A Level Physics

New to Edexcel

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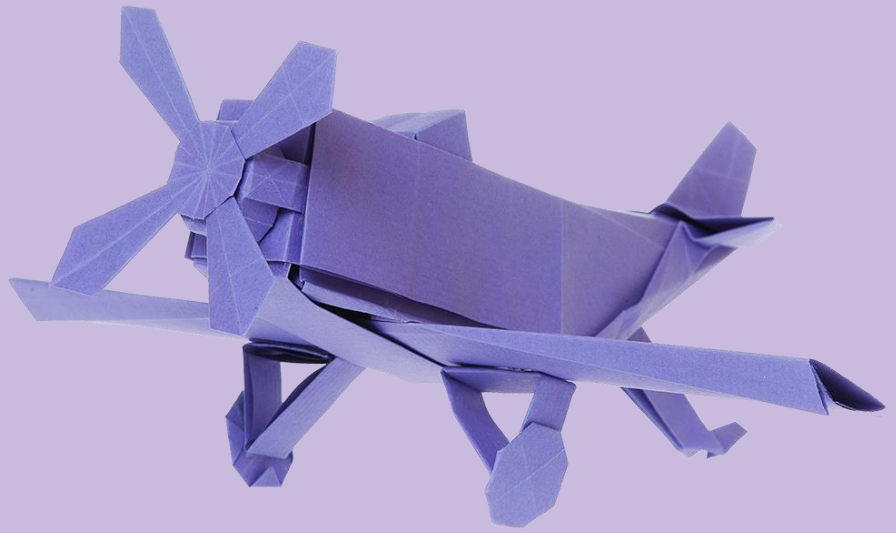

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Agenda

- 10 minutes Introduction
- 30 minutes Specification content and delivery
- 30 minutes Assessment
- 30 minutes Practical work
- 15 minutes Review of support
- 5 minutes Next steps

Aims and objectives

During this session you will:

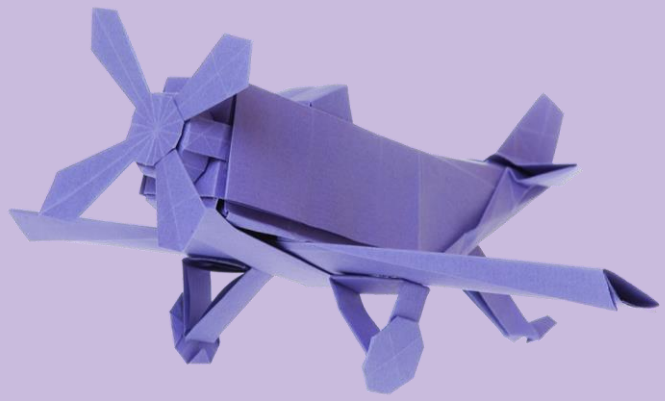
- consider the structure and content of the qualification
- explore possible teaching and delivery strategies
- review assessment, question papers and mark schemes
- find out more about the support available from Pearson

PAUSE

Please download the course materials.

Restart the recording when you are ready.

Specification content and delivery



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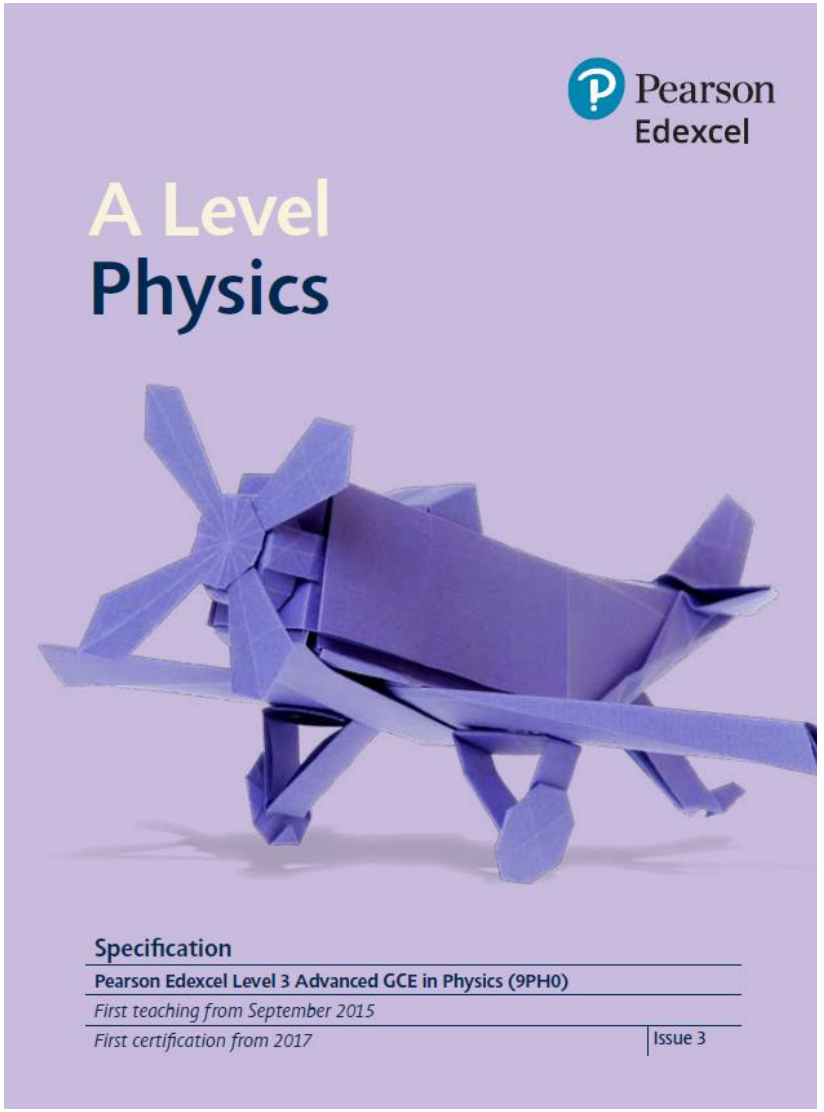
In this session…..

You will be looking at:

- Outline of specification content and topics
- Factors affecting the planning of the curriculum
- Supporting your planning with our free resources



The role of AS level

- ‘Stand-alone’ qualification
- Co-teachable with A level

Overview of specification topics

Paper	AS level		A level		TOTAL
1	2 Mechanics	21+1	6 Further mechanics	9+2	
	3 Electric circuits	16+2	7 Electric & magnetic fields	21+1	
			8 Nuclear & Particle Physics	14	
TOTAL		**37+3**		**44+3**	***81+6***
2	4 Materials	8+2	9 Thermodynamics	9+3	
	5 Waves & Particle Nature of Light	35+3	10 Space	8	
			11 Nuclear Radiation	9+1	
			12 Gravitational Fields	7	
			13 Oscillations	10+1	
TOTAL		**43+5**		**43+5**	***86+10***
TOTAL		**80+8**		**87+8**	***167+16***

Topic 1 ‘Working as a Physicist’ underpins all these

Topic 4: Materials

Students should:	
49.	be able to use the equation density $\rho = \frac{m}{V}$
50.	understand how to use the relationship upthrust = weight of fluid displaced
51.	a. be able to use the equation for viscous drag (Stokes' Law), $F = 6\pi\eta r v$. b. understand that this equation applies only to small spherical objects moving at low speeds with *laminar flow* (or in the absence of *turbulent flow*) and that viscosity is temperature dependent
52.	**CORE PRACTICAL 4: Use a falling-ball method to determine the viscosity of a liquid.**
53.	be able to use the Hooke's law equation, $\Delta F = k\Delta x$, where k is the stiffness of the object
54.	understand how to use the relationships • *(tensile or compressive) stress = force/cross-sectional area* • *(tensile or compressive) strain= change in length/original length* • *Young modulus = stress/strain*

Note that this is a concept-led approach

Context-led approach

An alternative way of delivering the course known as Salters Horners (SHAP).

- Begins with the consideration of applications that draw on one or more areas of physics, and moves on to the underlying laws, theories and models of physics.
- Common assessment to concept-led approach
- Motivating as based on real world applications
- Fully supported by resources

EAT – Good Enough to Eat

51.	a.	be able to use the equation for viscous drag (Stokes' Law), $F = 6\pi\eta rv$.
	b.	understand that this equation applies only to small spherical objects moving at low speeds with *laminar flow* (or in the absence of *turbulent flow*) and that viscosity is temperature dependent
52.		**CORE PRACTICAL 4: Use a falling-ball method to determine the viscosity of a liquid.**
53.		be able to use the Hooke's law equation, $\Delta F = k\Delta x$, where k is the stiffness of the object
55.	a.	be able to draw and interpret force-extension and force-compression graphs
	b.	understand the terms limit of proportionality, *elastic limit, yield point, elastic deformation and plastic deformation* and be able to apply them to these graphs
71.		know and understand that at the interface between medium 1 and medium 2 $n_1 \sin\theta_1 = n_2 \sin\theta_2$ where refractive index is $n = \frac{c}{v}$
72.		be able to calculate *critical angle* using $\sin C = \frac{1}{n}$

Note: contains a mixture of specification points from 2 concept-led topics

AS level topics

Concept-led approach

1 Working as a Physicist

2 Mechanics

3 Electric Circuits

4 Materials

5 Waves and the particle nature of light

SHAP approach

Working as a Physicist

Higher, Faster, Stronger (HFS)

The Sound of Music (MUS)

Good Enough to Eat (EAT)

Technology in Space (SPC)

Digging up the Past (DIG)

Spare Part Surgery (SUR)

A level topics

Concept-led approach

1 Working as a Physicist

7 Electric and Magnetic Fields

8 Nuclear and Particle Physics

9 Thermodynamics

10 Space

11 Nuclear Radiation

12 Gravitational Fields

13 Oscillations

SHAP approach

Working as a Physicist

Transport on Track (TRA)

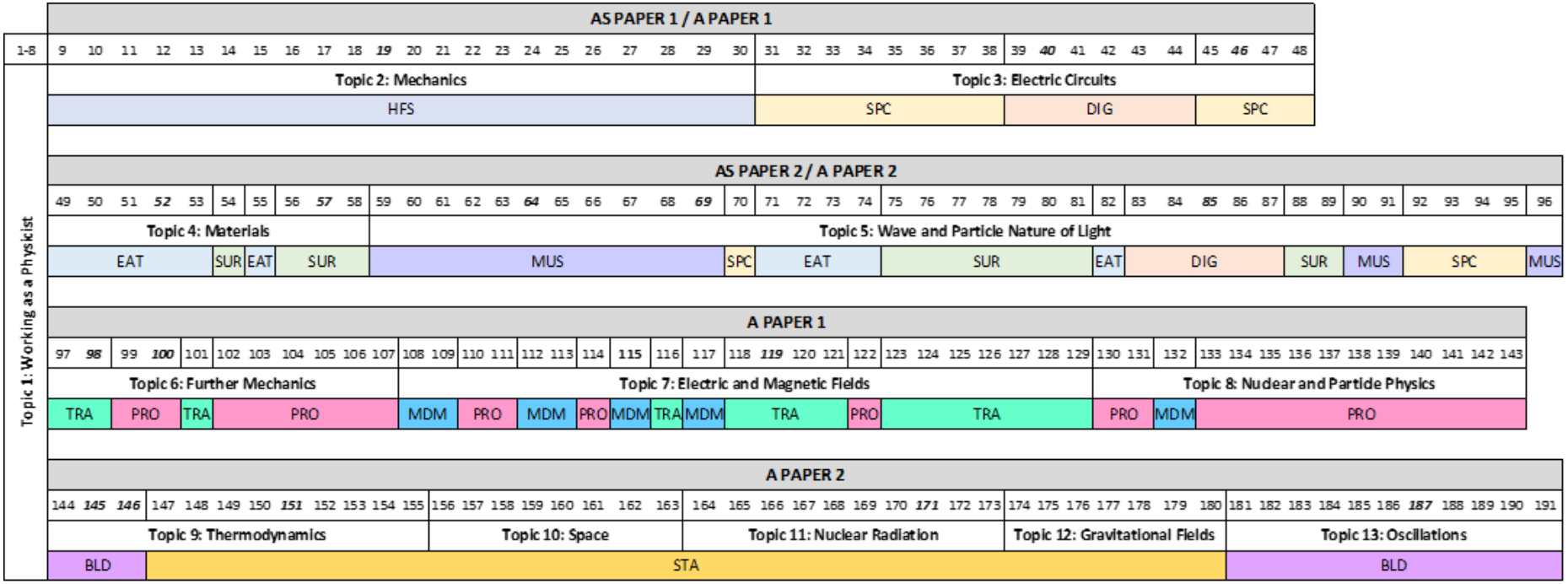
The Medium is the Message (MDM)

Probing the Heart of Matter (PRO)

Build or Bust? (BLD)

Reach for the Stars (STA)

Comparison of specification points



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W01 A Level Physics
Specification Issue 3

Activity 1 Task 1

Curriculum planning and delivery

- Intent and the OFSTED framework
- Development of skills and knowledge
- Engagement and enjoyment
- Staffing – how many teachers are available? What is their experience?
- Co-teaching AS – are there students only taking AS?
- Curriculum hours – are these split evenly between year 12 and 13?
- Transition from GCSE
- **Getting Started Guide** available on the Pearson qualifications website

Free planning support documents

- W02 Course Planner – editable Word file
- W03 Scheme of Work – editable Word file
- W04 Mapping documents to convert from AQA/OCR
- W05 Waves Topic Guide

The root of all support is the Edexcel Physics subject website:

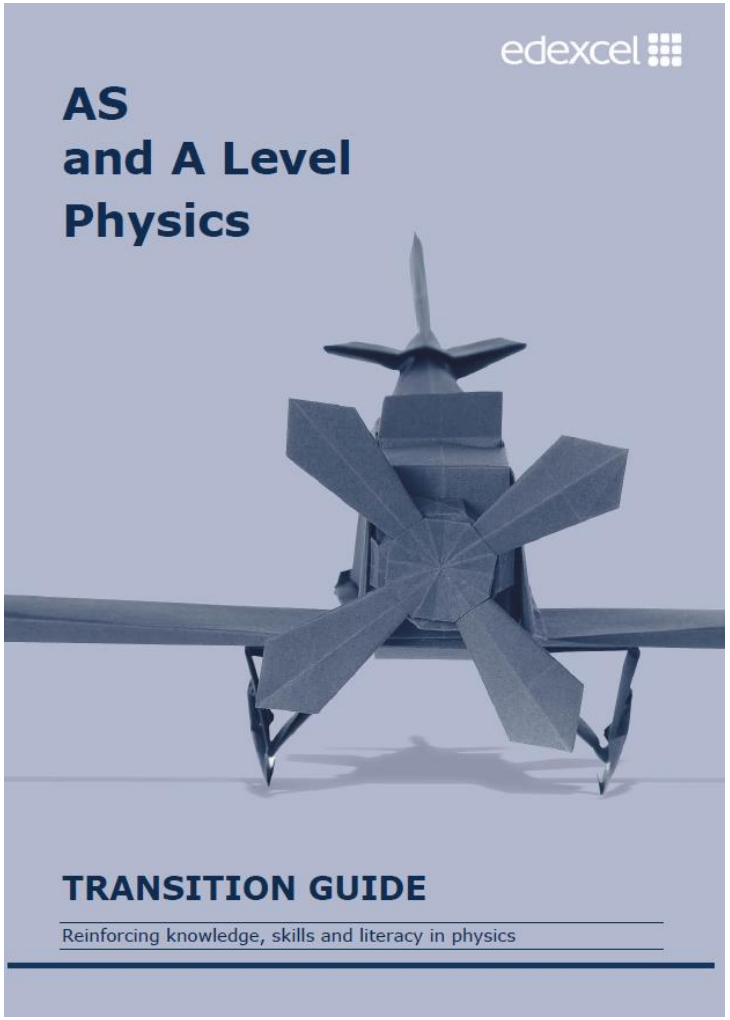
http://qualifications.pearson.com/en/qualifications/edexcel-a-levels/physics-2015.html

Transition from GCSE

W06 Transition Guide supports students moving on from GCSE:

- builds on GCSE
- 5 starter lessons
- baseline assessment
- mathematical activities

Also available on the website is additional support to help with transition.



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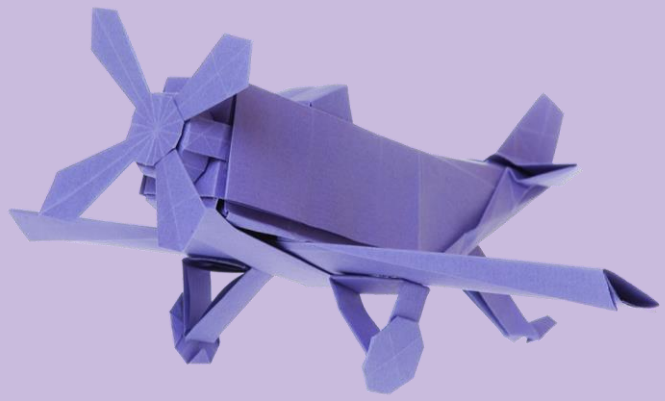
Activity 2

Assessment



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In this session…..

You will be looking at:

- the assessment model for AS and A level Physics
- how maths and practical skills are assessed
- the types of question found in exam
- the command words used in questions
- example questions activity
- free support available

Assessment – an overview

- Examinations are at the end of the course:
  - 2 exams for AS
  - 3 different exams for A level.
- AS results do not contribute to A level
- The Practical Endorsement is graded separately

Assessment model – AS level

	Paper 1	Paper 2
Length	1hr 30 mins	1hr 30 mins
Total Marks	80	80
Weighting of AS	50%	50%
Topics Section A Section B	1, 2 and 3 Synoptic and practical	1, 4 and 5 Synoptic and practical

Assessment model – A level

	Paper 1	Paper 2	Paper 3
Length	1h 45mins	1h 45mins	2h 30mins
Total Marks	90	90	120
Weighting of A level	30%	30%	40%
AS topics	1, 2 and 3	1, 4 and 5	All
A level topics	6, 7 and 8	9, 10, 11, 12 and 13	All 50% practical

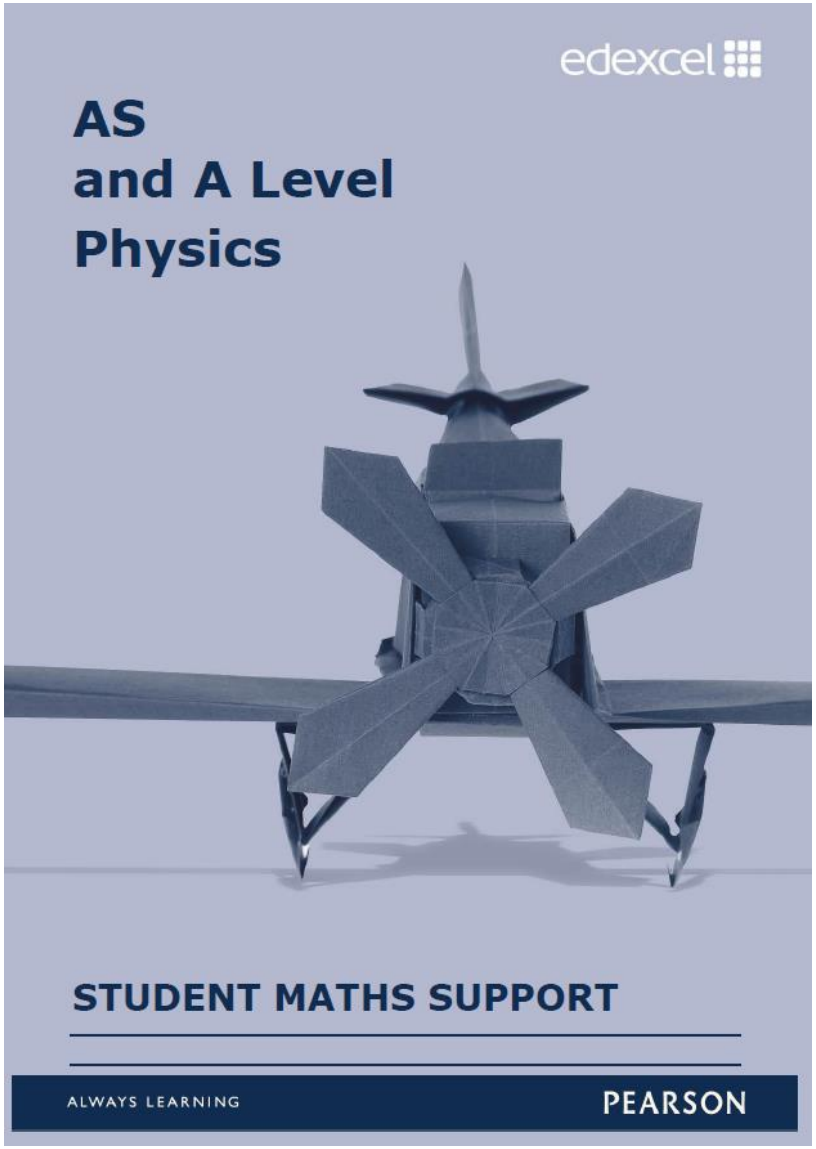
Assessment objectives

Students must:		% in GCE
AO1	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures	31–33
AO2	Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: • in a theoretical context • in a practical context • when handling qualitative data • when handling quantitative data	41-43
AO3	Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to: • make judgements and reach conclusions • develop and refine practical design and procedures	25-27
	Total	**100%**

Paper	AO1	AO2	AO3	Total for all Assessment Objectives
Paper 1: Advanced Physics I	11–13%	12–14%	5–7%	30%
Paper 2: Advanced Physics II	11–13%	12–14%	5–7%	30%
Paper 3: General and Practical Principles in Physics	8–10%	16–18%	13–15%	40%
Total for this qualification	**31–33%**	**41–43%**	**25–27%**	**100%**

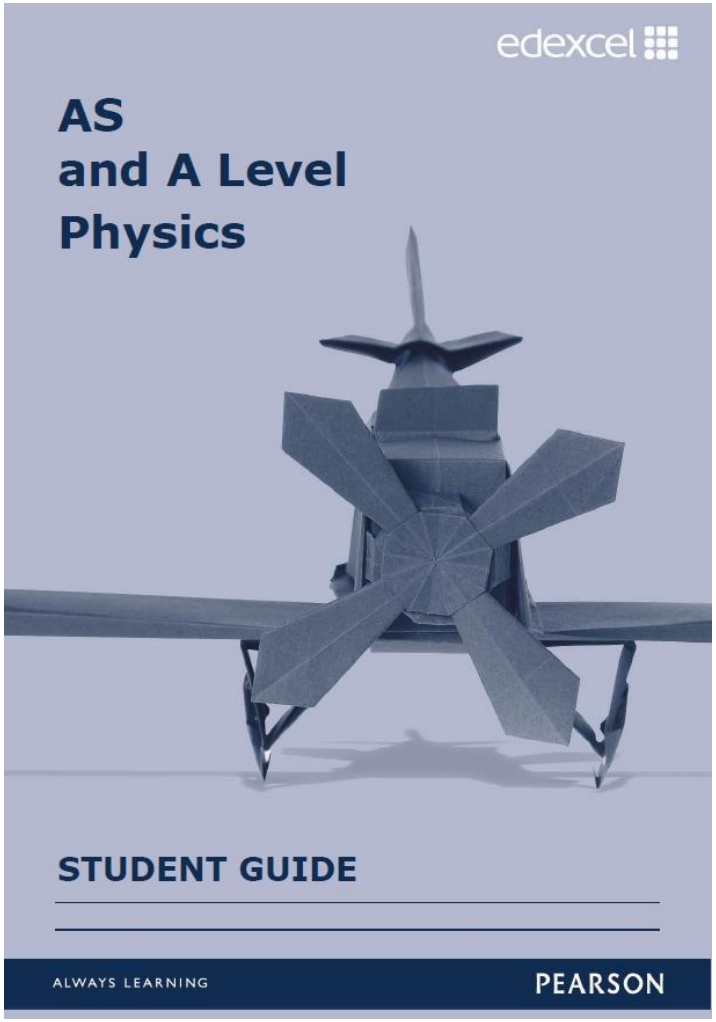
Assessing maths skills

- 40% of the total marks relate to maths skills spread across all 3 papers.
- The level of maths required is equivalent to GCSE Higher Tier maths, i.e. level 2
- Skill areas tested are in Appendix 6 of the specification and cover:
  - Arithmetic and numerical computation
  - Handling data
  - Algebra
  - Graphs
  - Geometry and trigonometry
- W07 Maths Guide



Assessing practical skills

- At least 15% of the marks assess practical skills in paper 3 only.
- Skill areas assessed are in Appendix 5a
  - to write a plan, or comment on or improve an example
  - select and justify choice of apparatus
  - comment on safety
  - plot a graph and analyse the data
  - calculate uncertainties
  - review results and outcomes
- Appendix 10: Uncertainties and Practical Work
- W08 Practical Guide
- International A level papers



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Activity 3

Question types

Papers are designed so that questions ramp up in difficulty through the paper. Types of question include:

- Multiple Choice
  - four responses, one correct
  - only one aspect is tested
- Short answer
  - calculation or short explanation
  - derivation
- Long answer
  - less-structured calculations
  - extended open response (identified with a *)
  - indicative content and linkage marks

Command words

Each question begins with a command word, e.g. describe, explain etc. The definitions of command words are in Appendix 7 of the specification.

- Command words that need a conclusion include:
  - Assess
  - Criticise
  - Deduce
  - Determine (whether)
  - Evaluate
  - Justify
- Students may also need to “Derive” a formula.

Example – calculation

15 In 2015 the Messenger spacecraft crashed into the surface of the planet Mercury after four years in orbit observing the surface of Mercury.

Messenger's orbit was highly elliptical, varying between 200 km and 15 000 km above the surface of Mercury. Messenger completed one full orbit every 12 hours.

mass of Messenger spacecraft = 565 kg
mass of planet Mercury = 3.30×10^{23} kg
radius of planet Mercury = 2430 km

(a) It has been suggested that the same orbital period of about 12 hours could have been achieved if Messenger was in a circular orbit 7690 km above the surface of Mercury.

(i) Determine whether this suggestion is correct.

(4)

- use of $F = Gm_1m_2/r^2$ **and** use of $F = mr\omega^2$
  Or use of $F = Gm_1m_2/r^2$ **and** use of $F = mv^2/r$ **(1)**
- use of $T = 2\pi/\omega$ **Or** use of $T = 2\pi r/v$ **(1)**
- T = 12 hours
  Or F = 120 N by gravitational approach and centripetal force approach
  Or $\omega = 1.45 \times 10^{-4}$ radians s^{-1} by gravitational approach and circular motion approach
  Or height of orbit = 7700 km **(1)**
- Comparative statement consistent with their value(s) **(1)**

MP3 and 4 - for force and angular velocity, both approaches required

Example of calculation
$T^2 = 4\pi^2r^3 / G m_1$

$T^2 = 4\pi^2 \times (2\,430\,000\text{ m} + 7\,690\,000\text{ m})^3 / 6.67 \times 10^{-11}$ N m^2 $kg^{-2} \times 3.30 \times 10^{23}$ kg

T = 43115 s = 11.98 hours

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Activity 4

Example 1

(4)

$mr\omega^2 = \frac{GMm}{r^2} \Rightarrow r\left(\frac{2\pi}{T}\right)^2 = \frac{GM}{r^3} \Rightarrow \frac{4\pi^2}{T^2} = \frac{GM}{r^3}$

$\frac{T^2}{4\pi^2} = \frac{r^3}{GM} \Rightarrow r^3 = \frac{GMT^2}{4\pi^2} \quad T^2 = \frac{4\pi^2 r^3}{GM}$

$r^3 = 6.67\times10^{-11} \times 3.30\times10^{23} \times$

$T^2 = \frac{4\pi^2 \times (7690\times10^3)^3}{6.67\times10^{-11} \times 3.3\times10^{23}}$

$T = 28559\text{s} = 7.93 \text{ hours.}$

$\Rightarrow$ Suggestion is incorrect.

ResultsPlus
Examiner Comments

In this response the relevant formulae have been combined before substitution. An incorrect value for *r* has been used, ignoring the planetary radius, so the 'use of' marks have been awarded, but not the mark for the final answer. There is a correct conclusion based on the value obtained, but it has not been compared directly with 12 hours, so the final mark is not awarded, giving a total mark of 2.

ResultsPlus
Examiner Tip

When you are asked to 'determine whether' certain conditions are met, you must make a clear statement, including any values being compared.

Example 2

$F = \frac{GMm}{r^2} = \frac{mv^2}{r}$ $\frac{GM}{r} = v^2$ $v^2 = (\omega r)^2 = \frac{4\pi^2 r^2}{T^2}$ (4) $GM = 4\pi^2$

$\frac{GM}{r} = \frac{4\pi^2 r^2}{T^2}$ $T = \sqrt{\frac{4\pi^2 r^3}{GM}}$

$\therefore T = \sqrt{\frac{4\pi^2 \times [(2430 + 7690) \times 10^3]^3}{6.7 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2} \times 3.3 \times 10^{23}}} = 4.31 \times 10^4 \text{ s}$

$\frac{4.31 \times 10^4}{60 \times 60} = 12.0$ hours.

$12.0 = 12.0$ $\therefore$ this suggest is correct.

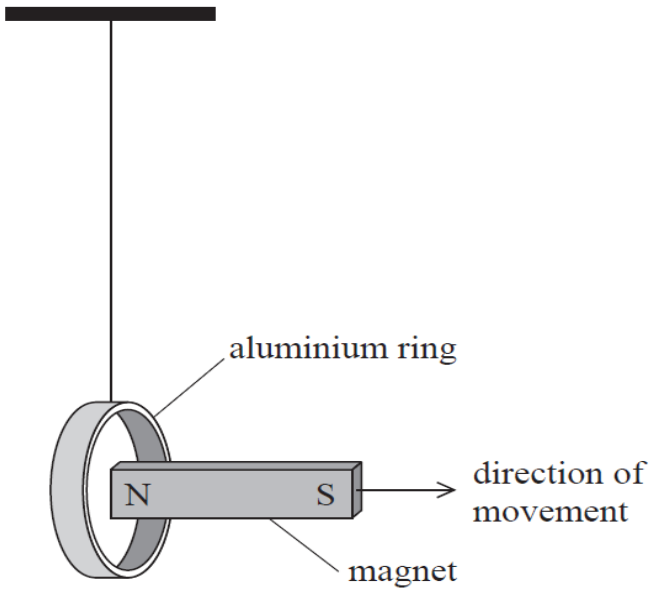
ResultsPlus
Examiner Comments

4 marks out of 4 awarded for the correct calculation of the answer and a correct conclusion including a direct comparison of the values.

Example – extended open response

*(c) A linear induction motor provides the force to accelerate the train forwards. A current flows in sequence through coils of wire mounted in the track. The train is dragged along as the magnetic field progresses along the coils of wire in the track. This is similar to moving a permanent magnetic field away from a conductor.

A teacher demonstrates this effect by quickly removing one end of a bar magnet from a suspended aluminum ring.



When the magnet is removed from the ring, the ring moves in the same direction as the magnet.

Explain, using the laws of electromagnetic induction, why the ring moves in the direction of the magnet.

(6)

Extended open response mark scheme

***10(c)**

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 table shows how the marks should be awarded for indicative content and structure and lines of reasoning.

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

	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:

1. Removing the magnet from the ring changes the magnetic flux (linked with the ring)
2. This induces an e.m.f. (in the ring)
3. E.m.f. causes a current in the ring
4. Which produces a magnetic field
5. The magnetic fields interact/combine
6. This opposes the change, causing an attractive force to act

IC Points	IC Mark	Max linkage mark avail.	Max final mark
6	4	2	**6**
5	3	2	**5**
4	3	1	**4**
3	2	1	**3**
2	2	0	**2**
1	1	0	**1**
0	0	0	**0**

IC1: accept references to flux cutting

Alternative indicative content for IC4 – IC5

4. The current is in the magnetic field produced by the magnet
5. The current experiences a magnetic force

6

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Activity 5

Example 3

When the north end of the bar magnet is moved quickly through the ring, it induces an e.m.f in the ring. This induces a current and a magnetic field in the ring. Due to Lenz's law, the direction of the force of the magnetic field of the ring opposes that that moved it (north side of the bar). Therefore, it moves in the direction of the South pole of the magnet, which is the direction the magnet is moving.

ResultsPlus
Examiner Comments

This response omits any reference to changes in flux linkage, although indicative content points 2 through to 5 are included. 4 indicative content points gives a mark of 3 for content. The lack of a clear argument (no starting point and no end point) means that no linkage marks are justified. and so this response scores 3 marks.

Example 4

- The movement of the magnet causes a changing magnetic flux which induces an emf in the ring
- The induced emf causes a current in the ring producing its own magnetic field
- The two magnetic fields will oppose eachother due to Lenz's law
- This means the ring is attracted to the magnet
- As the magnet keeps moving the attraction causes the ring to follow it

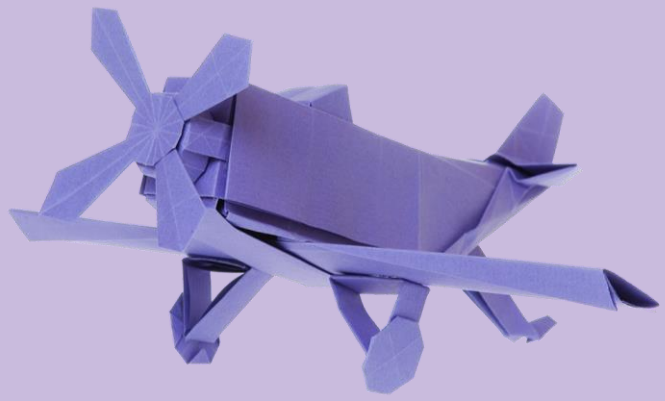
ResultsPlus
Examiner Comments

This is a good answer to the question. All 6 indicative content points are made, giving a mark of 4 for content. The logical flow of the argument is good enough for both linkage marks to be given.

Free support

- Exemplars with commentaries
- Sample assessment materials
- Two sets of specimen papers
- Mock papers
- All past papers
- Examiner's Reports written on previous examinations
- International A level practical exam papers (WPH13 for AS and WPH16 for A2)
- examWizard
- ResultsPlus
- FREE Access to Scripts service

Practical work



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In this session…..

We will be looking at:

- the Core Practicals and their purpose
- support through worksheets and practical guides
- tracking CPAC using the tracking spreadsheet

Practical assessment – two elements

1. Assessment in written papers

2. The Practical Endorsement

- Common to all Awarding Boards
- ‘Stand-alone’ qualification
- Assessed by teachers observing practical work in the lab
- Common Practical Assessment Criteria (CPAC) covers Appendix 5b

Purpose of the 16 core practicals

- Develop knowledge and understanding of Physics concepts
- Develop investigative skills

  Planning, implementing, analysis, drawing conclusions, evaluating methods and data

- Develop practical skills

  Using apparatus and techniques, working safely

- Provide coverage of CPAC criteria for Practical Endorsement

CPAC criteria

CPAC 1: **Follows written procedures**	a) Correctly follows instructions to carry out the experimental techniques or procedures.
CPAC 2: **Applies investigative approaches and methods when using instruments and equipment**	a) Correctly uses appropriate instrumentation, apparatus and materials (including ICT) to carry out investigative activities, experimental techniques and procedures with minimal assistance or prompting. b) Carries out techniques or procedures methodically, in sequence and in combination, identifying practical issues and making adjustments when necessary. c) Identifies and controls significant quantitative variables where applicable, and plans approaches to take account of variables that cannot readily be controlled. d) Selects appropriate equipment and measurement strategies in order to ensure suitably accurate results.
CPAC 3: **Safely uses a range of practical equipment and materials**	a) Identifies hazards and assesses risks associated with these hazards, making safety adjustments as necessary, when carrying out experimental techniques and procedures in the lab or field. b) Uses appropriate safety equipment and approaches to minimise risks with minimal prompting.
CPAC 4: **Makes and records observations**	a) Makes accurate observations relevant to the experimental or investigative procedure. b) Obtains accurate, precise and sufficient data for experimental and investigative procedures and records this methodically using appropriate units and conventions.
CPAC 5: **Researches, references and reports**	a) Uses appropriate software and/or tools to process data, carry out research and report findings. b) Sources of information are cited demonstrating that research has taken place, supporting planning and conclusions.

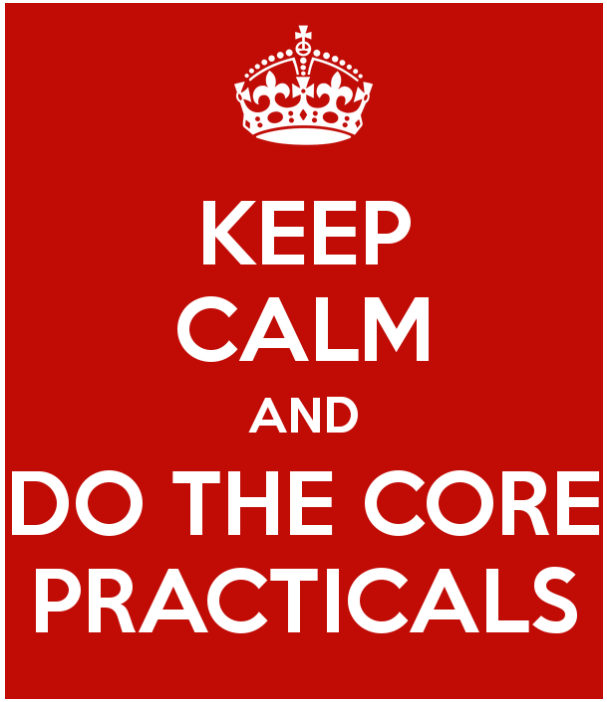
Tracking progress through CPAC

CPAC tracking Spreadsheet

- Free to download and use – no licence required
- Track your students for each practical or criteria
- Overview of student performance
- Add further practicals
- Change the criteria assessed and add notes

Supporting you through CPAC

- W09 CPAC and 5c mapping
- Comparison to AQA/OCR
- W08 Practical Guide
- W10 CPAC evidence
- Worksheets for each practical
- W12 Pen Portraits
- Lead Teacher Guide and training
- Tracking spreadsheet
- Lead Monitor report
- Monitoring visit



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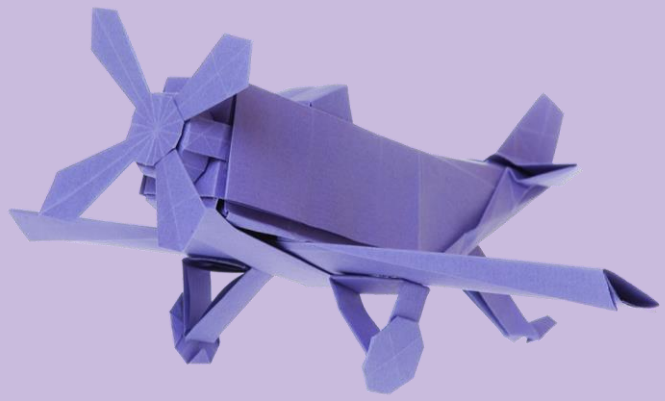
Activity 6

Review of support



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Free support on website

- Planning and delivery
  - *mapping documents*
  - *course planner*
  - *schemes of work*
  - *course guides*
- Preparing for practical work
  - *CPAC criteria*
  - *guidance*
  - *tracking support*
  - *mapping documents*
  - *worksheets*
  - *resources for developing investigative skills*

Free support on website

- Teaching and learning
  - *Topic guides*
  - *Developing Maths skills*
- Assessment and tracking progress
  - *Exemplars, specimens and mocks*
  - *past exam papers*
  - *Examiner's reports*
  - *examWizard*
  - *ResultsPlus*
- Training
  - *Live and pre-recorded events (paid for)*
  - *Local network events (free)*
  - *Previous training materials*

Tracking progress - ResultsPlus

- Free online service
- Instant and detailed analysis of performance
- Students' scores for every exam question
- Comparison with Edexcel national averages
  https://qualifications.pearson.com/en/support/ServitsPlus.html

- Free Access to Scripts service

Free online support

- Subject Advisor - Irine Muhiuddin

  Twitter: @PearsonSciences
  Email or live chat
  e-updates - complete this online form

- Ask the expert service

- Subject pages/communities

  Our own online community especially for Science teachers.
  IoP Talk Physics
  PTNC
  University of York SHAP page

The root of all assistance is the Edexcel Physics subject website:

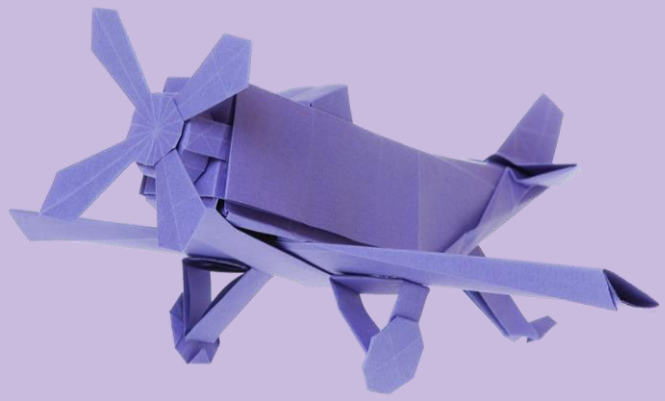
http://qualifications.pearson.com/en/qualifications/edexcel-a-levels/physics-2015.html

Endorsed resources

- **Hodder**: Year 1 and 2 textbooks, with practical skills summaries, exam practice questions and a dedicated ‘Maths in Physics’ chapter.
- **Pearson**: Year 1 and 2 textbooks, with support for synoptic understanding, exam practice, Maths and practical skills (repeated for SHAP approach). Also Laboratory books.
- **Pumpkin Interactive**: video/DVD resources on energy production and transmission; and electromagnetic induction.

It is not necessary to purchase endorsed resources to deliver our qualifications.

Next steps



Next steps

- Bookmark the A level Physics page:

https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/physics-2015.html

- Sign up to receive update emails:

scienceteamupdates@pearson.com

- Look out for further training.
- Investigate resources from different publishers.

Find out more

For more courses see our Pearson Professional Development Academy.

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