

International AS/A Levels

Science: Biology, Chemistry & Physics



First teaching September 2018

Choosing Pearson Edexcel as your school's International AS/A Level (IAL®) partner

Equipping your students to reach the world's best universities and compete for global employment opportunities will happen throughout their school life, but is even more key when it comes to choosing their International A Levels. We want to reassure you that with Pearson as your qualifications partner, you can be certain both you and your students are setting yourselves up for future success.

In this guide, you'll learn more about who we are, the recognition and progression our Pearson Edexcel International qualifications enjoy, and we'll take a closer look at International A Level Science.

We wish you the best of success for your International Advanced Level journey!

IAS = International Advanced Subsidiary.
IAL® = International Advanced Level.
IAL is a registered trademark of Pearson Education Ltd in the UK and other countries.

Pearson Edexcel IAL® qualifications are available to students attending International Schools (outside the UK) and any students attending Online Schools. They are not available to schools in the UK, the Channel Islands, the Isle of Man or in British Armed Forces schools overseas.



Inside this guide

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Key International Advanced Level Science highlights



Modular approach

Learn about the popular modular approach to Pearson Edexcel International A Levels, which gives students the flexibility to sit examinations when they feel fully prepared and ready.

See page 10

"It's been my dream to attend a world-renowned university. Pearson Edexcel IALs have given me a solid academic foundation for further studies."

Fei Xue, University College London

Welcome to Pearson

We're pleased to meet you!

Pearson is the world's leading learning company. We provide world class qualifications, assessments, digital content and learning experiences to international schools all over the world to enable more effective teaching and learning and to help learners increase their skills and global employability prospects.

We partner with more than 6,500 schools, universities, and employers worldwide:

- **at school level**, to offer Pearson Edexcel International and UK qualifications to over 3.5 million students annually;
- **at university level**, to ensure Pearson Edexcel qualifications are recognised and accepted by universities all over the world;
- **and with employers**, by building 21st century skills into our qualifications at the outset, to ensure learners have transferable skills alongside the knowledge they need to progress into the careers of their choice.

Our qualifications heritage stretches back over 150 years

Pearson's qualifications heritage stretches back over 150 years, our qualifications are offered in over 100 countries worldwide and we mark over 10 million exam scripts per year on behalf of the UK Department for Education.

Pearson Edexcel is regulated by Ofqual, ensuring our curricula meet the highest standards and our exams follow carefully controlled procedures at every stage of their development, delivery, marking and reporting.

As the largest exam board in the UK, Pearson Edexcel regularly achieves the highest marking accuracy of all UK boards.

What this means for you

You can trust Pearson Edexcel International Advanced Level qualifications. Thousands of students around the world take these same qualifications every year, progressing from our popular International GCSEs and on to the world's most respected universities.

"Cambridge Colleges welcome applications from those taking International A Levels... and these are recognised as equivalent to UK Board AS and A Levels."

The University of Cambridge



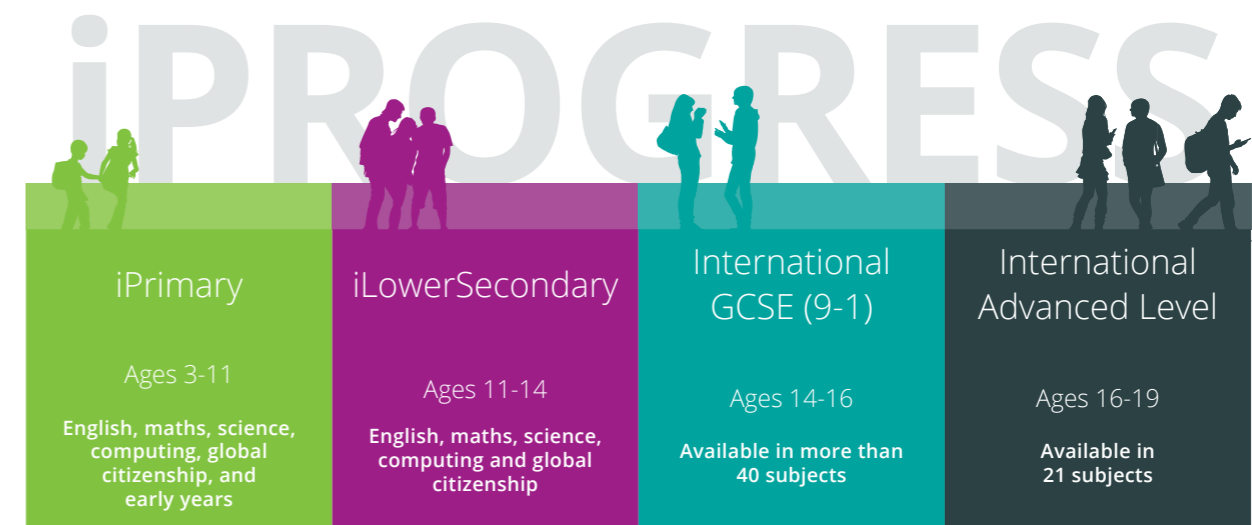
Modern, progressive International A Level qualifications

For globally minded learners aged 16 - 19

Renowned across the world for academic excellence, Pearson Edexcel International Advanced Levels provide learners with the skills and knowledge they need to progress onto the most prestigious universities across the world.

Pearson Edexcel International Advanced Levels are part of iProgress, our complete series of academic qualifications for 3 to 19 year-old learners at international schools following a UK curriculum.

At every stage, our iProgress continuum delivers a consistent learning journey with world class support, assessments and teaching and learning resources for students and teachers, everywhere in the world.



Qualifications for globally minded learners

Introducing Pearson Edexcel International AS/A Levels

Pearson Edexcel International AS/A Levels, also known as Advanced Subsidiary Level/Advanced Levels, have been developed in consultation with the international school community specifically for international learners.

They take the popular and flexible modular approach* where exams are taken at the end of each unit of study, throughout the programme of study when a student feels prepared and ready, or all together at the end of the course. This flexibility, together with exam series in January, June and October, for most subjects, means that students have more opportunities to get feedback to improve their performance and get the grade they need to progress.

Available in 21 popular subjects, they offer progression from International GCSEs, and are comparable to the linear UK A Level, equipping students for progression to university and employment.

*for all subjects except Law

World class assessment design for international students

Pearson Edexcel qualifications go through a rigorous world class assessment design process, which ensures that the content is relevant for international learners, and that there is a clear and consistent relationship between command words, marks and skills. With logical progression of difficulty throughout and consistency in template and design, our question papers are clear and provide suitable challenge and support for students of all abilities.

“I wanted to study subjects that were relevant to a future career. Pearson Edexcel iAL provides learners with a firm knowledge base.”

Nasim Mirzajani, now studying Chemical Engineering at Yale University, USA



Recognised worldwide for academic excellence

Opening doors to the world's best universities

Pearson Edexcel sets the standard for worldwide recognised qualifications aligned to the British educational system. Accepted by over 650 higher education institutions across the world – including top universities such as Oxford, Cambridge, Columbia University and Yale University – and with 21st century skills embedded in the curriculum, you can be confident students will have qualifications, skills and knowledge that admissions teams and employers are looking for.

Read about some of our IAL learner journeys with Pearson Edexcel [here](#).

Learn more at qualifications.pearson.com/progress-to-uni

Comparability with GCE AS/A Level

International A Levels (IAL®) are comparable to the UK A Level, as confirmed by UK ENIC, the national agency responsible for providing information and expert opinion on qualifications and skills worldwide. See the table below for a comparison. The same rigorous standards are applied to all Pearson Edexcel qualifications.

	Pearson Edexcel GCE AS Level (UK AS Level)	Pearson Edexcel International AS Level (IAS)	Pearson Edexcel GCE A Level (UK A Level)	Pearson Edexcel International A Level (IAL®)
Structure	Linear (all exams taken at the end of a one year programme) Standalone qualification and no longer contributes to GCE A Level grades	Modular and flexible structure with all units examined Contributes 50% to the IAL grade or can be a standalone qualification	Linear (all exams taken at the end of a 2 year programme)	Modular and flexible structure with all units examined Typically studied over a 2 year period
Assessment	Mainly examination based* May/June examinations only	100% examination based Examinations in January, May/June and October	Mainly examination based* May/June examinations only	100% examination based Examinations in January, May/June and October
Grading	A – E		A* – E	
Regulator	Regulated by Ofqual	Regulated by Pearson and confirmed by UK ENIC to be comparable to UK AS standard	Regulated by Ofqual	Regulated by Pearson and confirmed by UK ENIC to be comparable to UK A Level standard

*Other types of assessment used only where needed to test essential skills.

Pearson Edexcel International A Level Science Qualifications

Supporting confidence, knowledge and skills in science

Student confidence to sit exams

Practical skills are assessed through a dedicated examination unit, both at AS (Unit 3) and at A Level (Unit 6), instead of in a scheduled practical lab work exam, allowing more flexibility for when to embed and deliver practical work.

Breadth and depth

There are a range of question types in all exams, testing breadth of knowledge, as well as allowing depth of understanding to be examined.

Developing mathematical skills

Students develop and use a range of mathematical skills that support their knowledge and understanding. Teachers will know the minimum number of marks awarded to maths skills across the papers.

Accessible examination papers

At Pearson Edexcel, we develop our examination papers over a two-year period. The papers go through a rigorous world class assessment design process, which ensures that the content is relevant for international learners, and there is a clear and consistent relationship between command words, marks and skills. With logical progression of difficulty throughout and consistency in template and design, our question papers are clear and provide suitable challenge and support for students of all ability ranges.

IAS results contribute to IAL grade

International AS qualifications can be taken separately as a stand alone qualification, or used as a stage on the way to completing an International Advanced Level qualification. This provides international schools and learners with greater choice and flexibility to meet their needs and aspirations.

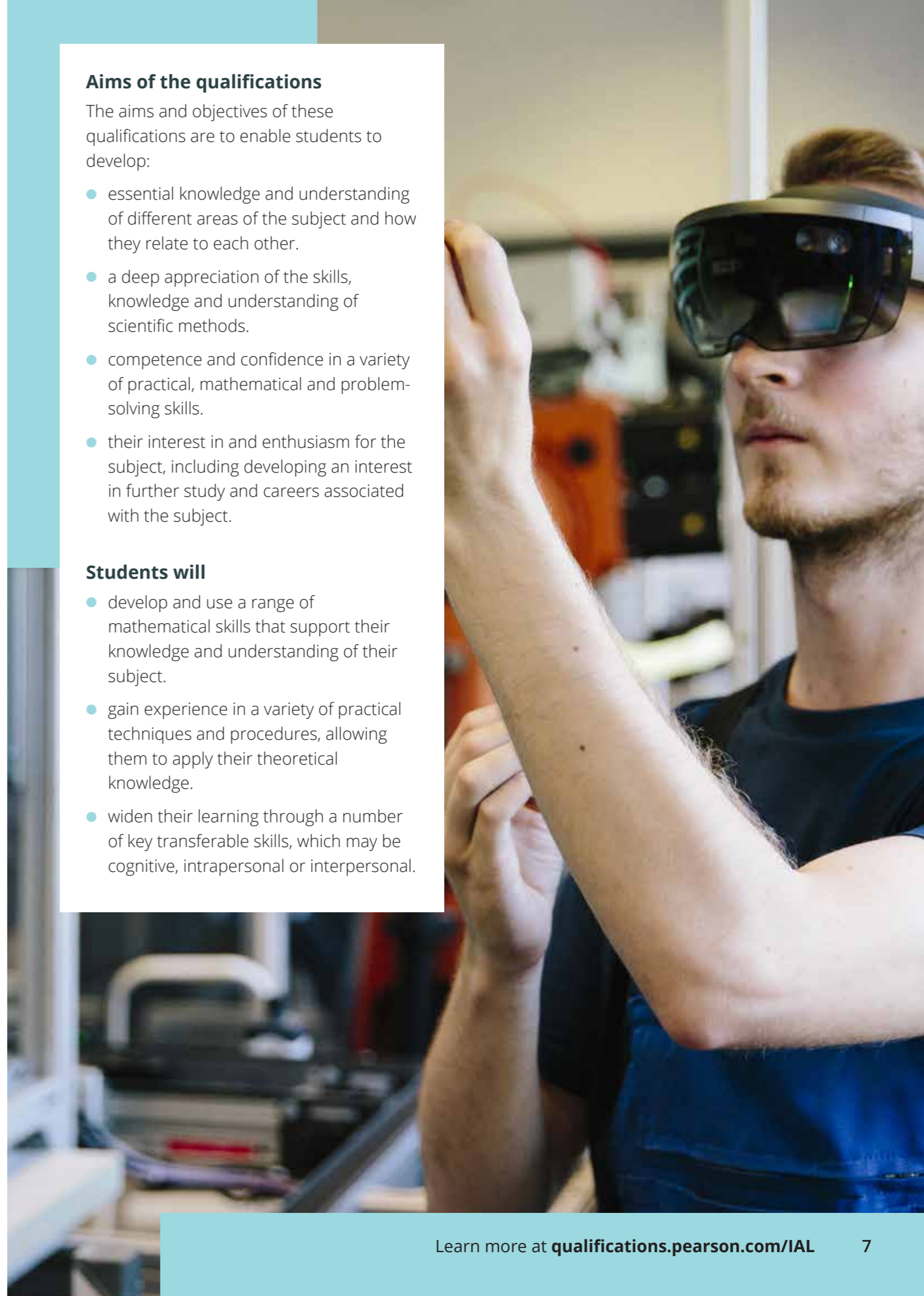
Aims of the qualifications

The aims and objectives of these qualifications are to enable students to develop:

- essential knowledge and understanding of different areas of the subject and how they relate to each other.
- a deep appreciation of the skills, knowledge and understanding of scientific methods.
- competence and confidence in a variety of practical, mathematical and problem-solving skills.
- their interest in and enthusiasm for the subject, including developing an interest in further study and careers associated with the subject.

Students will

- develop and use a range of mathematical skills that support their knowledge and understanding of their subject.
- gain experience in a variety of practical techniques and procedures, allowing them to apply their theoretical knowledge.
- widen their learning through a number of key transferable skills, which may be cognitive, intrapersonal or interpersonal.



Biology, Chemistry & Physics: a closer look

Exams
in January,
June and
October

Each specification covers the subject's major topics, including practical skills

Containing up to date and engaging content, the Pearson Edexcel International Advanced Level qualifications in Biology, Chemistry and Physics are designed to enhance students' future educational and employment prospects.

Learners will develop knowledge and understanding of their subject by applying the concepts in the specifications to a range of different problems, set in a variety of contexts.

Problems will require the application of mathematical skills. Core practical activities are embedded throughout the course, allowing students to link theoretical knowledge and understanding to practical scenarios. There is no practical lab examination — practical skills are assessed by exam. Centres are encouraged to include additional practical activities to develop students practical skills further, if possible.

An International Advanced Subsidiary qualification can be claimed as a discrete qualification on completion of the three International Advanced Subsidiary units (Units 1, 2 and 3). The International Advanced Level qualification can be claimed on completion of all six units in the specification.

100%
externally
assessed

Pearson Edexcel International Advanced Level Biology

Unit	Unit code:	% of the qualification	% of the total IAL	Examination duration	Marks available
Unit 1: Molecules, Diet, Transport and Health	WBI11/01	40% of IAS	20%	1 hr 30 mins	80 marks
Unit 2: Cells, Development, Biodiversity and Conservation	WBI12/01	40% of IAS	20%	1 hr 30 mins	80 marks
Unit 3: Practical Skills in Biology I	WBI13/01	20% of IAS	10%	1 hr 20 mins	50 marks
Unit 4: Energy, Environment, Microbiology and Immunity	WBI14/01	40% of IA2	20%	1 hr 45 mins	90 marks
Unit 5: Respiration, Internal Environment, Coordination and Gene Technology	WBI15/01	40% of IA2	20%	1 hr 45 mins	90 marks
Unit 6: Practical Skills in Biology II	WBI16/01	20% of IA2	10%	1 hr 20 mins	50 marks

For further information and to download the specification, visit qualifications.pearson.com/ialbiology2018

Pearson Edexcel International Advanced Level Chemistry

Unit	Unit code:	% of the qualification	% of the total IAL	Examination duration	Marks available
Unit 1: Structure, Bonding and Introduction to Organic Chemistry	WCH11/01	40% of IAS	20%	1 hr 30 mins	80 marks
Unit 2: Energetics, Group Chemistry, Halogenoalkanes and Alcohols	WCH12/01	40% of IAS	20%	1 hr 30 mins	80 marks
Unit 3: Practical Skills in Chemistry I	WCH13/01	20% of IAS	10%	1 hr 20 mins	50 marks
Unit 4: Rates, Equilibria and Further Organic Chemistry	WCH14/01	40% of IA2	20%	1 hr 45 mins	90 marks
Unit 5: Transition Metals and Organic Nitrogen Chemistry	WCH15/01	40% of IA2	20%	1 hr 45 mins	90 marks
Unit 6: Practical Skills in Chemistry II	WCH16/01	20% of IA2	10%	1 hr 20 mins	50 marks

For further information and to download the specification, visit qualifications.pearson.com/ialchemistry2018

Pearson Edexcel International Advanced Level Physics

Unit	Unit code:	% of the qualification	% of the total IAL	Examination duration	Marks available
Unit 1: Mechanics and Materials	WPH11/01	40% of IAS	20%	1 hr 30 mins	80 marks
Unit 2: Waves and Electricity	WPH12/01	40% of IAS	20%	1 hr 30 mins	80 marks
Unit 3: Practical Skills in Physics I	WPH13/01	20% of IAS	10%	1 hr 20 mins	50 marks
Unit 4: Further Mechanics, Fields and Particles	WPH14/01	40% of IA2	20%	1 hr 45 mins	90 marks
Unit 5: Thermodynamics, Radiation, Oscillations and Cosmology	WPH15/01	40% of IA2	20%	1 hr 45 mins	90 marks
Unit 6: Practical Skills in Physics II	WPH16/01	20% of IA2	10%	1 hr 20 mins	50 marks

For further information and to download the specification, visit qualifications.pearson.com/ialphysics2018

Modular assessment

Why is the modular approach so popular?

The modular assessment structure offers students the flexibility to sit examinations when they feel fully prepared and ready. Once they have sat a unit exam and received a unit grade, that result is banked until they have completed all units. Students then 'cash-in' the completed unit exam results to receive an overall qualification grade.

The structure of Pearson Edexcel IAL qualifications allows teachers to construct a course of study that can be taught and assessed as either distinct modular units or a linear course assessed in its entirety at the end.



How the modular approach works

Bank robust and ongoing evidence of performance

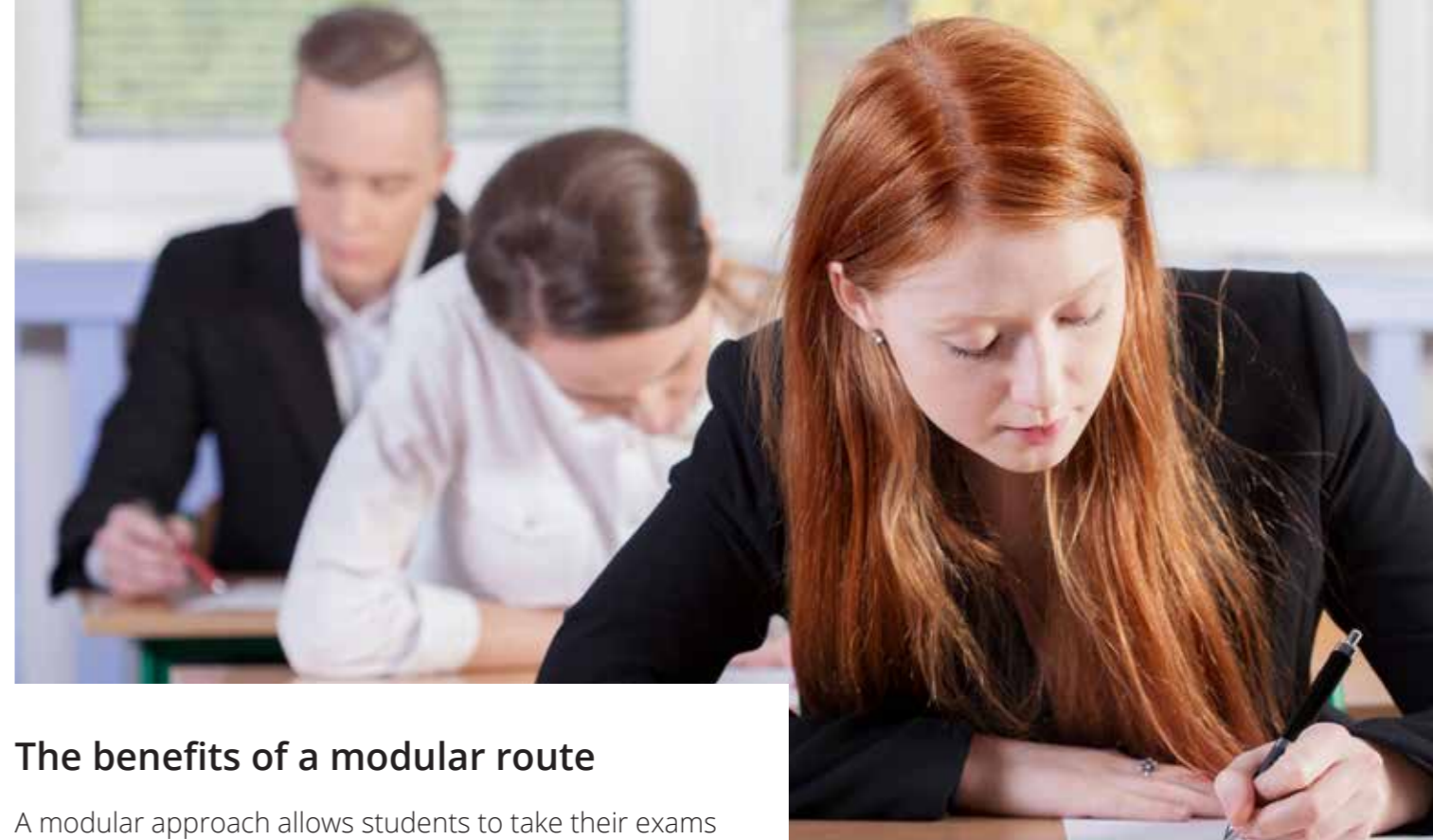
This 'building blocks' approach means that students can 'bank' their unit exam results throughout their period of study. This provides robust evidence of their studies and performance, providing more options to obtain the grade they need to progress.

Multiple exam opportunities throughout the year

Students can take and re-sit individual unit assessments in any series, with examination opportunities in January, June and October in most subjects. This means students have more opportunities to get feedback to improve their performance and get the grades they need to progress.

Students 'cash in' unit results when ready

Once a student has all their unit results for the qualification they are taking, they exchange those for a grade – this is called 'cashing in'. To cash in, all units must have been entered. International AS qualifications can be taken as a separate, standalone qualification, as well as contributing to an Advanced Level qualification.



The benefits of a modular route

A modular approach allows students to take their exams when they feel ready and prepared. They benefit from more exam practice and familiarity. Unit exam results provide formal feedback earlier on in their studies, so students understand the standard required to reach the final level of achievement they are aiming for. This understanding motivates them to improve and builds a sense of ownership through bite-size, short-term goals.

The modular approach can help reduce the mental load and stress at exam time by allowing learners to focus on one year of curriculum content at a time and spread out their high stakes exams over two years and multiple exam series. Learners can also take advantage of multiple re-sit opportunities if needed.

A modular route provides teachers with rich mid-cycle data on learner performance. It offers international schools greater flexibility for exam administration across the school year. And where parents pay exam fees, it helps with budgeting by enabling families to spread their child's exam fees over two years.

What this means for you

Pearson Edexcel were the first awarding organisation to introduce the modular International AS/A Levels, so can offer a wealth of experience and support for international schools. The modular approach is so popular with schools, teachers, parents, and students, that we now offer a modular approach for International GCSE which is great preparation for Pearson Edexcel International AS/A Level.

"I like the modular nature of IAL, the fact that I can choose whichever core units I want to do, whichever applied units I want to do. It's very comprehensive. It opens up many doors to many international universities."

Wang, Pearson Edexcel International Advanced Level student from Sri Lanka, studying Chemistry, Biology, Physics, and Mathematics.

Building transferable skills

The most in demand skills are human skills

In recent years, higher education institutions and employers have consistently flagged the need for students to develop a range of transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

In fact, universities and employers consider transferable skills – otherwise known as Core Competencies, or 21st century skills – to be the largest skills gap overall.



Supporting the development of transferable skills in your school

If you follow Pearson Edexcel IAL specifications, or your students are using our IAL textbooks, you've already started integrating transferable skills into your teaching.

That's because our qualifications and resources are mapped to the National Research Council's framework for 21st century skills, which includes cognitive, intrapersonal and interpersonal skills. They are embedded and signposted in the specifications and schemes of work, with accompanying skills mapping and transferable skills definitions for every subject.

Transferable skills are also developed as part of activities in the Student Books. These are clearly labelled, so you and your learners can easily identify the skills they are building.

We help you instil and embed these skills, supporting children to grow into resilient, curious and globally connected young adults.

No.1

9/10 of the most in-demand skills are human skills³

The highest priority for skills training is analytical thinking, followed by creative thinking²

87% of companies say they have skill gaps, or expect to within a few years¹

Supporting you at every stage

We provide an unparalleled level of support services, tools, resources and training alongside our qualifications, making teachers and students lives easier at every stage.

At a glance: support for you at every stage

FREE resources and support	Planning, teaching & learning	Exam preparation and assessment	Results support
Getting started guide	✓		
Training events (face-to-face, online & downloadable content)	✓		
Subject advisor support	✓	✓	✓
Ask the expert	✓	✓	✓
Community forums	✓	✓	✓
Scheme of Work	✓		
Sample assessment materials	✓		
Examiner reports	✓	✓	✓
Exemplar marked responses		✓	
Past papers		✓	
examWizard		✓	
Mark schemes		✓	
ResultsPlus mock exam analysis		✓	
ResultsPlus		✓	✓
FREE Access to Scripts service (ATS)			✓

Additional paid for resources			
Printed Student Books and digital ActiveBooks	✓	✓	
Online Teacher Resource Packs	✓	✓	

¹ McKinsey & Company (2020) Available from: www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/beyond-hiring-how-companies-are-reskilling-to-address-talent-gaps

² World Economic Forum (2023) Future of Jobs Report [online]. Available from: www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf

³ Pearson (2022) Pearson Skills Outlook: Power Skills [online]. Available from: plc.pearson.com/en-GB/news-and-insights/pearson-skills-outlook-powerskills



Pre and post exam support for your educators

Supporting you every step of the way - for free

As a Pearson Edexcel centre, you will have free access to a full range of integrated support services, tools and resources to support the delivery of your International A Levels. Unlike other awarding bodies, with Pearson Edexcel there are no additional costs for the following support:

- Easy, all year-round access to our specifications, sample assessment materials and teaching resources.
- **Teacher training** in-person and online including 'Welcome to Pearson' sessions to help your educators make the most of our qualifications.
- **Expert subject advisors** on hand to help with any subject-specific queries you may have and available to support your educators throughout the year.
- **examWizard:** a huge bank of past papers and mark schemes to create topic tests and revision activities in minutes.
- **ResultsPlus:** our popular online results analysis tool, which also includes an insightful group analysis service.
- **Access to Scripts:** our service that allows you to view your candidates' marked exam papers for free online or as downloaded PDFs, providing a rich source of information to inform future teaching plans and approaches.
- Plus, local, experienced Pearson Regional Development Managers who are there to support you every step of the way.

Additional paid for support options

Professional development

Enhanced training combining the qualification framework, support and feedback mechanisms with teaching and learning strategies, is available.

Mocks Service

We provide exam papers for your students to sit in mock examinations. Marked by Pearson examiners, results are uploaded to ResultsPlus for item level analysis.

Your free subject support

Our subject advisors provide fast, reliable, expert help and aim to answer all emailed questions within 48 hours and resolve 90% of issues phoned in on the first call.

Email teachingscience@pearson.com or call +44 (0) 344 463 2535

A valued support partner

"One of the good features of ResultsPlus is that it provides the top ten questions that students scored poorly in, so we as the lecturers can actually identify the topics that students found difficult and can incorporate a different approach when teaching our current students."

Dr Khong Yoke Kum, A Levels Department, HELP Academy, Malaysia

"Because of ResultsPlus, students can learn about their mistakes and rectify."

Kanagambigai, Chief Counsellor, A levels Department, HELP Academy, Malaysia commenting on the ResultsPlus mocks service.

"I used the website with its course outlines, past papers, summaries of key points, revision notes and mark schemes... they provide great tips about possible exam questions and how you could answer them."

Alexia Kattavenos, student, The Nicosia Grammar School, Cyprus



What this means for you

We will support you to deliver an outstanding teaching and learning experience for every student taking Pearson Edexcel International A Levels.

With examWizard, they will be able to prepare topic tests and revision activities based on past exam questions to help prepare students for their final assessments, and using ResultsPlus, they will be able to analyse their mock results to pinpoint where they may need further support and can then tailor their teaching to support them.

Post-exams, our Access to Scripts service will allow your educators to review students' exam papers for free, providing greater visibility and a deeper understanding of individual students' exam performance and helping them identify skills gaps to tailor teaching plans for future cohorts.

A wide range of teaching and learning resources

Written specifically to support our qualifications

Developed for Biology, Chemistry and Physics, these published resources have a strong focus on progression, recognition and transferable skills. Appropriate international content puts learning in a real-world context, making it engaging and relevant for all learners.

Student Books

- Provide comprehensive coverage of the specification content.
- Each Student Book includes 3-year access to an online ActiveBook (a digital version of the Student Book).
- Student Books feature Checkpoint questions, Thinking Bigger pages and Practical Skills boxes to support understanding and highlight key concepts.
- Exam practice provided at the end of each chapter, and sample exam answers in the back of the book.
- Glossaries for subject vocabulary and command words are collated at the back of the books for easy reference.

Online Teacher Resource Packs

- Comprehensive teaching plans for every section of the book.
- Practice assessments and accompanying mark schemes for every chapter follow exam format.
- Answers to the Checkpoint and Exam Practice questions in the Student Book.
- Practicals support includes student worksheets, exam-style questions and teacher and technician notes for each core practical.
- 'Guide to Thinking Bigger' provides teacher support for these pages of the Student Books.

Title	ISBN
Pearson Edexcel International IAS Biology Student Book	978 1 292244 84 6
Pearson Edexcel International IAL Biology Student Book	978 1 292244 70 9
Pearson Edexcel International AS/A Level Biology Lab book	978 1 292244 69 3
Pearson Edexcel International IAS Biology Teacher Resource Pack (ALDS)	978 1 292244 88 4
Pearson Edexcel International IAL Biology Teacher Resource Pack (ALDS)	978 1 292244 73 0
Pearson Edexcel International IAS Chemistry Student Book	978 1 292244 86 0
Pearson Edexcel International IAL Chemistry Student Book	978 1 292244 72 3
Pearson Edexcel International AS/A Level Chemistry Lab book	978 1 292244 71 6
Pearson Edexcel International IAS Chemistry Teacher Resource Pack (ALDS)	978 1 292244 89 1
Pearson Edexcel International IAL Chemistry Teacher Resource Pack (ALDS)	978 1 292244 74 7
Pearson Edexcel International IAS Physics Student Book	978 1 292244 87 7
Pearson Edexcel International IAL Physics Student Book	978 1 292244 77 8
Pearson Edexcel International AS/A Level Physics Lab book	978 1 292244 75 4
Pearson Edexcel International IAS Physics Teacher Resource Pack (ALDS)	978 1 292244 91 4
Pearson Edexcel International IAL Physics Teacher Resource Pack (ALDS)	978 1 292244 80 8



The **specification reference** is given at the start of each section as well as references to any core practicals. The course provides full coverage of specification requirements.

Learning objectives at the beginning of each section/ chapter highlight what students need to know and understand, and refer to the specification requirements.

Learning tips help learners to focus their learning and avoid common errors. **Exam hints** draw learners' attention to potential pitfalls in the exam and give practical hints about preparing for the exams, answering questions in the correct format, and checking work.

Did you know? boxes in the science books feature interesting facts to help students remember the key concepts.

1.A 1 VELOCITY AND ACCELERATION SPECIFICATION REFERENCE 1-3.1

LEARNING OBJECTIVES

- Explain the distinction between scalar and vector quantities.
- Distinguish between speed and velocity and define acceleration.
- Calculate values using equations for velocity and acceleration.

Fig A These runners are accelerating to a high speed.

RATE OF MOVEMENT

Movement is fundamental to the functioning of our universe. Whether you are running to catch a bus or want to calculate the speed required for a rocket to travel to Mars or the kinetic energy of an electron in an X-ray machine, you need to be able to work out how fast things are moving.

One of the simplest things we can measure is how fast an object is moving. You can calculate an object's **speed** if you know the amount of time taken to move a certain distance:

$$\text{speed (m s}^{-1}\text{)} = \frac{\text{distance (m)}}{\text{time (s)}}$$

$$v = \frac{d}{t}$$

However, the calculation for speed will only tell you how fast an object is moving. Often it is also vitally important to know in what direction this movement is taking the object. When you include the direction in the information about the rate of movement of an object, this is then known as the **velocity**. So the velocity is the rate of change of **displacement**, where the distance in a particular direction is called the 'displacement'.

Fig B The displacement due north is only 75 m, whilst the actual distance this athlete has run is 300 m. So the velocity due north is much less than the actual speed.

LEARNING TIP

The upper case symbol for the Greek letter delta, Δ , is used mathematically to mean a change in a quantity. For example, Δs means the change in the displacement of an object, to be used here to calculate its velocity.

DID YOU KNOW?

The frogger, a 6 mm long insect, can accelerate at 4000 m s^{-2} .

SCALARS AND VECTORS

A quantity for which the direction must be stated is known as a **vector**. If direction is not important, the measurement is referred to as a **scalar** quantity. Therefore, velocity is a vector and speed is a scalar; distance is a scalar and displacement is a vector.

Scalar and vector quantities are not limited to measurements related to movement. Every measured quantity can be classified to include the direction (vector, e.g. force) or as sufficiently stated by its magnitude only (scalar, e.g. mass).

Sample page from Pearson Edexcel International AS/A Level Physics Student Book 1

TOPIC 4 PLANT STRUCTURE AND FUNCTION, BIODIVERSITY AND CONSERVATION

CHAPTER 4B CLASSIFICATION

In 2012, scientists working in Papua New Guinea found the smallest known vertebrate to date - a tiny frog measuring 7.7 mm in length. *Pandohyla anomala* feeds on tiny mites in the leaf litter of its rain forest home - and it can jump up to 30 times its own body length. DNA analysis shows that tiny frogs have evolved 11 times in different areas of the world, all filling a similar niche. In 2014, a new species of dead-leaf frog (*Rhinophrynus*) was discovered in the Peruvian Andes. In shape, colour and patterning, it resembles a dead leaf and, with the poison it exudes from glands on the back of its head, the toad looks similar to other toads of the same genus. It was only when scientists noticed that these toads lack ear drums that they realised they had discovered a new species. Finding new species is always exciting, but it becomes even more special when that new species is already endangered, such as the new species of orang utan identified in November 2017.

Scientists used two different methods of identifying these new species - traditional observation of physical characteristics such as ear drums, and DNA analysis of the genome. In this chapter you will find out more about how we classify the organisms in the world around us - and why it is important that we do so.

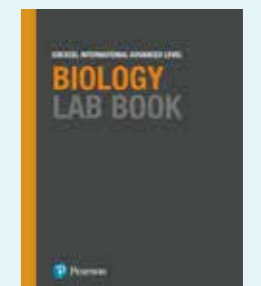
You will learn the main taxonomic groups of the living world including domains, kingdoms and species, and will begin to classify different organisms. You will consider the problems of defining a species in a way that is useful for all types of organisms, and evaluate the different ones in use. The use of DNA technology is having a major impact on our ability to identify organisms and work out how they are related to other species. There has been a long-running debate about the numbers of domains and kingdoms which should be used in classification - decide who you think is right!

MATHS SKILLS FOR THIS TOPIC

- Recognise and use expressions in decimal and standard form (e.g. when considering the number of base pairs in DNA and the proportion of those base pairs that may differ between species)
- Use scales for measuring (e.g. size and parts of different organisms for comparisons when classifying)
- Use ratios, fractions and percentages (e.g. regarding the proportion of base pairs shared in genes from different species)

Sample page from Pearson Edexcel International IAS Biology Student Book

Student Books are all accompanied by a Lab Book, which include instructions and writing frames for the core practicals, as well as practical skills practice questions and answers.



An introduction to the chapter to help students think about the concepts they will encounter.

Each Student Book comes with 3-year access to an ActiveBook, a digital version of the Student Book, which can be accessed online, anytime, anywhere, supporting learning beyond the classroom.



About Pearson

Pearson's qualifications heritage stretches back over 150 years and our qualifications are offered in more than 110 countries worldwide. We also mark over 10 million exam scripts per year on behalf of the UK Department for Education. Pearson Edexcel is regulated by Ofqual, the UK's qualifications regulator, ensuring our curricula meet the highest standards and our exams follow carefully controlled procedures at every stage of their development, delivery, marking and reporting. As the largest awarding organisation in the UK, Pearson Edexcel regularly achieves the highest marking accuracy of all UK boards.

Learn more about our qualifications at quals.pearson.com

Pearson International Schools

Whether you're a teacher inspiring achievement in the classroom, a parent supporting your child's learning journey, or a school owner seeking the best outcomes for your students, we can support you with our inspiring and proven international curriculum, qualifications and published resources.

Learn more about how we support international schools at pearson.com/international-schools

