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INTERNATIONAL ADVANCED LEVEL

Physics

Getting Started

Pearson Edexcel International Advanced Subsidiary in Physics (XPH01)

Pearson Edexcel International Advanced Level in Physics (YPH01)

For first teaching in September 2013
First examination January 2014

ALWAYS LEARNING

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This guide is Issue 1. We will inform centres of any changes to this issue. The latest issue can be found on the Edexcel website: www.edexcel.com/ial

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Contents

A Getting started for teachers

Introduction

This *Getting Started* book will give you an overview of the International Advanced Level (IAL) in Physics course and what it means for you and your students. The guidance in this book is intended to help you plan the course in outline and give you further insight into the principles behind the content, to help you and your students succeed in the course.

Key principles

The key principles of the new IAL Physics specification are summarised below.

An innovative specification

Edexcel's Physics specification has been designed to engage and inspire students who have different needs and abilities by providing two distinct and flexible approaches:

- a concept led approach
- a context led topic approach based on the Salters Horners Advanced Physics Project.

These approaches can be mixed to allow variety in course delivery. Teachers may select the approach that best meets the needs of their students.

A motivating specification

This specification enables motivating, up-to-date, contemporary contexts to be included in the teaching and learning programme, and opportunities for practical work are identified throughout the specification. It has a realistic, manageable level of content and assessment and therefore provides an enjoyable teaching and learning experience.

A supported specification

Support is available from both Edexcel and the Salters Horners Advanced Physics project team at York University. Teachers will also find that many of their current resources will be applicable to this specification.

Assessment overview

The course will be assessed by both examination and internal assessment. A more detailed guide to the internally assessed units can be found later in this book in the section entitled 'Internal assessment guide'.

AS units

Unit 1: Physics on the go	Unit 2: Physics at work	Unit 3: Exploring physics
External assessment: written examination paper (90 mins)	External assessment: written examination paper (90 mins)	External assessment: written examination paper (80 mins)

A2 units

Unit 4: Physics on the move	Unit 5: Physics from creation to collapse	Unit 6: Experimental physics
External assessment: written examination paper (95 mins)	External assessment: written examination paper (95 mins)	External assessment: written examination paper (80 mins)

Course Overviews

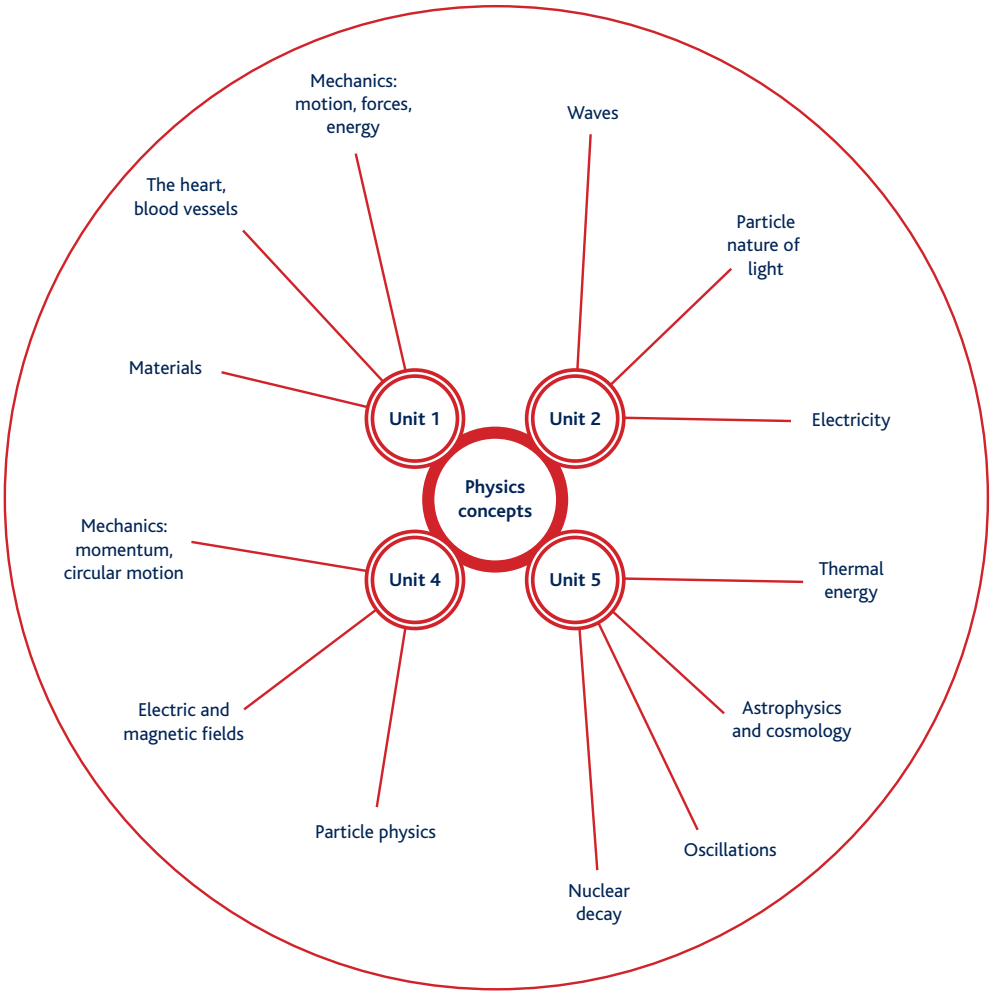
One of the key features of the IAL Physics specification is that you can approach each unit in this course in one of two ways:

- the concept approach
- the context approach.

The following diagrams provide an overview of the themes of each approach so you can see at a glance the different options you have for delivering the course.

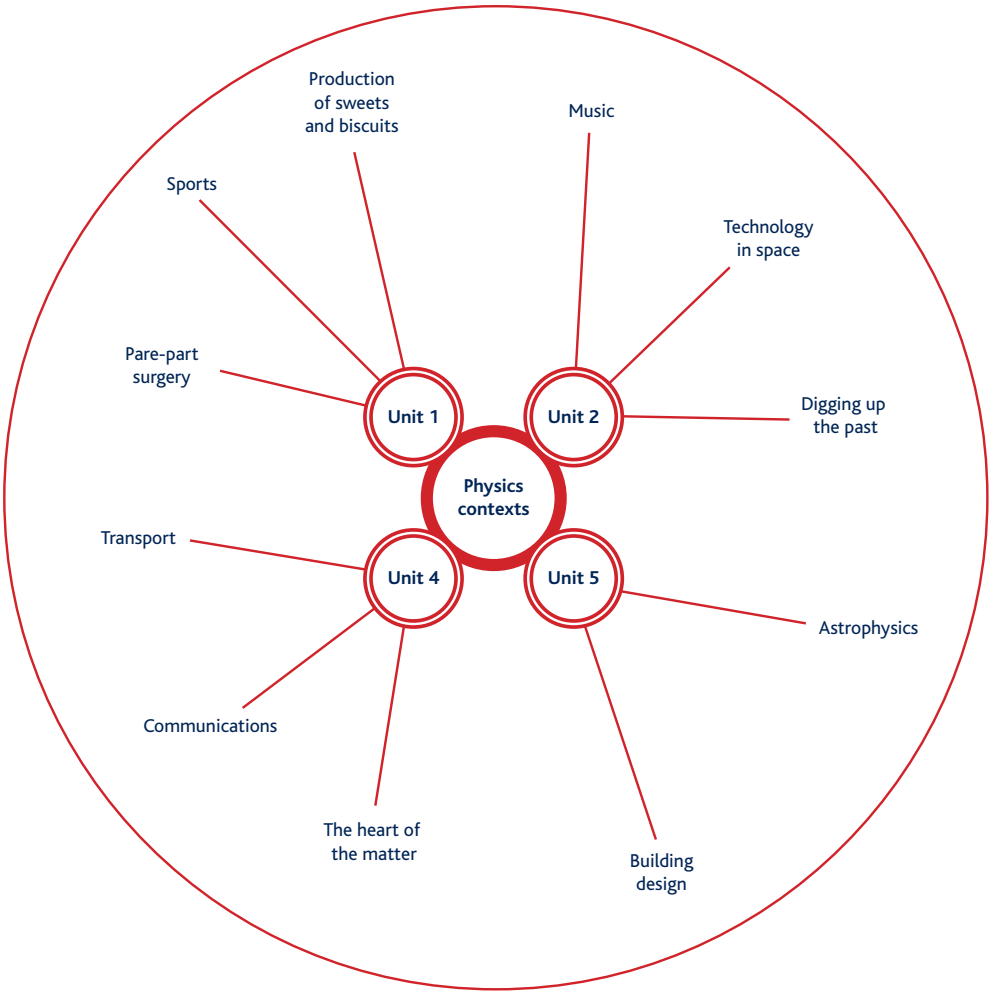
Concept approach overview

This diagram shows all the concepts covered in the course.



Context approach overview

This diagram shows all the contexts you can use to teach the course.



Unit Overviews

These tables give an overview of the content of each unit, allowing you to choose the approach that is most appropriate for your students.

AS units

Unit 1 Two approaches, one exam

Concept approach		Context approach	
Mechanics ■ velocity ■ acceleration ■ forces ■ equilibrium ■ energy ■ power	**Materials** ■ fluid flow ■ elastic/plastic deformation ■ properties ■ compression	**Mechanics and sport** ■ speed and acceleration in sprinting and jogging ■ work and power in weightlifting ■ forces and equilibrium in rock-climbing ■ forces and projectiles in tennis ■ force and energy in bungee jumping	**Materials** ■ measuring and controlling the flow of a viscous liquid for producing sweets ■ mechanical testing of products ■ mechanical properties of bone and replacement materials for spare part surgery ■ 'designer' materials for medical uses

Unit 2 Two approaches, one exam

Concept approach		Context approach	
Waves ■ characteristics ■ standing waves ■ refraction ■ diffraction ■ polarisation **Electricity** ■ series/parallel circuits ■ Ohms law ■ resistivity	■ potential divider ■ emf and internal resistance ■ negative coefficient temperature thermistors **Nature of light** ■ photons ■ Einstein's photoelectric equation ■ efficiency	**The sound of music** ■ synthesised and 'live' sounds ■ standing waves in string and wind instruments ■ reading a CD by laser **Satellites** ■ illuminating solar cells ■ operation of solar cells ■ combining sources of emf ■ radar imaging	**Archaeology** ■ resistivity surveying ■ artefact analysis by X-ray diffraction ■ artefact analysis by electron microscopy

Unit 3

Students are expected to develop experimental skills, and a knowledge and understanding of experimental techniques, by carrying out a range of practical experiments and investigations while they study Units 1 and 2.

This unit will assess students' knowledge and understanding of experimental procedures and techniques that were developed when they did those experiments and investigations.

A2 units

Unit 4 Two approaches, one exam

Concept approach		Context approach	
Further mechanics ■ momentum ■ circular motion **Electric and magnetic fields** ■ electric field strength ■ potential ■ capacitance ■ resistor-capacitor circuits ■ magnetic flux ■ flux linkage ■ Fleming's left hand rule ■ Faraday's law ■ Lenz's law	**Particle physics** ■ the nuclear atom ■ thermionic emission ■ particle accelerators ■ particle tracks ■ quark-lepton model ■ De Broglie's equation	**Transport system** ■ track circuits and signalling ■ sensing speed ■ mechanical braking ■ regenerative and eddy current braking ■ crash-proofing **Communication and display techniques** ■ fibre optics and exponential attenuation ■ CCD imaging ■ cathode-ray tube ■ liquid crystal and LED displays	**Probing the heart of matter** ■ alpha scattering and the nuclear model of the atom ■ accelerating particles to high energies ■ detecting and interpreting interactions between particles ■ the quark-lepton model

Unit 5 Two approaches, one exam

Concept approach		Context approach	
Thermal energy ■ specific heat capacity ■ ideal gas equation ■ internal energy **Nuclear decay** ■ types of radiation ■ penetrating power ■ ionising ability ■ half life	**Oscillations** ■ simple harmonic motion ■ free, damped and forced oscillations **Astrophysics and cosmology** ■ gravitational fields ■ Hertsprung-Russell diagram ■ Stefan-Boltzmann law ■ fate of the universe	**Reach for the stars** ■ distances of stars ■ masses of stars ■ energy sources in stars ■ star formation ■ star death and the creation of chemical elements ■ the history and future of the universe	**Building design** ■ earthquake detection ■ vibration and resonance in structures ■ damping vibration using ductile materials

Unit 6

Students are expected to further develop the experimental skills and the knowledge and understanding of experimental techniques that they acquired in Units 1 and 2 by carrying out a range of practical experiments and investigations while they study Units 4 and 5.

This unit will assess students' knowledge and understanding of the experimental procedures and techniques that were developed when they did those experiments and investigations.

The Specification

This section provides key information on the Edexcel IAL in Physics specification for both new and current Edexcel centres.

The specification

The Edexcel IAL in Physics specification provides a flexible but clearly structured and supported course with manageable levels of content and assessment. In particular, it has been designed to inspire students and develop their enthusiasm for physics by providing one specification which has:

- **two** teaching approaches: concept led and context led
- **one** common set of assessments for both approaches.

This means that teachers may select an approach to meet their students' needs and learning styles that is based on a common assessment model.

The content of the specification has been devised in consultation with practising teachers, the Project Director for Salters Horners Advanced Physics and professional bodies to ensure that it is both attractive to students and can be studied in satisfying depth in the time available. The course features a range of contemporary physics contexts. As specific contexts will not be examined, they can be kept up to date with new developments in physics, and chosen for local interest or the specific interests of different groups of students.

FAQs

What is the difference between the International Advanced Level (IAL) specification and the current GCE specification?

The IAL specification is made up of 6 units which are examined by externally marked written papers while the current 2008 GCE specification is made up of 6 units 2 of which are internally assessed coursework/practicals.

Also, the IAL examinations are available in January and June while the GCE examinations are available in June only.

Another difference is that IALs are regulated by Pearson, therefore the award is IAL while GCEs are regulated by Ofqual and the award is GCE.

Which award will a student receive if he/she completes written papers for the AS course and completes a coursework/practical assessment in the A2 course?

The student will be awarded an IAL.

Are there any content or structural changes in the IAL specification?

No. There are no changes to content or structure, so teachers can carry on planning and teaching in the normal way.

If a student has already completed some GCE units, would it be possible to combine them with IAL units to complete an IAL award?

Yes. *HOWEVER*, only relevant GCE units which have been *banked up to and including June 2013 can be used* in combination with IAL units for a full IAL award. This service is available until June 2015 only.

How many times can a student re-sit a unit examination?

A student can re-sit a unit examination once i.e. each unit examination can be taken twice and the higher of the two marks will be used to calculate the overall subject grade.

Guide to *How Science Works*

An important requirement of the Advanced Level Science criteria is that *How Science Works* should be embedded within the programme of study. To help you meet this requirement when teaching the Edexcel IAL in Physics specification, the *How Science Works* content has been integrated into the main course content. This means that you will deliver much of *How Science Works* without noticing, as you teach the course.

A brief summary of the criteria for Advanced Level Science subjects is given below. Students must:

- be able to use their knowledge and understanding to pose scientific questions, define scientific problems, and to present scientific arguments and ideas
- consider ethical issues and appreciate the ways in which society uses science to inform decision-making
- use theories, models and ideas to develop and modify scientific explanations, and use appropriate methodology to answer scientific questions
- appreciate the tentative nature of scientific knowledge and appreciate how society uses science in decision-making
- communicate their ideas well, use appropriate terminology and consider applications and implications of science (together with risks and benefits).

A document showing in detail how the *How Science Works* content has been integrated into the Advanced Level in Physics specification can be found at www.edexcel.com/ial.

Course Planner

This course planner gives you an overview of the course content and an idea of how to organise your delivery, for AS and for A2. In particular, it shows you how you can deliver each unit using either the concept approach or the context approach.

AS

Concept approach	
Week	**Lesson content**
1	Unit 1: Mechanics
2	
3	
4	
5	
6	
7	
8	Unit 1: Materials
9	
10	
11	
12	
13	
14	
15	Revision

OR

Context approach	
Week	**Lesson content**
1	Unit 1: Higher, faster, stronger
2	
3	
4	
5	
6	
7	
8	Unit 1: Spare-part surgery
9	
10	
11	Unit 1: Good enough to eat?
12	
13	
14	
15	Revision

Concept approach	
Week	**Lesson content**
16	Unit 2: DC electricity
17	
18	
19	
20	
21	
22	Unit 2: Waves
23	
24	
25	
26	
27	
28	
29	
30	Revision

OR

Context approach	
Week	**Lesson content**
16	Unit 2: The sound of music
17	
18	
19	
20	Unit 2: Technology in space
21	
22	
23	
24	
25	
26	
27	
28	Unit 2: Digging up the past
29	
30	Revision

A2

Concept approach	
Week	**Lesson content**
1	Unit 4: Further mechanics
2	
3	
4	
5	Unit 4: Electric and magnetic fields
6	
7	
8	
9	Unit 4: Particle physics
10	
11	
12	
13	
14	
15	Revision

OR

Context approach	
Week	**Lesson content**
1	Unit 4: Transport on track
2	
3	
4	
5	Unit 4: The medium is the message
6	
7	
8	Unit 4: Probing the heart of the matter
9	
10	
11	
12	
13	
14	
15	Revision

Concept approach	
Week	**Lesson content**
16	Unit 5: Oscillations
17	
18	
19	Unit 5: Nuclear decay
20	
21	Unit 5: Thermal physics
22	
23	Unit 5: Astrophysics and cosmology
24	
25	
26	
27	
28	
29	
30	Revision

OR

Context approach	
Week	**Lesson content**
16	Unit 5: Build or bust
17	
18	
19	
20	Unit 5: Reach for the stars
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	Revision

B Getting started for students

Student Guide

What do I need to know, or be able to do, before taking this course?

The qualification builds on the knowledge, understanding and process skills that you achieved in GCSE/International GCSE Science. You will need at least a GCSE grade C in Physics or Additional Science (or equivalent in International GCSE). You should also have at least a grade C in GCSE Mathematics (or equivalent in International GCSE) as numerical and mathematical skills are important in physics. Communication is also important as you will need to be able to communicate effectively, carry out research and critically think about problems.

What will I learn?

Unit 1: Physics on the go

This unit leads on from your GCSE/International GCSE studies.

You will learn about motion, forces, energy, power, flow of liquids, viscosity and properties of materials. Applications that use these concepts include sports, the production of sweets and biscuits, and spare-part surgery.

Unit 2: Physics at work

The physics content of this unit is related to applications that include medical physics, music, technology in space and solar cells.

You will learn about waves including standing waves, refraction, polarisation, diffraction and the nature of light. You will also learn about electric circuits, resistivity, thermistors, emf and internal resistance.

Unit 3: Exploring physics

This unit is based on the practical skills that you develop while studying Units 1 and 2.

Unit 4: Physics on the move

The physics content of this unit is related to applications that include transport, communications and display techniques. It is also related to exciting, current research in the field of particle physics.

You will learn about momentum, circular motion, electric and magnetic fields, evidence for a nuclear atom, particle accelerators, particle detectors and different types of sub-atomic particles.

Unit 5: Physics from creation to collapse

The physics content of this unit is related to applications that include the construction of buildings in earthquake zones and a detailed exploration of astrophysics and cosmology.

You will learn about thermal energy, radioactive decay, simple harmonic motion, resonance, gravitation, the life cycle of stars, fission, fusion and the fate of the universe.

Unit 6: Experimental physics

This unit is based on the practical skills that you develop while studying Units 1, 2 4 and 5.

While studying these units you will develop practical skills that include planning experiments, collecting data, analysing experimental results and making conclusions. You will also gain an appreciation of how scientific models are developed and evolve, the applications and implications of science, the benefits and risks that science brings, and the ways in which society uses science to make decisions.

Is this the right subject for me?

AS Physics is suitable if you:

- want to progress to the full A-level
- want a grounding in a relevant worthwhile qualification of recognised value
- want to broaden your educational experience before making a decision about which A-levels to take
- are taking A-levels in the other Sciences and/or Mathematics or other relevant courses such as Design and Technology and want to take another course that will support your studies.

A2 Physics is suitable if you:

- have an interest in, and enjoy, physics
- want to find out about how things work in the physical world
- enjoy applying your mind to solving problems
- enjoy carrying out investigations by the application of imaginative, logical thinking
- want to use physics to move on to further studies in Higher Education, support other qualifications or enter physics-based employment.

How will I be assessed?

AS For Units 1 and 2 you will do a written paper that lasts for 90 minutes. The papers will contain objective questions, short questions and longer questions. For Unit 3 you will do a written paper that lasts for 80 minutes. The paper will assess knowledge and understanding of experimental procedures and techniques that were developed in Units 1 and 2.

A2 For Units 4 and 5 you will do a written paper that lasts for 95 minutes. The papers will contain objective questions, short questions and longer questions. For Unit 6 you will do a written paper that lasts for 80 minutes. This unit will assess knowledge and understanding of the experimental procedures and techniques that were developed in Units 4 and 5.

What can I do after I've completed the course?

Physics leads on to a wide range of courses and careers. You could use Physics to support other qualifications or move on to further studies or employment, including:

- a BTEC Higher National (HNC and HND) or a degree course such as Physics, the Sciences, Medicine, Metrology, Engineering (including Chemical Engineering) and related programmes
- employment in the area of, for example, radiography or biotechnology.

In fact, Physics is recognised as an entry qualification for a wide range of Higher Education courses and employment opportunities.

Next steps!

You could:

- discuss the possibility of studying this subject with your Physics or Science teacher(s)
- visit your careers office to find out more about careers and Higher Education courses that need IAL Physics
- order free physics careers booklets from the Institute of Physics website: *www.iop.org/activity/education/Promoting_Physics/Career_Resources/page_5893.html*
- visit the Edexcel website, *www.edexcel.com/ial*, to obtain a full copy of the Edexcel IAL in Physics specification.

Unit Overviews for Students

Introduction

Each overview provides you with a summary of the content and assessment for each unit, making it clear what you need to know, and how you will be expected to demonstrate what you know.

While studying these units, you will develop practical skills that include planning experiments, collecting data, analysing experimental results and making conclusions. You will also gain an appreciation of how scientific models are developed and evolve, the applications and implications of science, the benefits and risks that science brings, and the ways in which society uses science to make decisions.

AS units

Unit 1: Physics on the go	
Content	This unit leads on from your GCSE studies. You will learn about motion, forces, energy, power, flow of liquids, viscosity and properties of materials. Applications that use these concepts include sports, the production of sweets and biscuits, and spare-part surgery.
Assessment	You will do a written paper that lasts for 90 minutes. The paper will contain objective questions, short questions and longer questions.

Unit 2: Physics at work	
Content	The physics content of this unit is related to applications that include medical physics, music, technology in space and solar cells. You will learn about waves including standing waves, refraction, polarisation, diffraction and the nature of light. You will also learn about electric circuits, resistivity, thermistors, emf and internal resistance.
Assessment	You will do a written paper that lasts for 90 minutes. The paper will contain objective questions, short questions and longer questions.

Unit 3: Exploring physics	
Content	This unit is based on the practical skills that you develop while studying Units 1 and 2.
Assessment	You will do a written paper that lasts for 80 minutes. The paper will assess knowledge and understanding of experimental procedures and techniques that were developed in units 1 and 2.

A2 units

Unit 4: Physics on the move	
Content	The physics content of this unit is related to applications that include transport, communications and display techniques. It is also related to exciting, current research in the field of particle physics. You will learn about momentum, circular motion, electric and magnetic fields, evidence for a nuclear atom, particle accelerators, particle detectors and different types of sub-atomic particles.
Assessment	You will do a written paper that lasts for 95 minutes. The paper will contain objective questions, short questions and longer questions.

Unit 5: Physics from creation to collapse	
Content	The physics content of this unit is related to applications that include space technology, medical physics and construction of buildings in earthquake zones. It also includes a detailed exploration of astrophysics and cosmology. You will learn about thermal energy, radioactive decay, simple harmonic motion, resonance, gravitation, the life cycle of stars, fission, fusion and the fate of the universe.
Assessment	You will do a written paper that lasts for 95 minutes. The paper will contain objective questions, short questions and longer questions.

Unit 6: Experimental physics	
Content	This unit is based on the practical skills that you develop while studying Units 1, 2 4 and 5.
Assessment	You will do a written paper that lasts for 80 minutes. This unit will assess knowledge and understanding of the experimental procedures and techniques that were developed in units 4 and 5.

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