 6 have all of these question styles *except* multiple choice.

Multiple-choice questions

A car is travelling at a velocity v. The driver applies the brakes and the car decelerates until it comes to rest. The work done by the brakes on the car is W.

Which of the following expressions is correct?

☒ **A** $W \propto v$

☒ **B** $W \propto v^2$

☒ **C** $W \propto \frac{1}{v}$

☒ **D** $W \propto \frac{1}{v^2}$

Short open questions

A light dependent resistor (LDR) has a resistance of 6100 Ω when illuminated with indoor lighting.

(a) Explain how the resistance of an LDR changes with illumination. Your answer should include reference to conduction electrons.

(2)

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Calculation questions

Zinc has a work function of 4.3 eV. Calculate the maximum wavelength of light that will produce the photoelectric effect with zinc.

(3)

Maximum wavelength = ...

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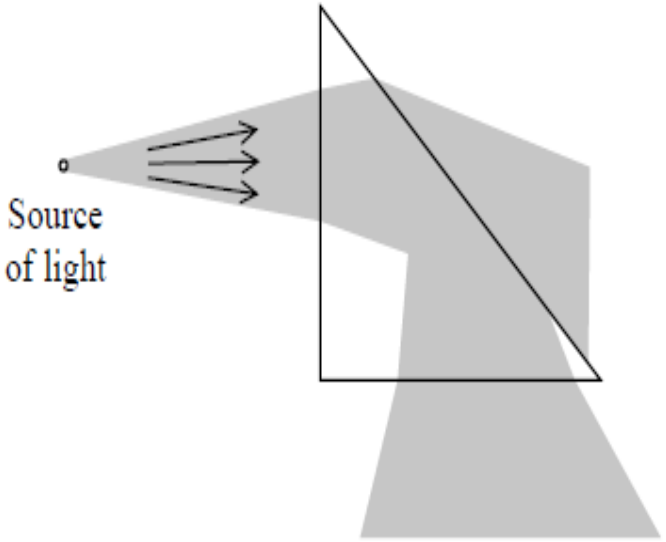
Open response questions

The diagram shows the path of a beam of light travelling from a light source in air through a 45° glass prism. The path taken by the beam of light is shaded. The critical angle for glass is 41°.



Explain the path of the beam of light.

(4)

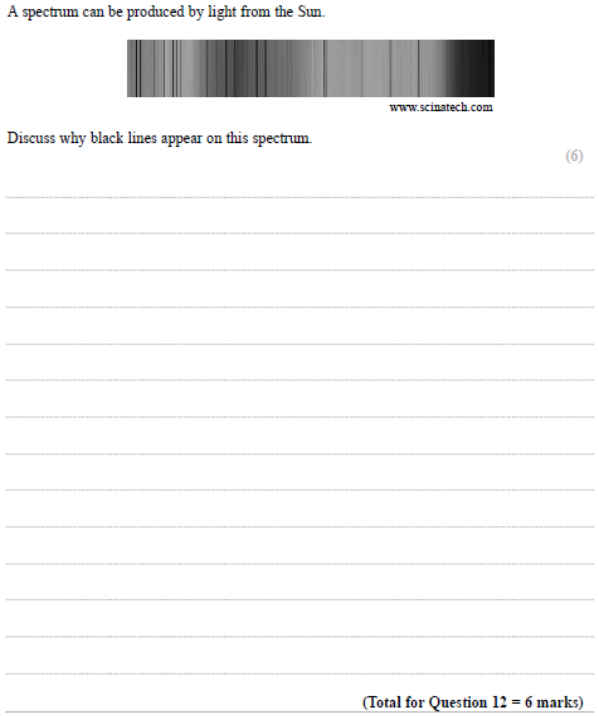
Extended writing

A spectrum can be produced by light from the Sun.

www.scinatech.com

Discuss why black lines appear on this spectrum.

A screenshot of the full page with this question at the top shows that a fair amount of space – a whole side of A4 – is provided for a candidate to respond to this 6-mark question.



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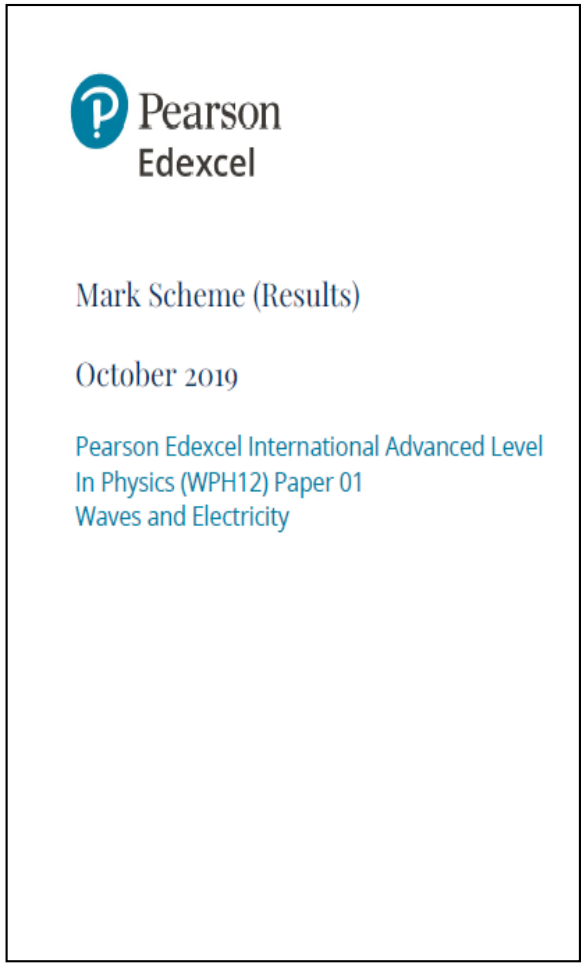
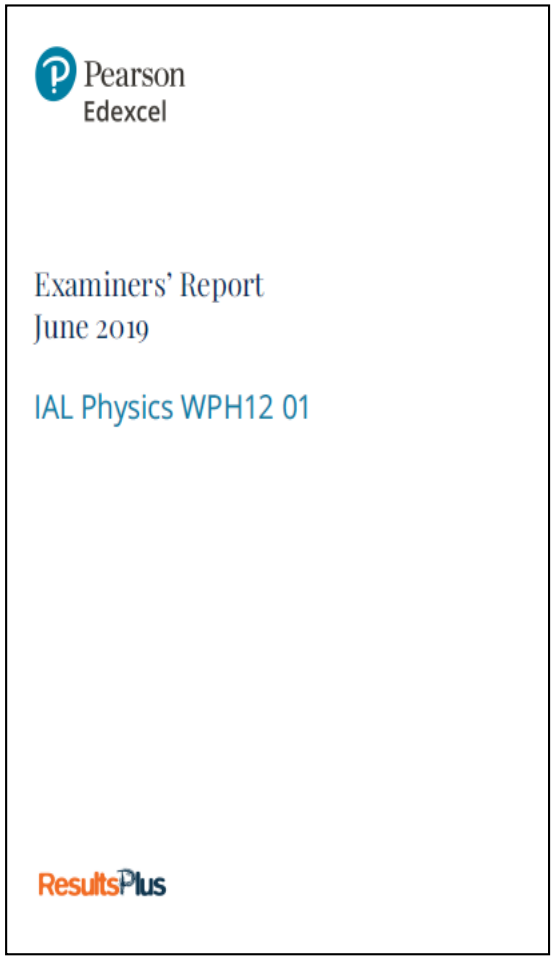
Mark schemes and examiner reports





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What are mark schemes?

- These are the ‘answers’ to the questions.
- They often give a number of alternative answers students might give.
- They can show indicative content to guide the markers.
- They also advise a marker of common errors and what to credit and not credit.
- Examiners are encouraged to use the mark scheme positively and to look to reward marks for what is there rather than penalise students for what isn’t.

What is in the mark schemes?

Question Number	Answer		Mark
13a	Use of $V=W/Q$ $W = 7.92 \times 10^5$ J **Example of calculation** $W = V \times Q = 22 \times 36{,}000 = 792{,}000$ J	(1) (1)	(2)
13bi	Use of speed = distance/time Time = 0.45 s (Accept 7.5×10^{-3} minutes or 1.25×10^{-4} hours) **Example of calculation** 16 km hr^{-1} = 16,000 m/ 3,600 s= 4.4 m s^{-1} Time = distance / speed = 2.0 m / 4.4 m s^{-1} = 0.45 seconds.	(1) (1)	(2)
13bii	Use of $I = Q / t$ Calculates total charge used in 2.00 m Number of electrons = 4.2×10^{19} (e.c.f. from (i)) **OR** Use of speed = distance / time Calculates total charge used in 2.00m Number of electrons = 4.2×10^{19} (no e.c.f. required from (i) for this method) **Example of calculation** $I = Q / t$ = 36,000 C / (40 x 60) s = 15 A Total charge used in 2.00m = I × t = 15 A x 0.45 s = 6.75 C number of electrons = 6.75 C / 1.6×10^{-19} C = 4.2×10^{19}	(1) (1) (1) (1) (1) (1)	(3)
	Total for question 13		7

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What is in the mark schemes?

Question Number	Answer	Mark
*14a	This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning. Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning. The following table shows how the marks should be awarded for indicative content.	

Number of indicative marking points seen in answer	Number of marks awarded for indicative marking points
6	4
5–4	3
3–2	2
1	1
0	0

The following table shows how the marks should be awarded for structure and lines of reasoning.

	Number of marks awarded for structure of answer and sustained line of reasoning
Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout	2
Answer is partially structured with some linkages and lines of reasoning	1
Answer has no linkages between points and is unstructured	0

Indicative content

- When temperature is higher, greater energy to electrons (in thermistor)
- When temperature is higher, more conduction/free electrons
- When temperature is higher, lower resistance in thermistor
- Decreased p.d. across thermistor / YZ
  Or current in circuit/thermistor increases
- Increased p.d. across fixed resistor Or increased p.d. across XY
- So for the air conditioning application, secondary circuit should be across XY

(6)

(Allow converse statements for IC 1,2, 3 and 4)
(Do not allow contradicting statements for IC4 e.g. lower V so lower I)

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General marking guidance

- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Consider...

Which Assessment Objectives are being assessed in this part of an exam question?

Assessment objectives and weightings

AO1	Demonstrate knowledge and understanding of science.
AO2	(a) Application of knowledge and understanding of science in familiar and unfamiliar contexts. (b) Analysis and evaluation of scientific information to make judgements and reach conclusions.
AO3	Experimental skills in science, including analysis and evaluation of data and methods.

A student carried out an experiment to determine the resistivity of a metal in the form of a wire. She made the following measurements:

length of wire = 0.20 m
resistance of wire = 50 mΩ
diameter of wire = 0.36 mm

Determine the metal of the wire using information from the table below.

Metal	Resistivity / Ω m
aluminium	2.7×10^{-8}
tungsten	5.6×10^{-8}
iron	1.0×10^{-7}

(3)

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Activity

How can we encourage students to develop confidence in tackling questions (such as this one) where the context is different from that in which the concept was initially learned?

The photograph shows a machine used for surveying the seabed. A communications cable connects the machine to a ship on the surface.

Source from: http://www2.dupont.com/Personal_Protection/en_GB/assets/PDF/OandG/Nexans%20Case%20Study.pdf

The material used in the outer casing of the communications cable must withstand the large pressures at the seabed, yet be light enough to lift out of the water.

density of Kevlar = 1400 kg m^{-3}

density of steel = 7800 kg m^{-3}

(i) Deduce whether steel or Kevlar is more suitable to use in the outer casing of a communications cable at the seabed.

(4)

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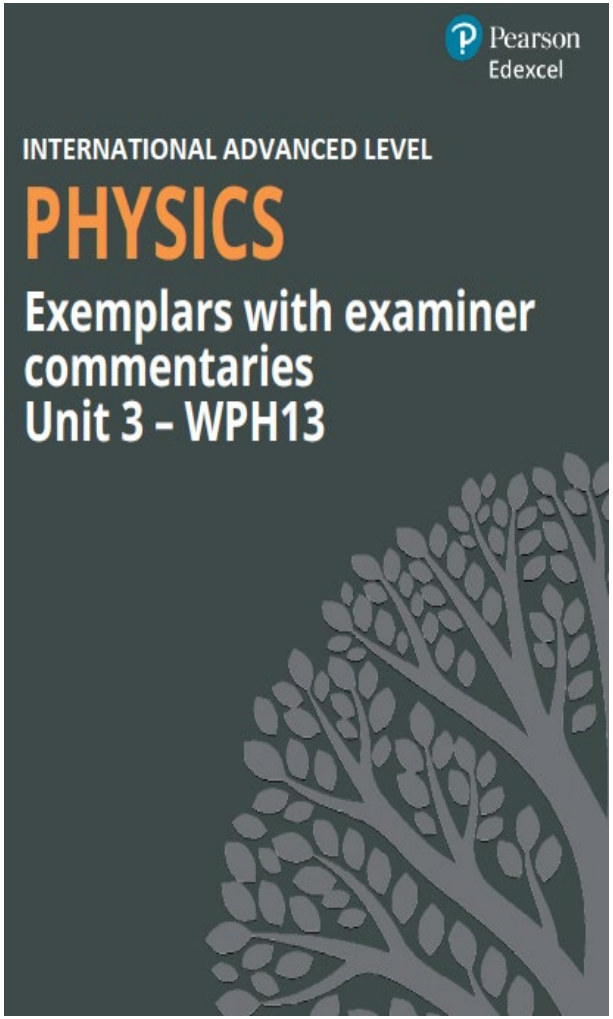
Exemplars



Exemplar response A

(a) Describe what the student should do to obtain the data to plot the force-extension graph. (4)

Measure the mass of the load using an electronic balance and repeat for same mass. Multiply with gravitational acceleration to get F. Use a meter-rule and set square to place the meter rule parallel to the spring and measure the initial ~~mass~~ length. Hang loads of varying masses and measure the final length of the spring for each mass. Substract initial length to find extension for each of value of F. ~~Plot the graph~~, Repeat measurements of each mass and its corresponding extension.

Examiner's comments:

This response was given 4 marks.

The first marking point is clear in the first 3 lines of this response.

There is a clear reference to the calculation of extension by subtracting the initial length from the final length in the 7th and 8th lines, so achieving the second marking point.

Although the response does not refer to parallax, it does make a credit worthy attempt at the third marking point, using the set square and ensuring the ruler is parallel to the spring.

Note – this mark was awarded rarely, as many candidates did not include ideas of accuracy when giving an account of what should be done to obtain the data.

The final marking point is awarded for responses that explain how the multiple pairs of force/mass and extension needed to plot a graph are achieved. Here, "hang loads of varying masses" is enough for the final marking point.

Exemplar activity

Here is an example, from an IAS 'Exemplars' document, of a part-question requiring a force diagram and the related mark scheme below.

Answer		Mark
• Weight/*W*/*mg* labelled • Tension/*T*	(1) (1)	2

A yo-yo is a toy that consists of two connected discs on a piece of string.

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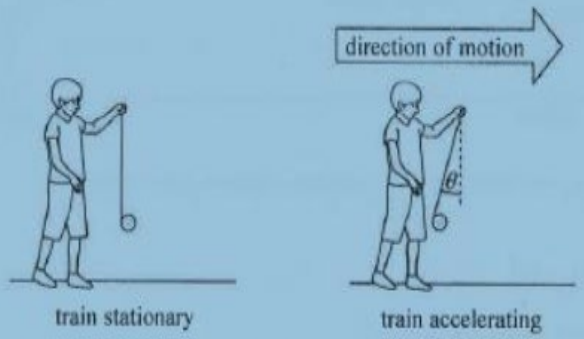
A child stands in a stationary train holding a yo-yo. The train accelerates and the string moves into the position shown, at an angle θ to the vertical.



(a) Draw the free-body force diagram for the yo-yo when the train is accelerating.

(2)

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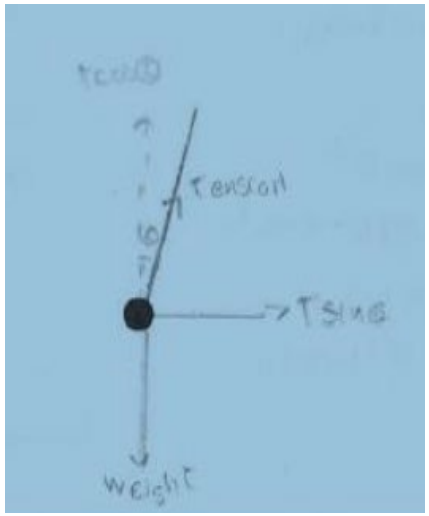
Exemplars

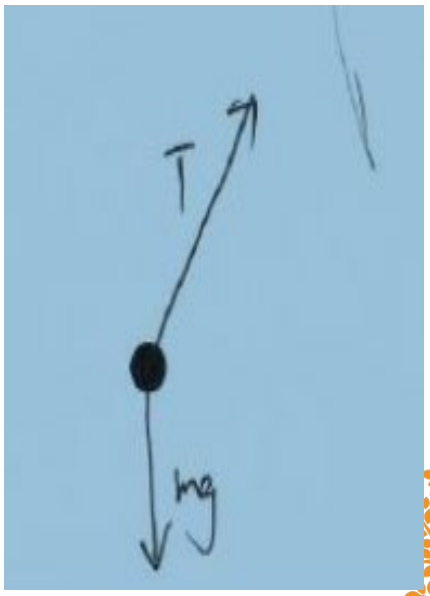
What mark would you give?

Answer		Mark
• Weight/*W*/*mg* labelled • Tension/*T*	(1) (1)	2

A



B



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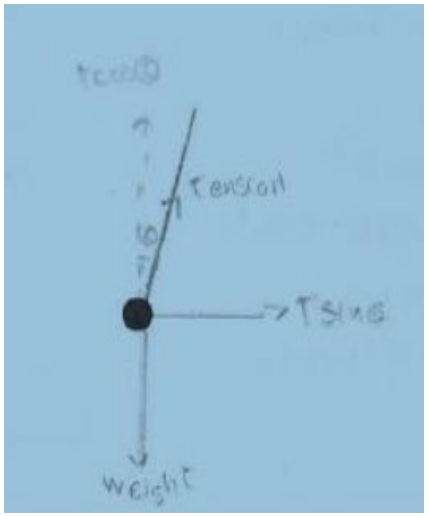
Exemplars

The examiner's decision

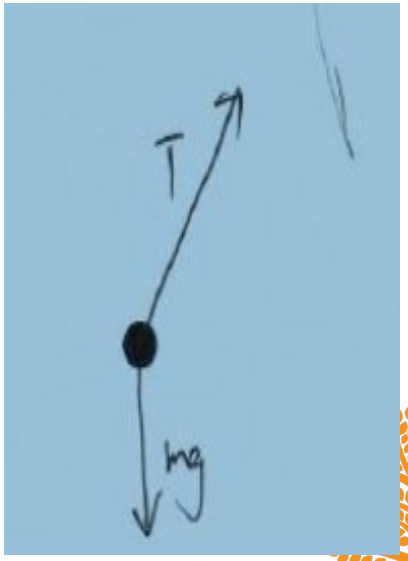
Exemplar A: 1 mark
This candidate has drawn both of the forces expected to score the 2 marks, but has added in the components of tension in both the horizontal and vertical planes. This might have been acceptable if both of the components of T drawn had been dotted lines. In this case the Tsinθ is drawn as a solid line, so this candidate scores just 1 mark.

A



Exemplar B: 2 marks
Ideally, lines of force would be drawn using a ruler. However, this candidate has scored both marks even though the lines are not completely straight. This is because it is completely clear which directions the weight and tension are acting. There are no additional forces drawn so all is correct.

B



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Physics (2018)

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Specification | Course materials | Published resources | News

Specification

First teaching: **September 2018**
First external assessment: **2019**

Our International Advanced Subsidiary and Advanced Level Physics has been developed to be engaging for international learners and to give them the necessary skills to support progression to higher education or further study in physics, as well as to a wide range of other subjects.

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Course materials

- Specification and sample assessments (2)
- Exam materials (19)
- Teaching and learning materials (16)

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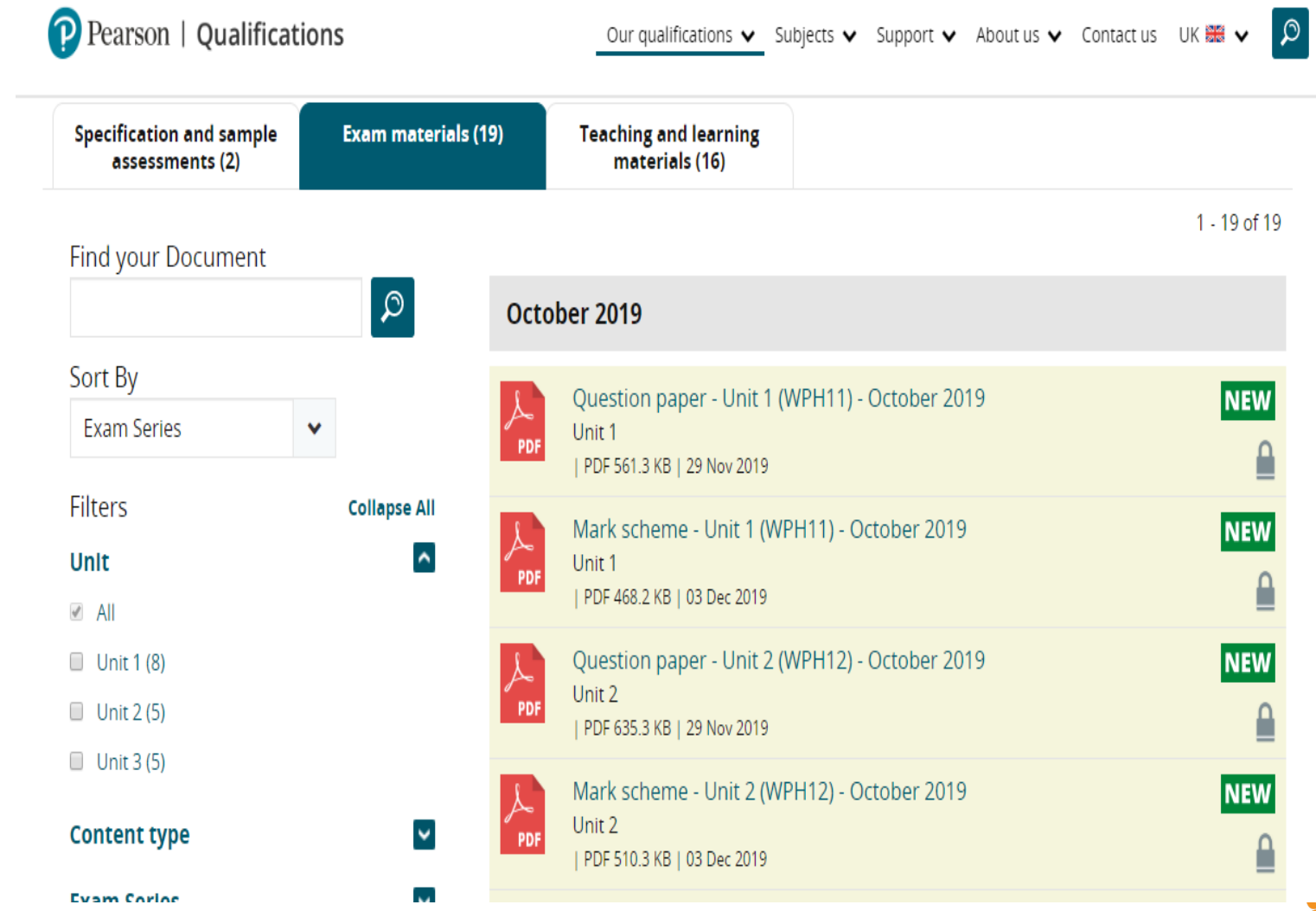

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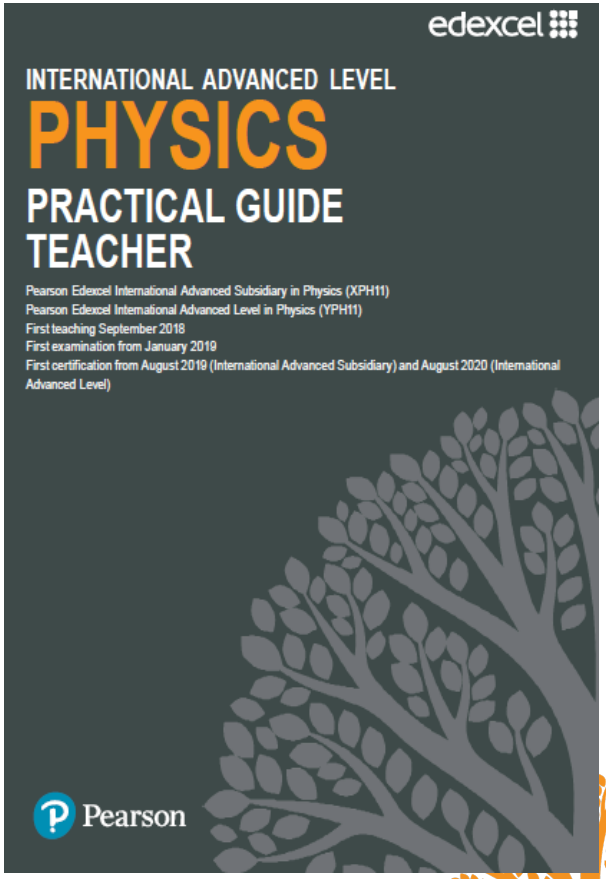
Assessment of practical work and exam techniques

Assessment of practical work

- As mentioned earlier, all of the assessment of practical work is in the final written exams on units 3 and 6 (about 20% of the total marks) – there is no practical exam, nor 'assessed practicals' in this course.
- This increases the need (over what may have happened in some older specifications) for learning during practical lessons to be planned carefully so that students develop the skills necessary to tackle those exam questions.
- The Practical Guide (Teacher) is an invaluable tool to aid this area of learning.



Practical Guide – Teachers

The practical guide for teachers includes:

- practical assessment – the whole picture
- assessment of practical skills
- using core practicals to teach skills
- mapping core practicals for mathematics skills development
- teaching approaches to core practicals
- answers to Student Guide questions
- answers to core practical questions.

Practical Guide – Teachers

Student records

Possible formats for students to keep records of their practical work include:

- a lab book. This has some advantages, mostly in being a 'working document' where students can write notes on procedures, as well as take down data, sketch rough graphs and so on
- a folder of practical work, having the advantage of being able to store worksheets and other stimulus material alongside the practical notes
- integrating practical notes into student's main folder.

Whichever format you decide works best, it is important that the method of collecting and recording the practical work that students do meets the following requirements:

- be a useful revision aid for students at the end of their course
- allow students to record evidence in a variety of formats, such as diagrams/drawings, tables, graphs and so on. This would also include space for any data analysis or evaluation.

5. Investigate the effects of length, tension and mass per unit length on the frequency of a vibrating string or wire

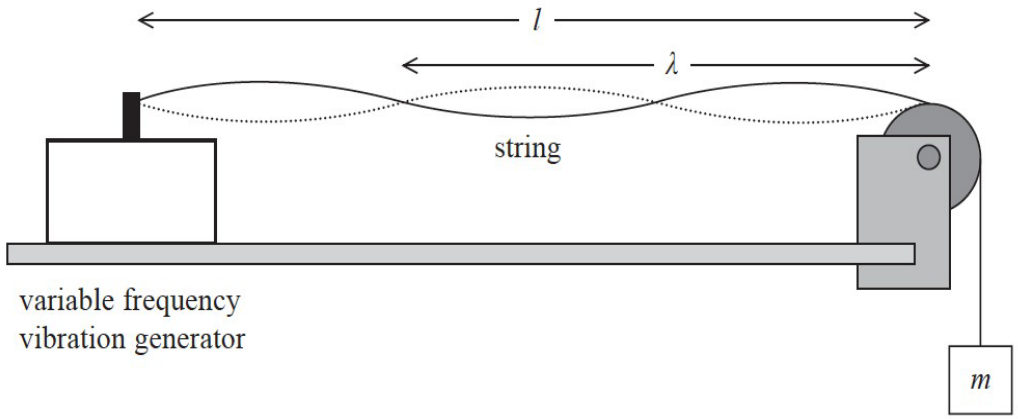
This experiment has 3 variables to test and so is another that makes a very good investigation and the sheets in the guide take this approach. The students might write a plan out of class and come to the lesson ready to carry it out so clearly the theory will have to be done thoroughly first. Because it is more open ended than some of these practicals students will need to keep a complete record of all that they do from the plan onwards.

It is unlikely that centres will have enough vibration transducers for a class set so if all students are to do this at the same time a vertical alternative is possible. A wire is hung vertically with slotted masses at the bottom, an alternating current is passed down the wire, leads attached with crocodile clips, an a magnetic field is placed at the centre – either a horseshoe magnet or pole faced magnets on a yoke. This removes frequency as a variable since it is 50 Hz, unless frequency generators are available. This makes a good alternative and students can still make measurements of standing waves by varying the mass on the wire. There will be no variable to control but students could still plan for frequency as a variable.

Safety should feature in all reports but this one has it as a feature since there are wires under tension and hanging masses. The data can be processed using ICT as there is a non-linear relation in the variables.

Example question on practical skills

A student carried out an experiment to determine the mass per unit length μ of a string, using a standing wave. The standing wave produced is shown in the diagram.



The student recorded the following data.

Length of string l	1.25 m
Frequency f	105 Hz
Mass m	0.25 kg

(a) Calculate μ given the equation below.

$$\sqrt{\frac{mg}{\mu}} = f\lambda$$

(3)

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Example question on practical skills – mark scheme for part (a):

Question Number	Answer		Mark
4(a)	• Use of $\sqrt{\frac{mg}{\mu}} = f\lambda$	(1)	
	• Use of $l = 1.5 \times \lambda$	(1)	
	• $\mu = 3.2 \times 10^{-4}$ kg m^{-1}	(1)	3
	Example of calculation $1.5 \times \lambda = 1.25$ m $\lambda = 0.833$ m $\mu = (0.25\text{ kg} \times 9.81\text{ m s}^{-2}) / (105^2\text{ Hz}^2 \times 0.833^2\text{ m}^2)$ $\mu = 3.21 \times 10^{-4}$ kg m^{-1}		

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Example question on practical skills (continued):

(b) (i) Identify two significant sources of uncertainty in the student's measurements.

(2)

(ii) For each of these sources of uncertainty, describe an experimental technique the student could have used to obtain an accurate measurement.

(4)

… and the accompanying mark scheme for part b(i):

4(b)(i)	Mark 4(b)(i) and (b)(ii) holistically **Max 2 from** *Frequency* • Uncertainty in identifying when nodes form (1) • Uncertainty in identifying maximum amplitude (1) *Length* • Parallax error when measuring length (1) • Uncertainty in measuring length to top of pulley **Or** uncertainty in measuring length as string is not straight (1) *Mass* • Zero error on mass balance (1)	**2**

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...and for part b(ii):

4(b)(ii)	**Max 4 (from only 2 pairs)** **For each source from (b)(i)** Description of experimental technique (1) Additional detail (1) <u>*Examples*</u> *Frequency* • Repeat and calculate the mean frequency (1) • Vary frequency from above and below resonance to find two values for the frequency when the standing wave forms (1) *Length* • Use a set square to reduce parallax error in length **Or** hold ruler in contact with the wire to reduce parallax error in length **Or** ensure ruler and string are at eye-level (1) • Switch off vibrator **Or** ensure string is straight (1) *Mass* • Zero balance before each measurement (1) • To remove systematic error **Or** idea that this error is not reduced by repeating (1)	**4**

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Activity

In the light of those sections of the specification which describe what students will be assessed on in the practical units (and the example question we have just looked at) what are the implications for teaching and learning when students are engaged in experiments and investigations?

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Exam technique

The exam paper

Instructions

• Use **black** ink or **black** ball-point pen.

• Answer the questions in the spaces provided – *there may be more space than you need*.

• **Show all your working in calculations and include units where appropriate**.

Information

• The total mark for this paper is 80.

• The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

• In questions marked with an **asterisk** (*****), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

• The list of data, formulae and relationships is printed at the end of this booklet.

Advice

• Read each question carefully before you start to answer it.

• Try to answer every question.

• Check your answers if you have time at the end.

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Exam technique

Preparation

- Effective exam techniques need to be practised by students using past papers or part-papers; perhaps ‘home-made’ papers using Exam Wizard tailored to suit the exercise or focused on the particular technique being practised.
- Give students such a paper to practise how to access it.
- Give students mark schemes so they can learn what is expected.
- Having a ‘go to’ strategy, a starting point, builds confidence and reduces the stress of ‘what do I do first’.

Exam strategy – one way to tackle a paper

- Look through the whole paper first, underlining (or, better, highlighting) the command words in each question.
- Decide which question to do first – start with the question(s) you feel most confident with, which is not necessarily question 1.
- Read the question carefully – don't repeat the stem in your answer.
- Don't give up on a whole question if you find one section of the question difficult – move on to the next part.
- The same strategy holds for whole questions you find difficult – move on.
- Come back to missed questions and parts of questions when you have picked off all the 'low-hanging fruit'.

Activity question

What strategies do you share with your students that you find effective?

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Walking-talking mocks

- Students sit in the same exam room where they will do their exam, preferably in the same seats (it can be done in the classroom, but not always as effective in building confidence in exam conditions).
- Students are given an exam paper which is as close to being like the real thing as possible (i.e. exam writing booklet if relevant).
- Students are literally walked through every question on the paper – the person leading the session talks them through the smallest steps, such as underlining key words, how to plan, things to remember, etc.
- You might focus on a particular area – such as mathematical questions, or questions based on devising a practical investigation.
- Students then write their responses in timed conditions.

Support from Pearson

Online Teaching and Learning support and Assessment support

To access the IAL Physics teaching and learning materials:
Click here

or (easier!) type:
'**Pearson International Advanced Level**' into a search engine (e.g. Google) and then choose '**Physics**' (all subjects arranged alphabetically).

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Support overview

Getting Started Guide & Scheme of Work	Face to Face & Online Training Events	Subject interpretation of transferable skills
Subject Advisor	Results Plus	Regional Support Manager
Curriculum Matched Publishing	Qualification Guides	Additional SAMs
Exemplar marked responses with commentaries	Examwizard	Access to Scripts

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Find and book

Our training hub makes it easy to find and book events. Whether you're looking for online, face-to-face, centre-based or pre-recorded sessions, we've got you covered.

Use our search-and-book tool to find live training events. If you're an Edexcel Online (EOL) customer, you can log in using your EOL account. If you're new to Pearson, you'll need to create an account. For more help, download our step by step guide.

If you're looking for training videos or courses to be delivered at your centre, visit our pre-recorded and centre-based training pages.

Step by step guide

Want to book a training course? Download our step by step guide to securing your place.

Download the guide

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Subject advisor details

Keep up to date

Irine Muhiuddin

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Useful link : Please have a look at your new community

Twitter : @PearsonSciences

› Contact us

https://support.pearson.com/uk/s/qualification-contactus

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Pearson International Schools Community

Connect with international teachers around the world

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Published resources

We are committed to helping teachers deliver our Pearson Edexcel qualifications and helping students to achieve their full potential.

To do this, we aim for our qualifications to be supported by a wide range of high-quality resources, produced by a range of publishers.

However, it is not necessary to purchase endorsed resources to deliver our qualifications.

Evaluation and next steps

Next steps

Think of THREE things you might try or do differently as a result of ideas you've discussed today.

(You won't be asked to share these.)

Share in the chat box ONE thing you would like to do as soon as you return to your classroom or department.

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Evaluation

Please fill in an evaluation form

Thank you for participating

Find out more about us at:
http://qualifications.pearson.com

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