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A-level physics

New specifications

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The new A-levels: the headlines

All the exam boards have used the change in curriculum as an opportunity to provide new specifications which, on the whole, build on what has gone before. Think evolution, not revolution. The core subject criteria developed by Ofqual / DfE have changed very little.

The main change for A-level physics is the removal of controlled assessment and the introduction of required practicals.

All the exam boards (with the exception of Eduqas) have made their AS and A-level physics specifications co-teachable.

The assessment objectives

There are still three assessment objectives (AOs) in the new A-level physics specifications. However, 'How Science Works' is no longer a separate AO. It has become referred to as 'working scientifically' and is expected to be embedded throughout the course. The new AOs are:

- **AO1** Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures. (30–35% of the marks)
- **AO2** Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: in a theoretical context, in a practical context, when handling qualitative and quantitative data. (40–45% of the marks)
- **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. (25–30% of the marks)

Quantitative skills

- A-level physics has always made extensive use of mathematical skills in examinations. The new specifications must ensure that they have a weighting of 40% (or more) for mathematical skills. These mathematic skills must be at least Level 2 standard. This means that they are skills which should have previously been encountered by students who have obtained a GCSE mathematics qualification at grades A*–C. The mathematical skills will be assessed in the context of relevant physics.
- Although this level and amount of explicit mathematics sounds daunting at first, a quick analysis of past papers will show that most Physics papers already contain the appropriate amount of maths ([SCORE, 2010](#)). However, it is likely that there will be more use of multi-step calculations than previously.

Practical assessment

- The major change for A-level physics is the removal of controlled assessment. This has been of concern to organisations such as the Royal Society and SCORE, but has on the whole been welcomed by teachers of A-levels. It offers the opportunity to routinely embed practical work throughout the course, rather than spending time on a single controlled assessment.
- Practical skills will now be teacher assessed throughout the 2-year course. A minimum of 12 practicals (6 at AS) will be carried out by each student. This assessment will result in a practical endorsement which will not be part of the final A-level grade but will be reported on the A-level certificate.
- The intention is for students to develop their practical skills and gain an understanding of experimental techniques used in physics. It is likely that the majority of students will pass the practical endorsement. Universities have not, as yet, made clear their intentions about the acceptance of the practical endorsement and whether it will form part of entrance requirements.
- The practical skills are defined by Ofqual, e.g. they must include measurements taken using ionising radiation, but the exam bodies have been able to produce their own list of practicals. However, teachers are not limited to use only these 12 practicals and it is to be hoped that more practical work will be carried out during a typical A-level course.
- The exact form that the endorsement will take has yet to be decided. All exam boards are currently working together to trial a number of approaches. The final practical endorsement will be common to all the exam boards.
- Practical work WILL be assessed in the final examinations, with up to 15% of the marks covering practical techniques, data analysis, evaluation and justifying conclusions.

The new specifications: content and skills

What stays the same and what changes?

- For every specification the DfE/Ofqual subject criteria specify approximately 60% of the subject content that must be covered. The other 40% allows for applications and implications of science and the development of scientific ideas and different areas of study.
- The main changes to the subject criteria are the inclusion of mechanical properties of matter (stress, strain, Young modulus) and explicit use of radians and angular velocity. However, previous specifications did generally include these topics.
- Much of the broad content remains the same for each exam board, with small changes to update and revise topics.
- All the exam boards have included a new module based on the development of practical skills. This is not necessarily to be taught as a separate topic, but incorporated throughout the 2 years of the course.

AQA	Pearson Edexcel	OCR (A)	OCR (B) Advancing Physics
<p>New topic: Measurement and their errors</p> <p>New option: Electronics</p>	<p>New topic: Working as a physicist</p>	<p>New module: Development of practical skills in physics. Retains reference to 'How science works'</p>	<p>New module: Development of practical skills in Physics. Retains reference to 'How science works'</p>
<p>1 Measurement and their errors</p> <p>2 Particles and radiation</p> <p>3 Waves</p> <p>4 Mechanics and materials</p> <p>5 Electricity</p> <p>6 Further mechanics and thermal physics</p> <p>7 Fields and their consequences</p> <p>8 Nuclear physics</p> <p>Options: A. Astrophysics B. Medical physics C. Engineering physics D. Turning points in physics E. Electronics</p>	<p>For SHAP approach</p> <p>1 Working as a physicist</p> <p>2 Higher, faster, stronger</p> <p>3 The sound of music</p> <p>4 Good enough to eat</p> <p>5 Technology in Space</p> <p>6 Digging up the past</p> <p>7 Spare-part surgery</p> <p>8 Transport on track</p> <p>9 The medium is the message</p> <p>10 Probing the heart of matter</p> <p>11 Build or bust</p> <p>12 Reach for the stars</p> <p>Content covered is the same for both approaches. The</p>	<p>1 Development of practical skills in physics</p> <p>2 Foundations of physics</p> <p>3 Forces and motion</p> <p>4 Electrons, waves and photons</p> <p>5 Newtonian world and astrophysics</p> <p>6 Particles and medical physics</p>	<p>1 Development of practical skills in physics</p> <p>2 Fundamental data analysis</p> <p>3 Physics in action</p> <p>4 Understanding processes</p> <p>5 Rise and fall of the clockwork universe</p> <p>6 Field and particle physics</p>

	module titles and content depends on approach chosen		
12 required practicals are given in the specification. Examination questions set based on the assumption that all these have been carried out	16 required practicals are given in the specification	12 practical activity groups are given. Suitable practicals are suggested, and more will be available on OCR website. Teachers can submit their own practicals as long as they meet the skills for that practical activity group	12 practical activity groups are given. Suitable practicals are suggested, and more will be available on OCR website. Teachers can submit their own practicals as long as they meet the skills for that practical activity group.
The only specification to offer option topics. Students / teachers study one from five.	Topics presented in two ways: context led (SHAP) and concept led.	The practical activity groups are common across both OCR specifications	Pre-release materials used as part of the assessment at the end of the course. Encourages reading about science.

The new specifications: assessment

- Assessment will in three exams taken at the end of the 2-year course. AS exams may be taken, but they will not count towards the A-level.
- All exam boards have gone for a three-exam structure. In general, papers 1 and 2 cover the topics, and paper 3 covers the written practical assessment and synoptic aspects of the course.
- All exam boards have also included multiple choice questions (MCQ) in at least one of their papers.

AQA	Edexcel	OCR A	OCR B (Advancing physics)
Paper 1 <ul style="list-style-type: none"> • 85 marks, 2 hours • includes 25 MCQ Paper 2 <ul style="list-style-type: none"> • 85 marks, 2 hours • includes 25 MCQ Paper 3 <ul style="list-style-type: none"> • 80 marks, 2 hours • Section A: practical skills and data analysis (45 marks) • Section B: Option topic (35 marks) 	Paper 1 <ul style="list-style-type: none"> • 90 marks, 1 hr 45 min • includes MCQ. (10 in SAMs) Paper 2 <ul style="list-style-type: none"> • 90 marks, 1 hr 45 min • includes MCQ (10 in SAMs) Paper 3 <ul style="list-style-type: none"> 120 marks, 2 hr 30 min The exam papers are common for both approaches.	Paper 1 <ul style="list-style-type: none"> • 100 marks, 2 hr 15 min • includes 15 MCQ Paper 2 <ul style="list-style-type: none"> • 100 marks, 2 hr 15 min • includes 15 MCQ Paper 3 <ul style="list-style-type: none"> • 70 marks, 1 hr 30 min 	Paper 1 <ul style="list-style-type: none"> • 110 marks, 2 hr 15 min • includes 30 MCQ Paper 2 <ul style="list-style-type: none"> • 100 marks, 2 hr 15 min • Section C: advance notice article questions. Paper 3 <ul style="list-style-type: none"> • 60 marks, 1 hr 30 min

What the REVIEW provides for the new specifications

Content

Articles provide a broad coverage of the specified content within a range of contexts. Forthcoming articles include:

- *Supersonic skydive* (free fall, buoyancy, modelling)
- *Rail stress* (mechanical and thermal properties of solids)
- *Touch screen* (capacitance and electric field)
- *Trojan asteroids* (gravitation and orbital motion)

Quantitative skills

- *Mathskit* in each issue focuses on maths techniques in physics
- Boxes within articles show how maths is used in physics
- *Exam Talkback* gives advice on using maths to answer exam questions

Independent learning

- Archive point 1 – PA will provide
- Archive point 2 – PA will provide
- Archive point 3 – PA will provide



Assessment

- Exam technique: *Exam Talkback* in each issue presents examiners' advice and comments on students' answers
- Revision: *At a Glance* provides a concise overview of a topic; *Online* points to some of the best websites; *Crossword* is a fun test of broad physics knowledge
- Practical endorsement: a new series *The Skilful Physicist* supports the development of experimental skills

Stretch and challenge

- Applications: exploring and explaining physics in novel situations
- Synoptic material: bringing together physics from more than one content area
- Going deeper: boxes that go more deeply into the concepts

Excitement

- Articles about modern applications of physics provide the 'wow factor'.
- Forthcoming articles include:
 - *Landing on a comet*: the physics behind the 2014 Philae lander
 - *Planet energy*: can comparing the 'energy budget' of Earth and other planets help us understand climate change?
 - *Dowsing for explosives*: how evidence from physicists helped convict the makers of a fake bomb detector

CPD events that put you in the picture

- Content from PA
- Content from PA
- Content from PA

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