Oide

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí

Supporting the Professional Learning of School Leaders and Teachers

Focus on Practical Investigation for Leaving Certificate Physics

Professional Learning Experience – Day 3

CC BY NC

The Oide Science Team

Helen Van Eesbeck
Senior Leader

Oide: Range of Supports

Collaboratives

Webinars

Oide.ie / Oidetechnologyin education.ie

Half Day Professional Learning Experiences

Scoilnet.ie

Full Day Professional Learning Experiences

School Support Visits

Senior Cycle Redevelopment - Science Timeline

Year 1 - 2024/2025

01 **Sept - Jan 2024/25**
Full Day PLE 1 - Unifying Strand Day

02 **December 2024**
Guidelines to Support the AACs Published

03 **Jan - Apr 2025**
Full Day PLE 2* Subject Specific
- Biology
- Physics
- Chemistry

*Including PLE for teachers teaching 2 or 3 LC Science Subjects

04 **April 2025**
Sample Papers Published

05 **April 2025**
PLE: Webinar #1

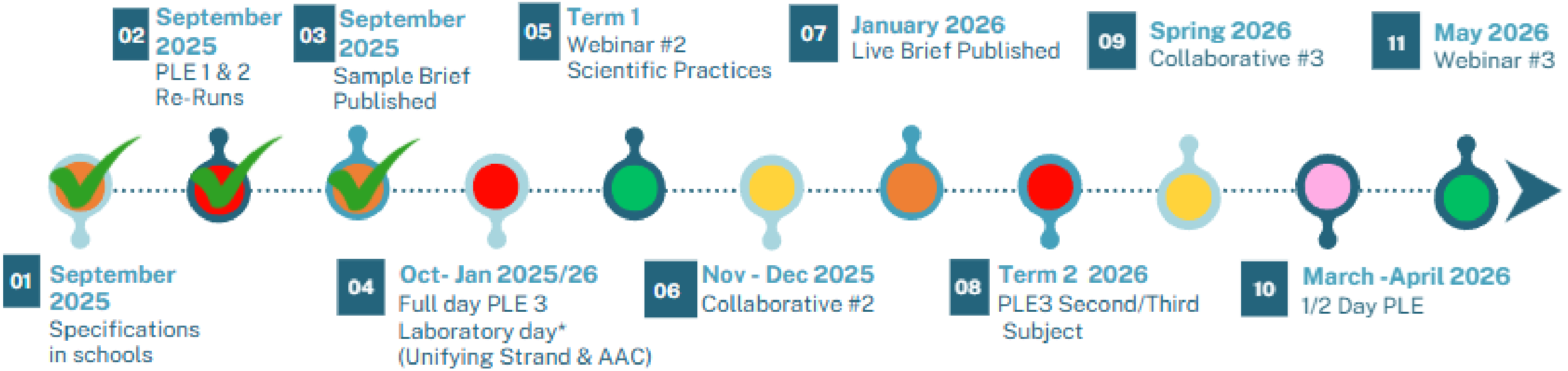
06 **May 2025**
PLE: Collaborative #1
- Biology
- Physics
- Chemistry

Full Day PLE | Collaborative | Webinar | Half Day PLE | SEC Publications | AAC Publications

Senior Cycle Redevelopment - Science PLE Timeline

Oide

Year 2 - 2025/2026



Full Day PLE | Collaborative | Webinar | Half Day PLE | SEC Publications | AAC Publications

Schedule

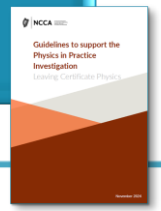
Session 1 9:15 – 10:40	The Investigative Approach
10:40 - 11:00	Tea and Coffee
Session 2 11:20 – 13:00	Additional Investigations & Digital Tools
13:00 - 14:00	Lunch
Session 3 14:00 – 15:45	Engaging with the AAC Brief

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

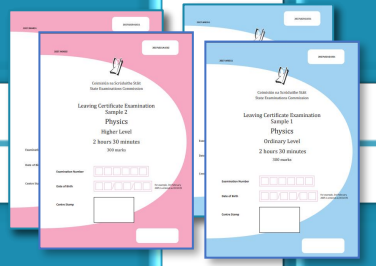
Key Dates

September 2024
Specification published

December 2024
AAC Guidelines published



April 2025
Sample examination papers



September 2025
Introduction in classroom

September 2025
Sample AAC Brief

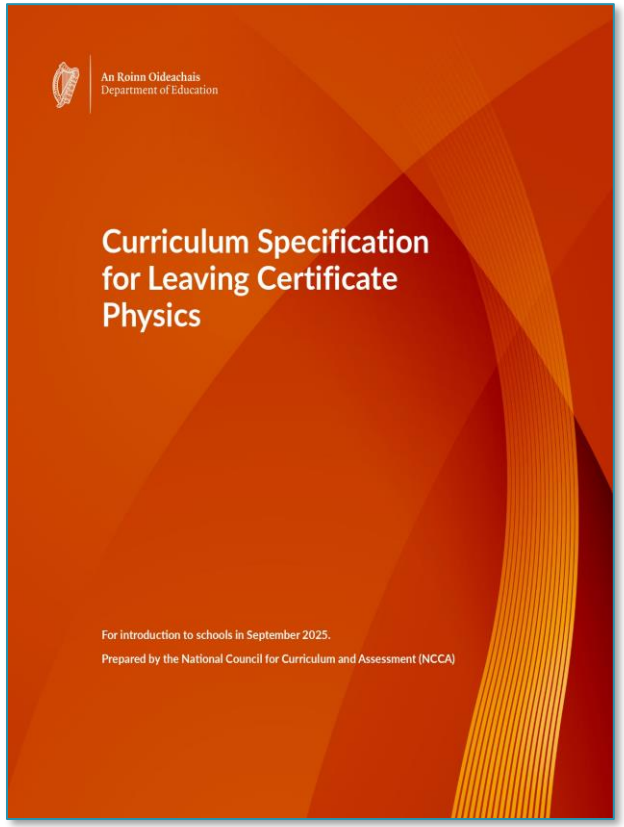
January 2026
Live AAC Brief

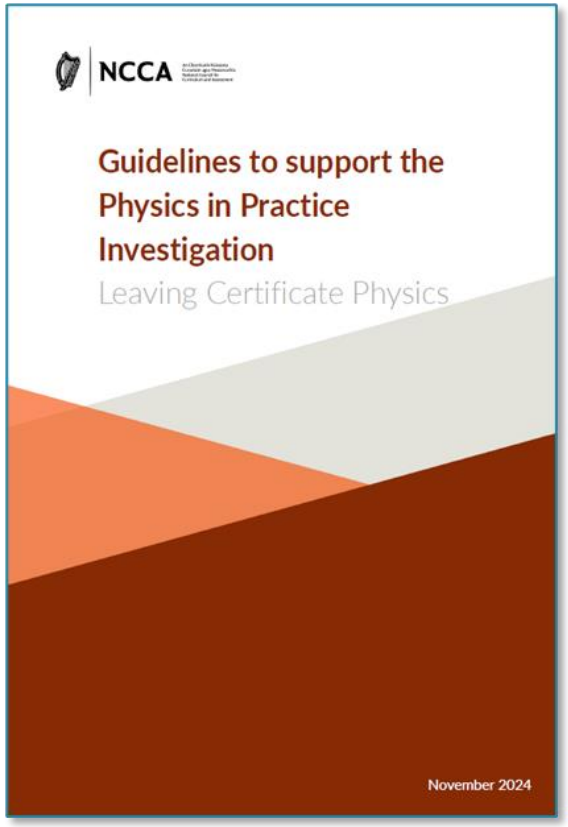
Year 2
AAC Submitted

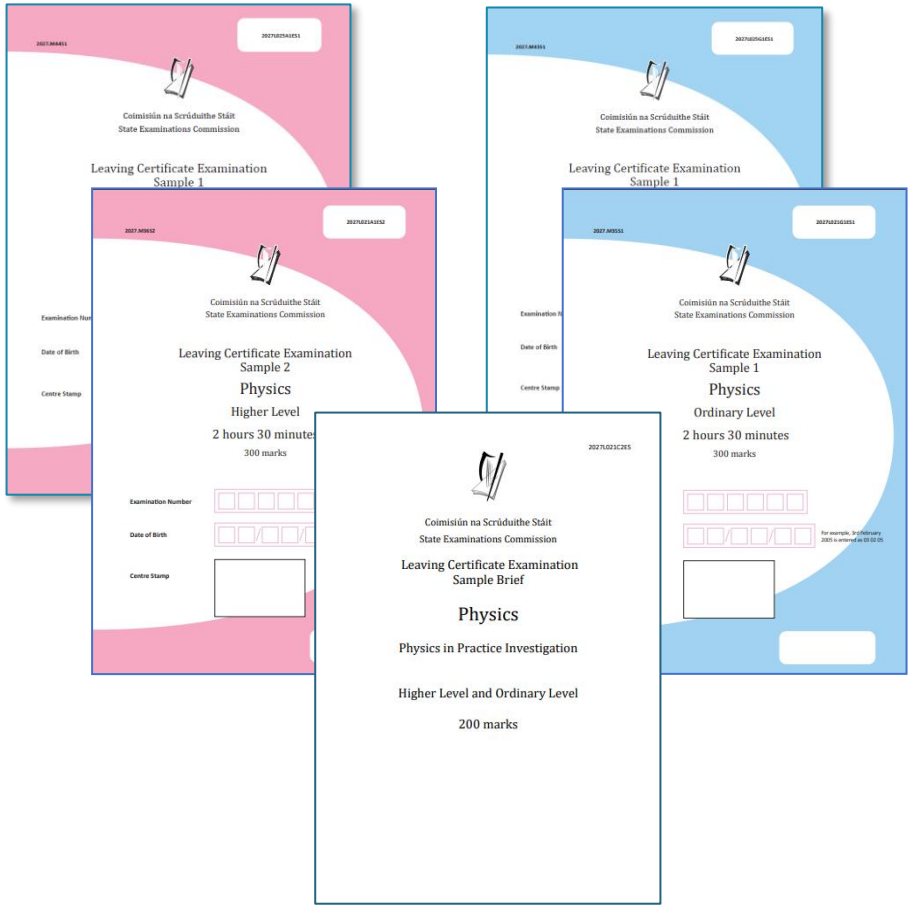
June 2027
Written State Examination

Key Supporting Documents

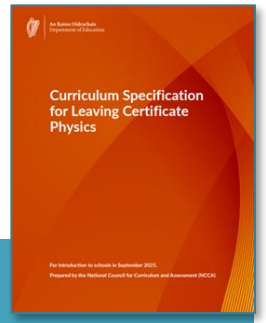
Key Documents







Key Competencies and the Physics Specification

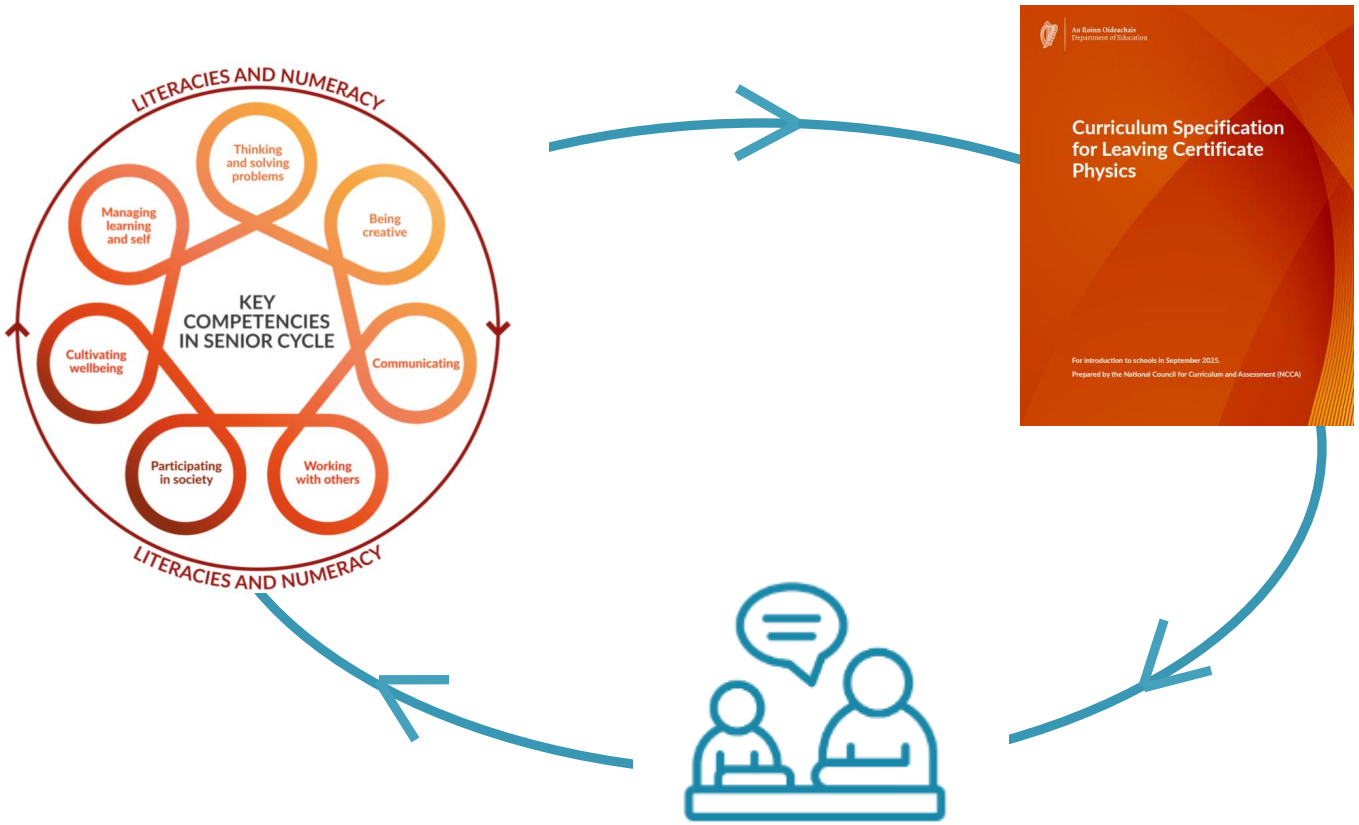


"… it is vital to recognise that key competencies and subject or module learning are developed in an integrated way. By design, key competencies are integrated across the rationale, aims, learning outcomes and assessment sections of specifications."

(NCCA, p.6)

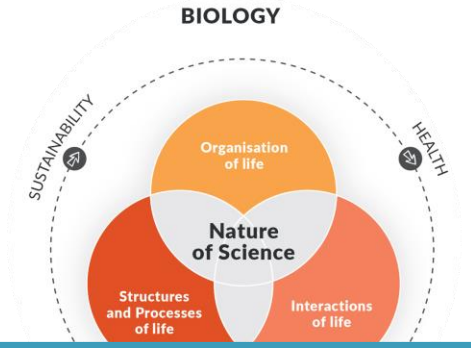
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

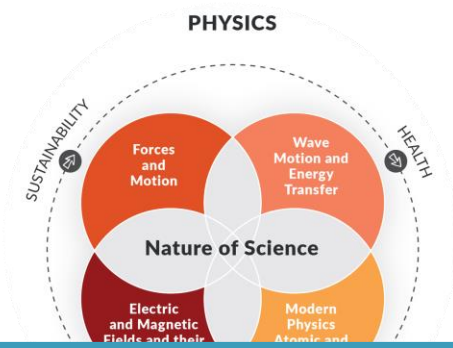
Key Competencies and the Physics Specification



Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Unifying Strand – Nature of Science





"In senior cycle it is expected that students will be able to meet these learning outcomes with a greater degree of independence"

(NCCA, p.12)

Junior Cycle Science Specification, 2015, p.10

Biology, Chemistry and Physics Specifications, 2024

The Aims of Leaving Certificate Physics

- to build knowledge and understanding of specified core concepts and fundamental principles of physics
- to develop the skills, values and dispositions needed to apply this knowledge to explain, analyse, solve problems and predict events in a variety of systems and interactions in the physical world
- to demonstrate inquiry and practical skills consistent with the principles and practices of physics
- understand how society and science are interwoven, the everyday relevance and the ethical implications of physics.

Physics Specification, pg. 4

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Key Messages for today:

The unifying strand says that students should be able to appreciate how scientists work and how scientific ideas are modified over time, which places learning related to investigation through experimentation, research and verifying models at the very core of the specification.

The continued development of research questions, hypothesis, and experimental design are skills that students need to learn through their participation with junior and senior cycle to support student engagement with the AAC.

The collection and use of primary data allows students to learn how to critically analyse data, identify patterns and relationships, identify anomalous observations, draw and justify conclusions.

By the end of today, we will…

- Recognise the focus on the collection of primary data within the LC Physics specification, both within the contextual strands and the AAC, and how this is in keeping with the requirements of the unifying strand.
- Engage with the Sample Physics in Practice Investigation (AAC Brief) and look at where it aligns with the learning outcomes of the new Leaving Certificate Physics Specification.
- Engage with using digital tools to enhance student research and support the development of investigations.

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Oide
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

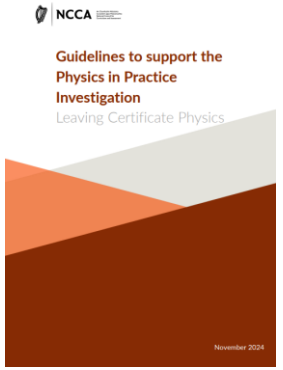
Session 1

Engaging with Investigations

Investigating in the Physics Classroom

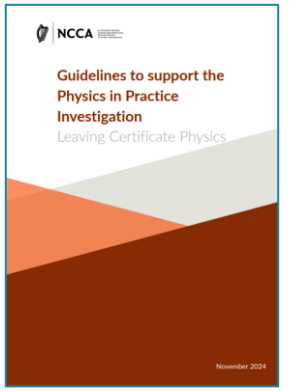
"Students are encouraged to work like scientists, with a focus on outlining assumptions and decisions made during each stage, and to explain how these assumptions and decisions impact on reliability, validity, accuracy, precision, error, fairness, safety and integrity"

(NCCA, p. 5)



Investigating in the Physics Classroom

"Through the Physics in Practice Investigation … students pursue their own interests in physics and make their own investigative decisions to demonstrate scientific investigative skills as outlined in the learning outcomes of the unifying strand."

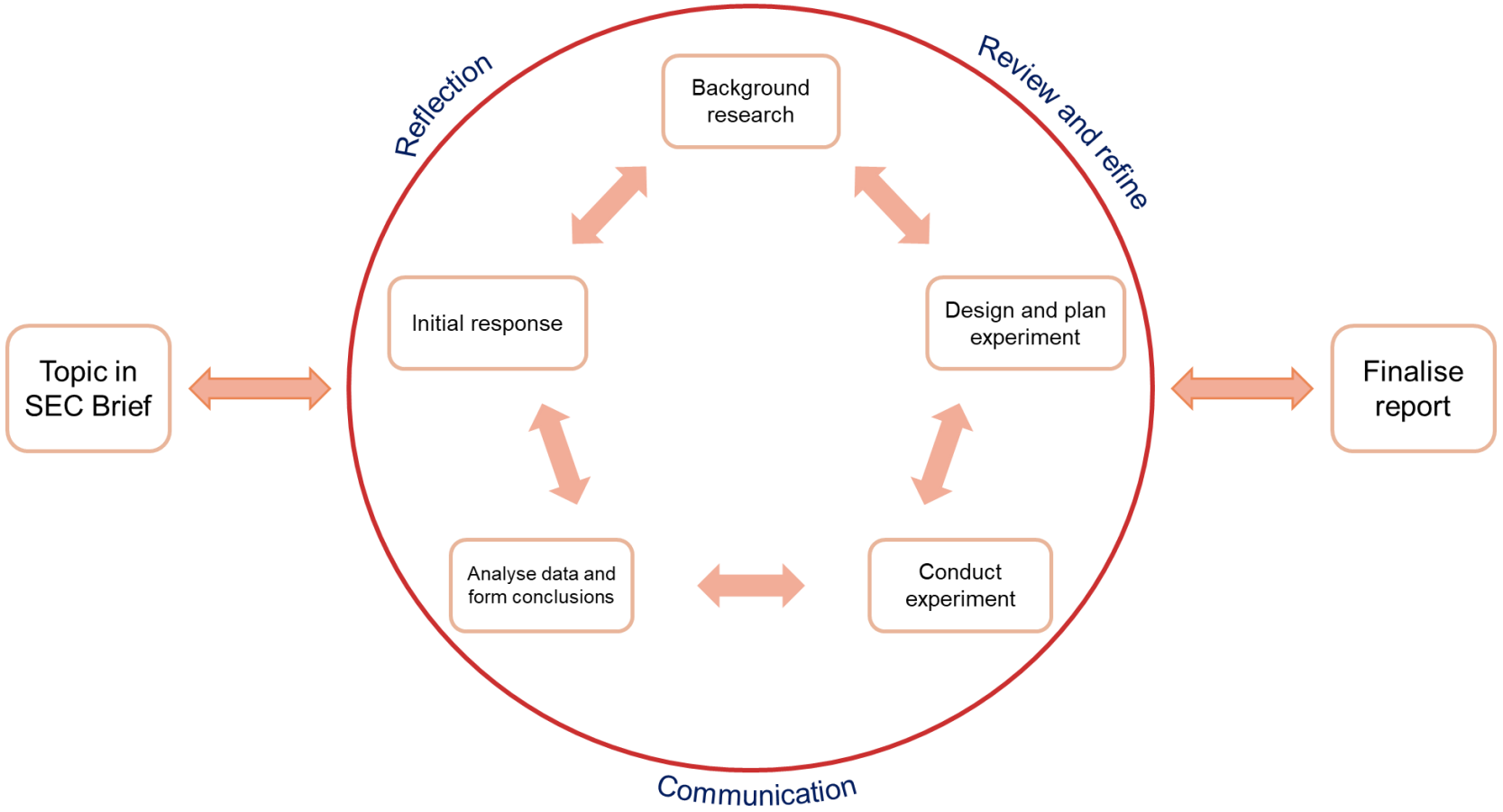


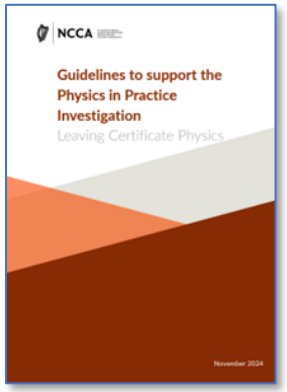
"Completing this autonomous investigation is an opportunity for students to deepen their understanding of physical concepts within the specification and through the cross-cutting themes make connections between a concept and, it's application in real-life"

(NCCA, p. 4)

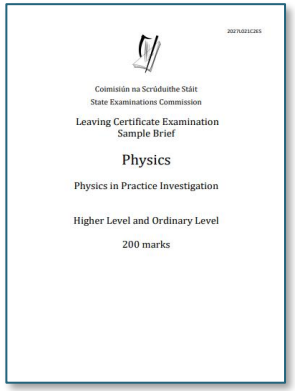
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Process for the completion of the Physics in Practice Investigation





(NCCA, 2024, p. 3)



(Physics Sample Brief, p. 5)

Engagement with Guidelines for the Physics in Practice Investigation

1. **Identify** the key learning from each stage of the AAC process
2. **Discuss** how can you prepare your students for this stage of the AAC process
3. **Identify** which unifying strand learning outcomes are being engaged with at this stage

Reflecting on the Guidelines for the Physics in Practice Investigation

Take a moment to note down your thoughts about the guidelines

How can students develop the required skills?

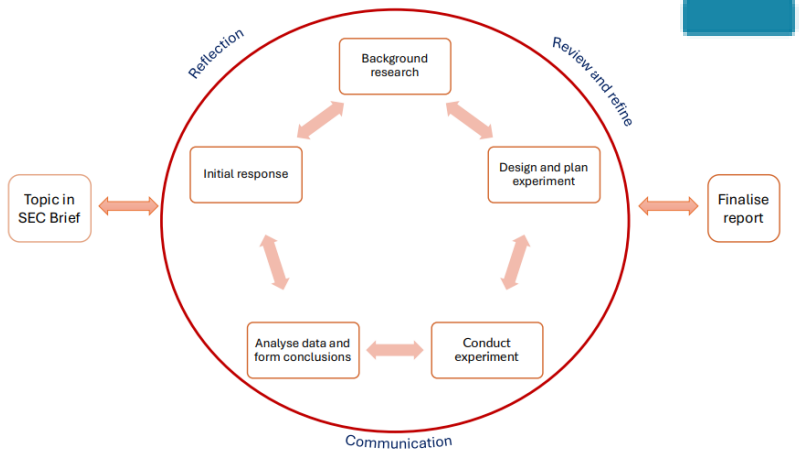


Figure 1. Overview of the process for completion of the Physics in Practice Investigation

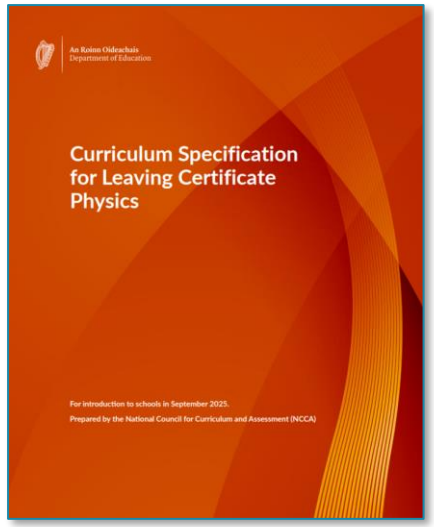
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Investigation in the Physics Classroom

"Leaving Certificate science education provides a means by which students can investigate the natural world to foster an evidence-based understanding of how it works."

"Leaving Certificate Biology, Chemistry, Physics aims to empower students to: 'demonstrate inquiry and practical skills consistent with the principles and practices of Biology, Chemistry and Physics"

(NCCA, p. 4)



Unifying Strand – Working like Scientists

"As they learn to work like scientists, they develop a habit of mind that sees them rely on a set of established procedures and practices associated with scientific inquiry to gather evidence, generate models and test their ideas. It becomes apparent that the process of science is often complex and iterative, following many different paths."

(NCCA, p.12)

Tea/Coffee Break

Oide
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Oide
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Session 2

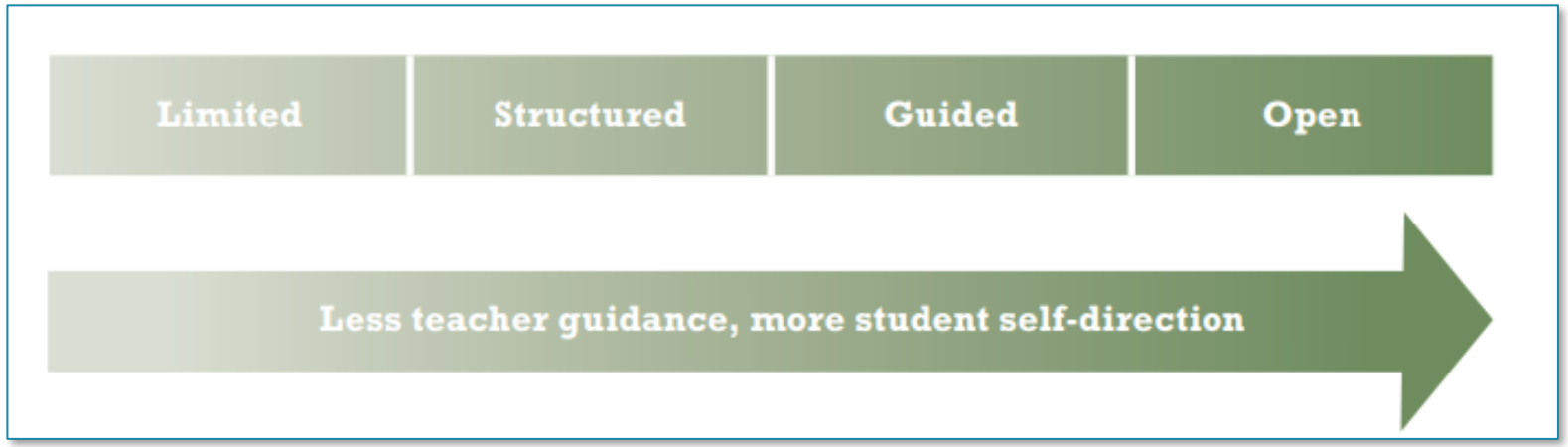
Investigation Stations

Unifying Strand – Working like Scientists

"As they learn to work like scientists, they develop a habit of mind that sees them rely on a set of established procedures and practices associated with scientific inquiry to gather evidence, generate models and test their ideas. It becomes apparent that the process of science is often complex and iterative, following many different paths."

(NCCA, p.12)

Investigation and the Continuum of Inquiry



Junior Cycle Science Specification, 2015, p. 14

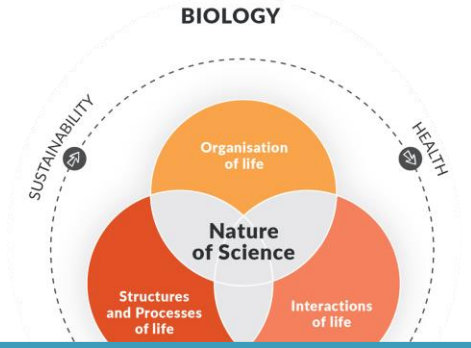
"Teachers are best positioned to make professional judgements on how to develop these skills with their students through an appropriate balance of explicit instruction and inquiry-based approaches"

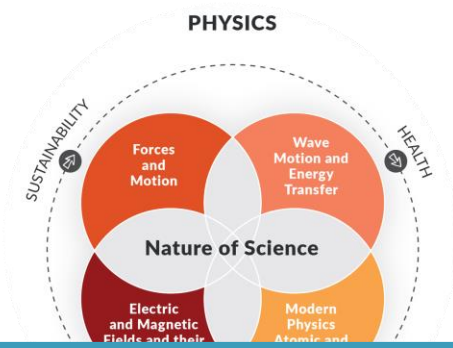
(NCCA, 2024)

Inquiry Learning in Physics

- Inquiry based learning approach
- Rotate through 4 stations
- Consider connections to the Unifying Strand
- SCAMPER each activity to reflect on your school context

Unifying Strand – Nature of Science





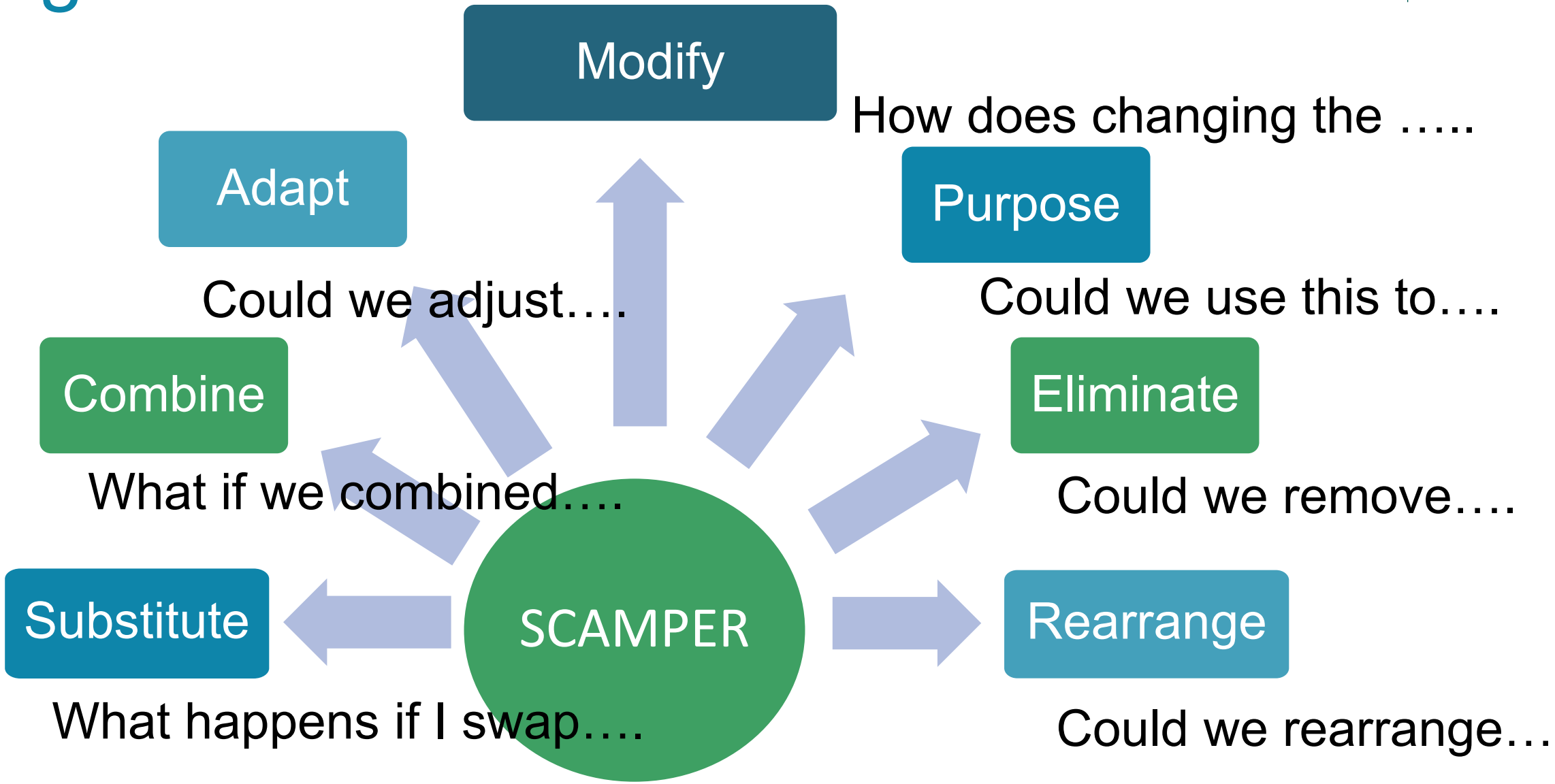
"In senior cycle it is expected that students will be able to meet these learning outcomes with a greater degree of independence"

(NCCA, p.12)

Junior Cycle Science Specification, 2015, p.10

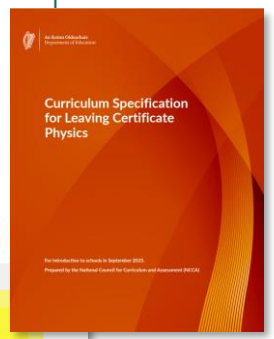
Biology, Chemistry and Physics Specifications, 2024

Using SCAMPER



Investigations: Station 1

How can we assist students to engage with this learning outcome?



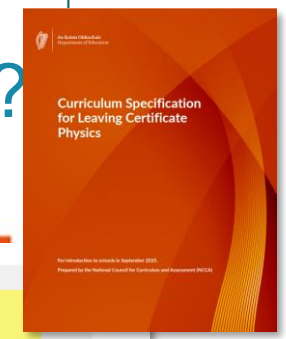
Students learn about	Students should be able to
1.5. Forces acting in a gravitational field • mathematical models for g the acceleration due to gravity $g = 4\pi^2 \frac{1}{T^2}$ $g = \frac{2s}{t^2}$ $g = \frac{Gm}{r^2}$ $g = \frac{P}{h\rho}$	1. verify at least one model to determine g using primary data and all four using secondary data
U4. Modelling in Physics • verifying models	2. make connections between mathematical representations of a system and data about the system obtained from that system with integrity through reliable, accurate, and precise observation and safe and fair experiment

Physics Specification Learning Outcome 1.5.1 and U4.2

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Investigations: Station 2

How can we assist students to engage with this learning outcome?



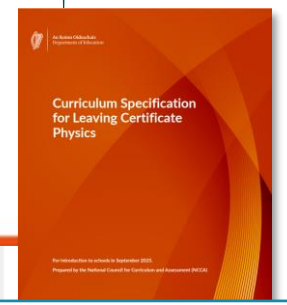
Students learn about	Students should be able to
1.3. Stretching and compressing objects • stretching and compressing objects • Hooke's law; $F = -ks$	1. investigate the force needed to compress or stretch an object using primary and secondary data 2. verify Hooke's law for elastic objects using primary and secondary data 3. solve problems involving compressed a materials

Physics Specification Learning Outcome 1.3.1 and 1.3.2

How does this Learning Outcome connect to the Unifying Strand Learning Outcomes about investigation and verifying models?

Investigations: Station 3

How can we assist students to engage with this learning outcome?



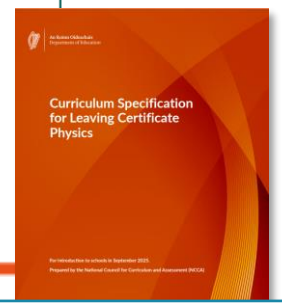
Physics Specification Learning Outcome 1.4.4

Students learn about	Students should be able to
1.4. A work-energy model for analysing particle motion • $E_P = mgh$ • $E_k = \frac{1}{2}mv^2$ • $W = Fs$ • $P = \frac{W}{t}$ • **Work done in stretching or compressing** $E_P = \frac{1}{2}ks^2$ • the principle of conservation of energy	1. define work done by a constant force 2. model real life situations describing gravitatio energy, **elastic potential energy**, kinetic energ and the rate of doing work 3. **solve problems involving compressed and stretched materials** 4. investigate the principle of conservation of energy using primary and secondary data 5. apply the principle of conservation of energy to real life situations

How does this Learning Outcome connect to the Unifying Strand Learning Outcomes about investigation and verifying models?

Investigations: Station 4

How can we assist students to engage with this learning outcome?



Physics Specification
Learning Outcome 1.1.4

Students learn about	Students should be able to
• graphical representation and interpretation: displacement-time graphs, velocity-time graphs • the kinematics equations under constant acceleration $v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$ • identifying and representing scalar and vector quantities • **resolving vectors into perpendicular components** • **calculating the resultant of two vectors**	**3. derive the kinematic equations**

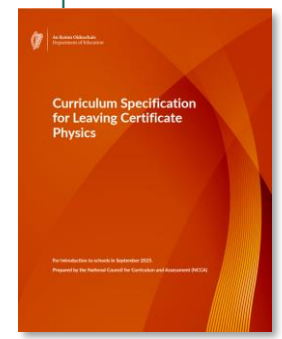
How does this Learning Outcome connect to the Unifying Strand Learning outcomes about investigations and verifying models?

4. verify the law of addition of vectors using primary and secondary data in one and two dimensions

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Investigations: Station 5

Physics Specification
Learning Outcome 3.3.7



How can we assist students to engage with this learning outcome?

Students learn about	Students should be able to

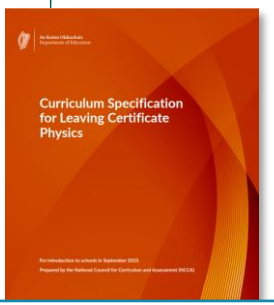
• conservation of charge and energy in a circuit
  • $R = R_1 + R_2 + R_3 \ldots\ldots$
  • $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots\ldots$
	7. model resistances in series and parallel in electrical circuits using primary and secondary data
	
	8. **derive** and use the formulae for resistors in series and parallel

How does this Learning Outcome connect to the Unifying Strand Learning Outcomes about investigation and verifying models?

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Investigations: Station 6

How can we assist students to engage with this learning outcome?



Students learn about	Students should be able to

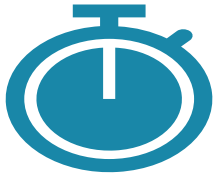
3.6. Induced potential difference and the generator effect
• **magnetic flux Φ = BA**
• **Faraday's law**
• **Lenz's law**
  ◦ $E = -\frac{d\Phi}{dt}$
• Mutual inductance in transformers
  ◦ $\frac{V_s}{V_p} = \frac{N_s}{N_p}$
  ◦ $I_p V_p = I_s V_s$
• electrical generation; A.C and D.C generators and their components
  ◦ $V_{rms} = \frac{V_0}{\sqrt{2}}$
  ◦ $I_{rms} = \frac{I_0}{\sqrt{2}}$
	1. investigate the relationship between a change in magnetic flux on any induced emf and subsequent current flow in a conducting coil
	2. model
	  • the generator effect
	  • ac and dc generators
	  • transformers
	3. investigate the use of induced potential difference in a variety of applications using secondary sources
	4. solve problems involving the efficiency of transformers
	5. investigate transmission losses in the National grid using secondary sources
	6. investigate issues related to electrical generation and distribution using secondary sources

Physics Specification Learning Outcome 3.6.1 and 3.6.5

How does this Learning Outcome connect to the Unifying Strand Learning Outcomes about investigation and verifying models?

Investigation in the Physics Classroom

Select 4 learning outcomes that you would like to engage with through investigation



20 minutes per station

At each station, consider

- How might students design a suitable investigation?
- How would it help students move along the continuum of learning?
- How would it help them engage with the learning outcomes of the unifying strand?

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

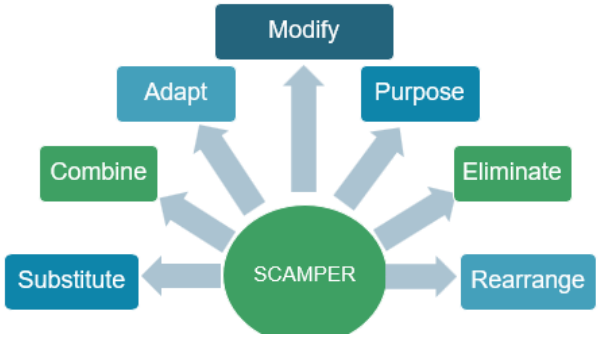
Carousel of Investigations

Looking at each station

- What other contextual strand learning outcomes could this activity support?

- What unifying strand learning outcomes are students engaging with?

- SCAMPER each investigation



5 mins

Reflection

1. How can I scaffold my students' learning to ensure they build confidence and competence in planning and carrying out scientific investigations?

2. What could this look like in my classroom going forward?

3. How can I support my students in developing the necessary skills for inquiry-based learning?

Lunch

Oide

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí

Supporting the Professional Learning of School Leaders and Teachers

Session 3

Supporting teachers as they prepare students for the design of investigative work for their AAC:

CC BY NC

Unit Analysis

1 T	1 V	1 C
1 J	1 N	1 Pa

	$1\ kg\ m^2\ s^{-3}\ A^{-1}$		$1\ kg\ m^{-1}\ s^{-2}$
	$1\ kg\ A^{-1}s^{-1}$		$1\ kg\ m^2/s^2$
	$1\ kg\ m/s^2$		$1\ A\ s$

Switch template

Match up
Find the match
Quiz
Anagram
Matching pairs
Flash cards
Open the box
Speaking cards
Spin the wheel

SCAN ME

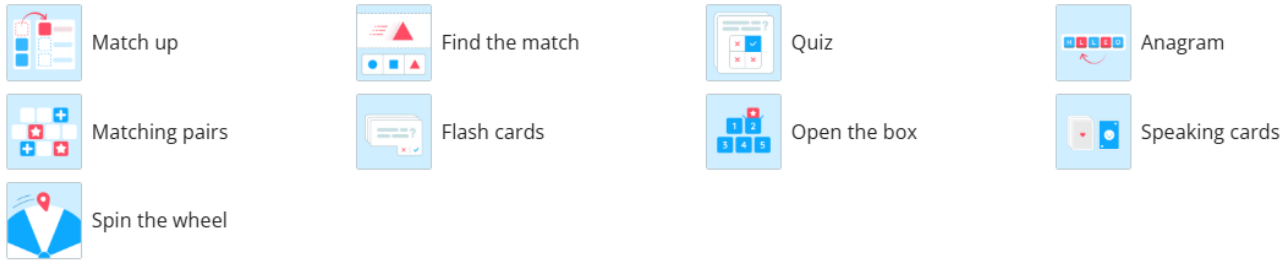
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Unit Analysis

1 T	1 V	1 C
1 J	1 N	1 Pa

1 V	$1\ kg\ m^2\ s^{-3}\ A^{-1}$	1 Pa	$1\ kg\ m^{-1}\ s^{-2}$
1 T	$1\ kg\ A^{-1} s^{-1}$	1 J	$1\ kg\ m^2/s^2$
1 N	$1\ kg\ m/s^2$	1 C	1 A s

Switch template

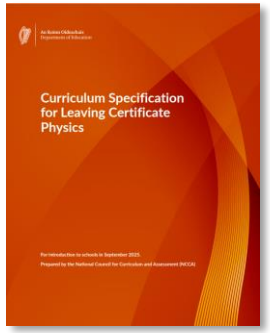


SCAN ME

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Unit Analysis

Physics Specification
Learning Outcome U.5.1



U5. Unit analysis

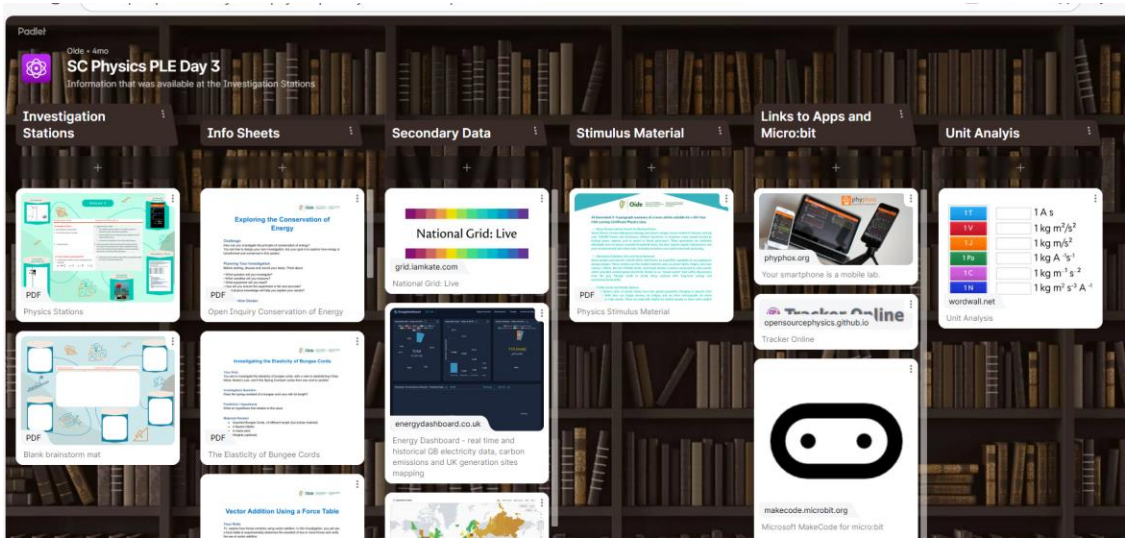
- dimensional/unit analysis
- making order of magnitude estimates

1. evaluate and articulate whether an answer is reasonable by analysing the dimensions / units and the order of magnitude

Evaluate (data)	collect and examine data to make judgments and appraisals; describe how evidence supports or does not support a conclusion in an inquiry or investigation; identify the limitations of data in conclusions; make judgments about the ideas, solutions or methods

Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Resources



https://padlet.com/jct2/sc-physics-ple-day-3-i9i1z3lct0dq06b0

Key Messages for today:

The unifying strand says that students should be able to appreciate how scientists work and how scientific ideas are modified over time, which places learning related to investigation through experimentation, research and verifying models at the very core of the specification.

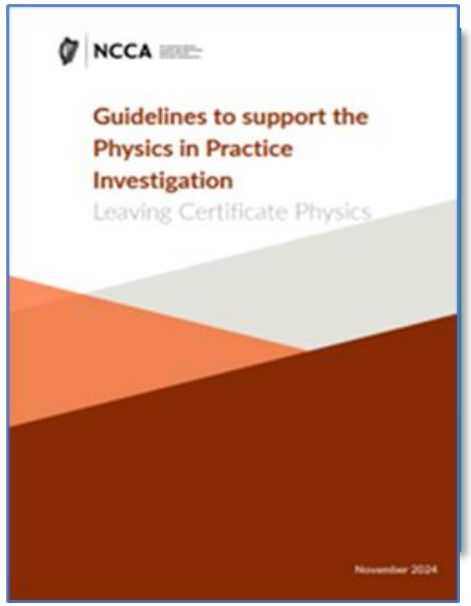
The continued development of research questions, hypothesis, and experimental design are skills that students need to learn through their participation with junior and senior cycle to support student engagement with the AAC.

The collection and use of primary data allows students to learn how to critically analyse data, identify patterns and relationships, identify anomalous observations, draw and justify conclusions.

Making Connections across the Specification

Figure 1: The components of key competencies and their desired impact

Physics in Practice Investigation Considerations



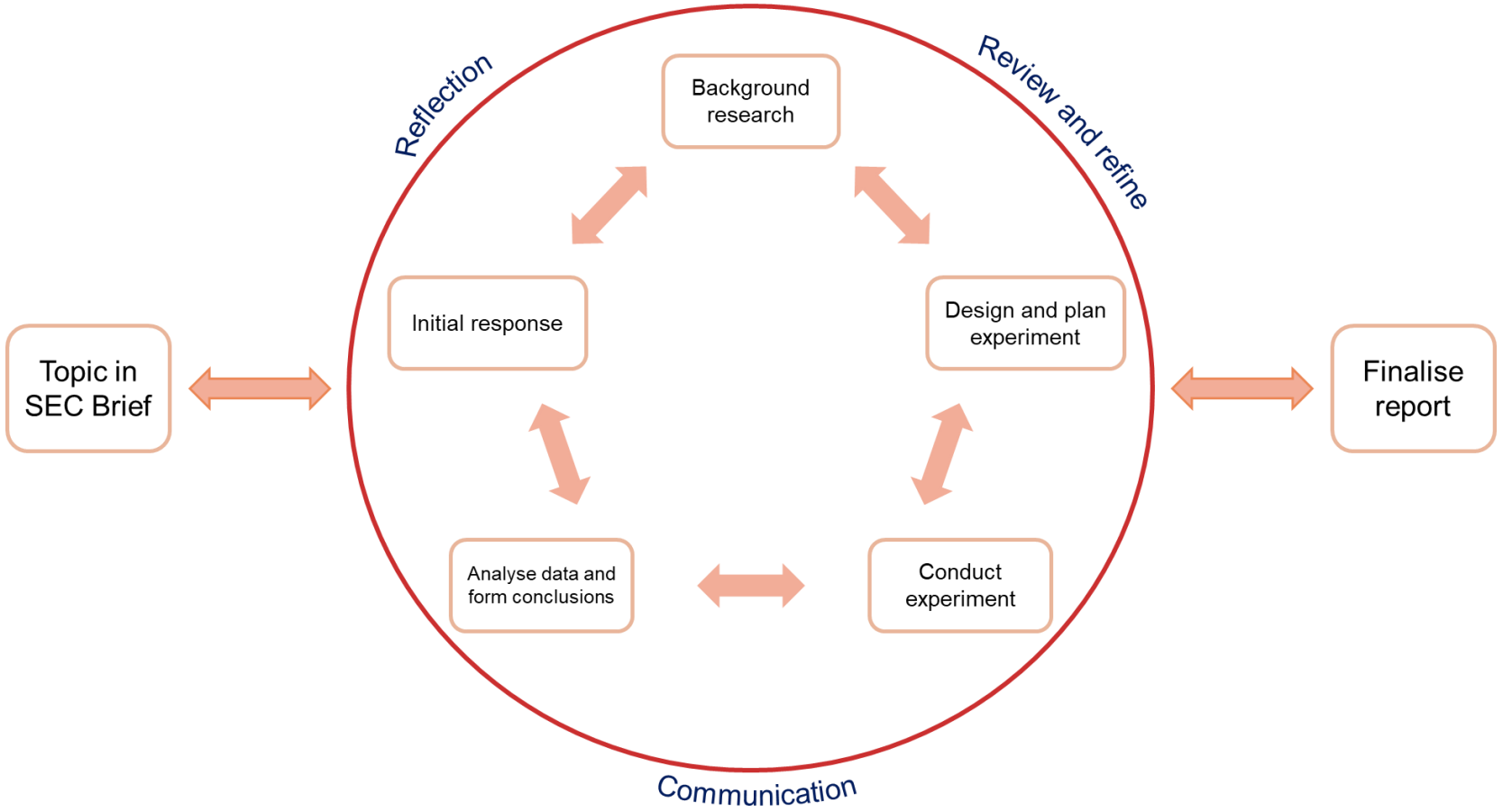
"The Physics in Practice Investigation is intended to be integrated into the regular teaching and learning of the physics classroom. As such, students will be planning for its completion from the very beginning of the course, developing the skills required to complete the investigation as they engage with the learning set out in the specification.."

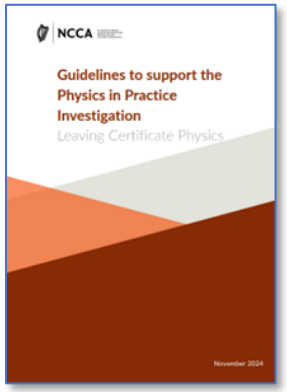
(NCCA, 2024, p.5)

"Teaching and learning related to the additional assessment component should be integrated into ongoing classroom practice to maximise opportunities for students to achieve the learning outcomes of the specification and support the development of key competencies."

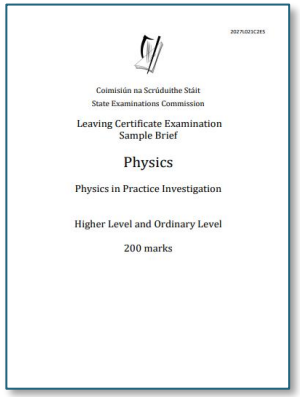
(NCCA, 2024, p.12)

Process for the completion of the Physics in Practice Investigation





(NCCA, 2024, p. 3)



(Physics Sample Brief, p. 5)

Sample Brief

Oide

"When Galileo first trained his optic telescope on the heavens and opened up modern optical astronomy, that was the first of the electromagnetic windows out of the universe: light."

Kip Thorne

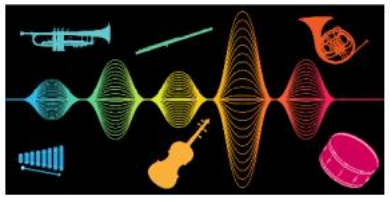
Waves can carry energy from one location to another, but the behaviour of waves also makes them suitable as a means of carrying information.

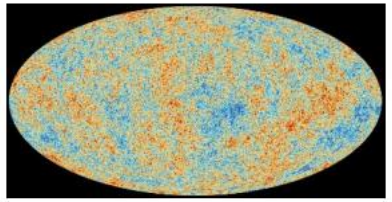
Both mechanical and electromagnetic waves are used as a means of understanding our environment on Earth, and the universe beyond. They give us windows through which we can interrogate nature. Telescopes, seismometers, and sonar are all devices employed to exploit the information carried by different types of wave. Animals, too, have evolved techniques using waves to navigate, hunt prey, or confuse predators.

Investigate how information is carried by and/or obtained from waves using the process described in **Section 4** of this document.

(Leaving Certificate Examination Sample Brief Physics, p.6)

SCAN ME



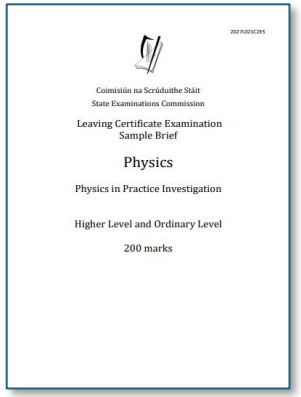


Engaging with the Sample Brief

Oide

Using the sample brief identify the following-

- What contextual strands are involved?
- What real-world links can you find?
- What cross-cutting themes connect to this brief?
- Could SCAMPER be used to adapt or extend any investigations?



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination
Sample Brief

Physics

Physics in Practice Investigation

Higher Level and Ordinary Level

200 marks

Physics in Practice Investigative Log

"It is recommended that students keep an investigative log of learning activities that relate to and support the development of inquiry and practical skills that they can draw upon as they complete their investigation"

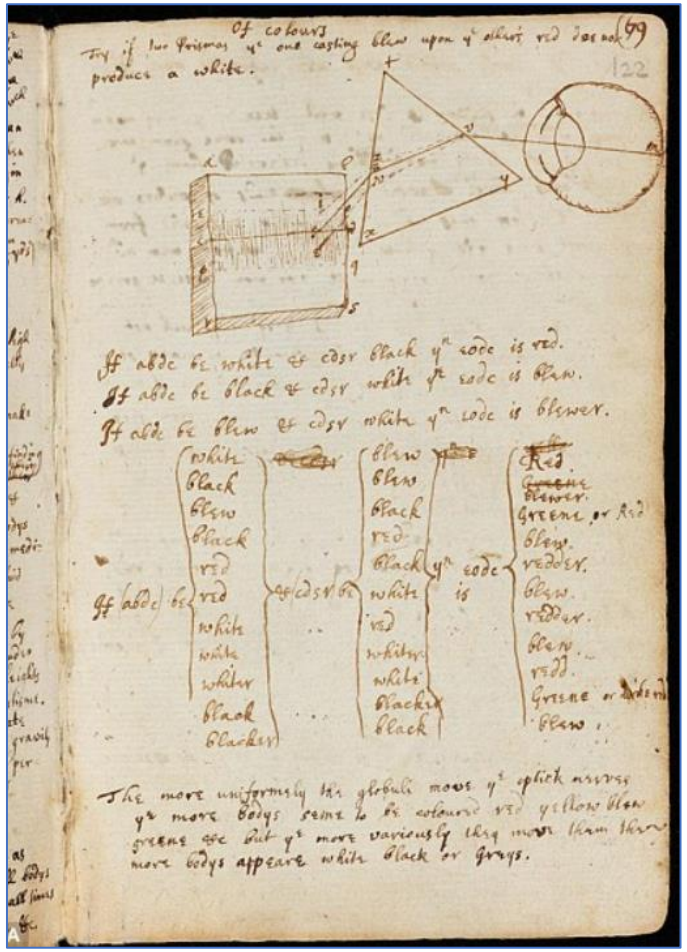
(NCCA, 2024, p.4)

"An investigative log is the student's working document where they record and reflect on the process of their investigation. As this personal document is not submitted to the SEC for examination, its format, which may be digital or hard copy, is decided by the student."

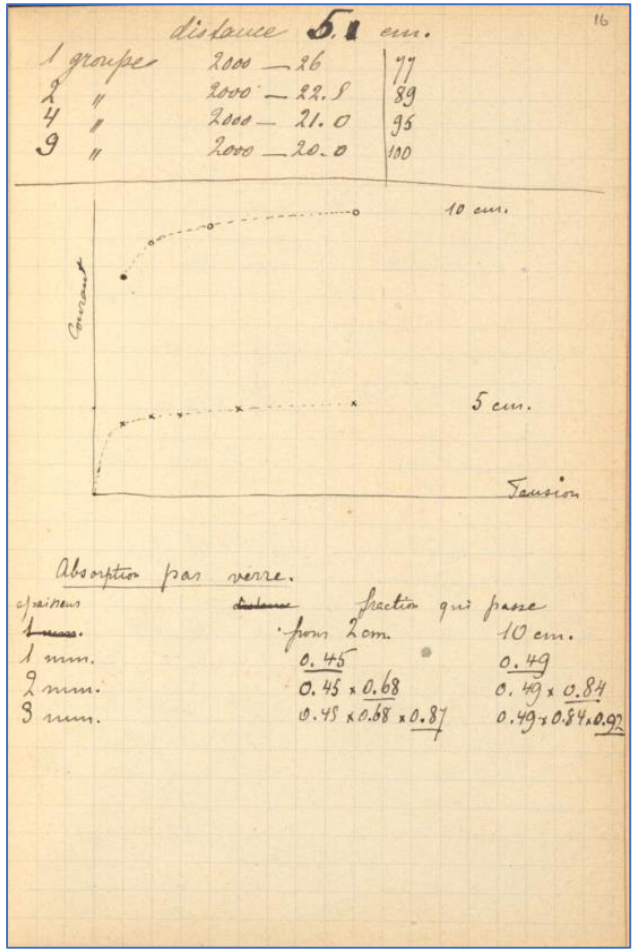
Features of an Effective Investigative Log

Oide

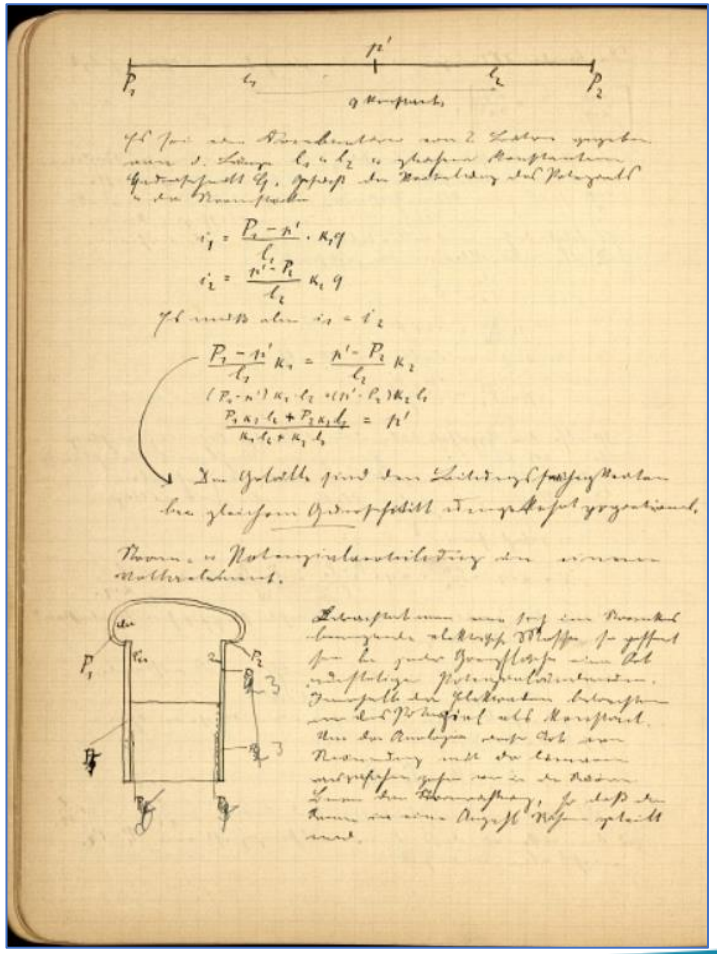
Newton



Marie Curie



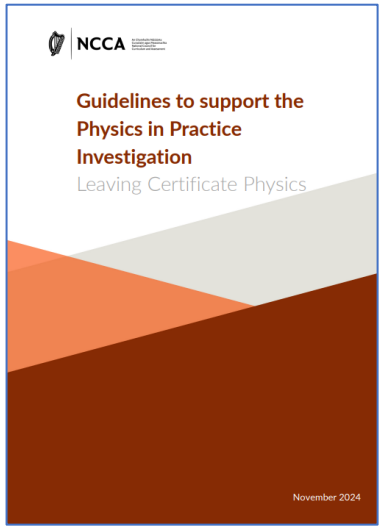
Einstein



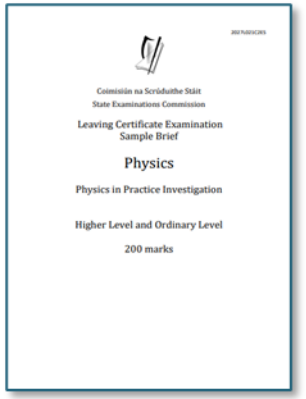
The Role of the Teacher in supporting Student Work

"Regular, comprehensive engagement with each student's work on their Physics in Practice Investigation will enable teachers to confidently and legitimately authenticate any work being submitted for assessment""

(NCCA, 2024, p.11)



Engaging with the Sample Brief


Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination
Sample Brief

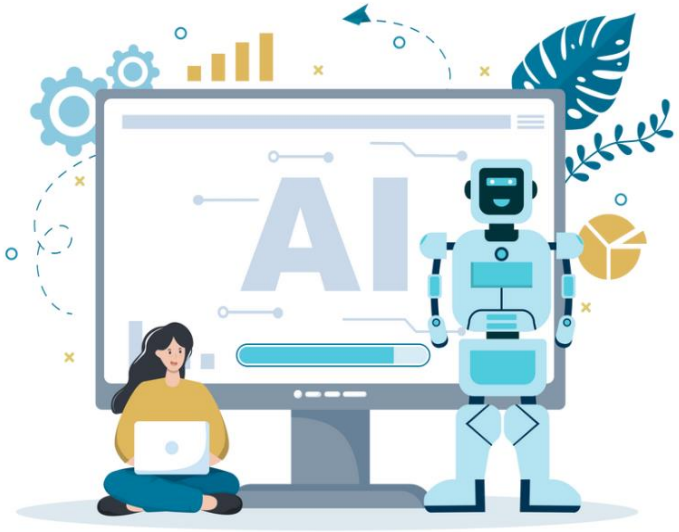
Physics

Physics in Practice Investigation

Higher Level and Ordinary Level

200 marks

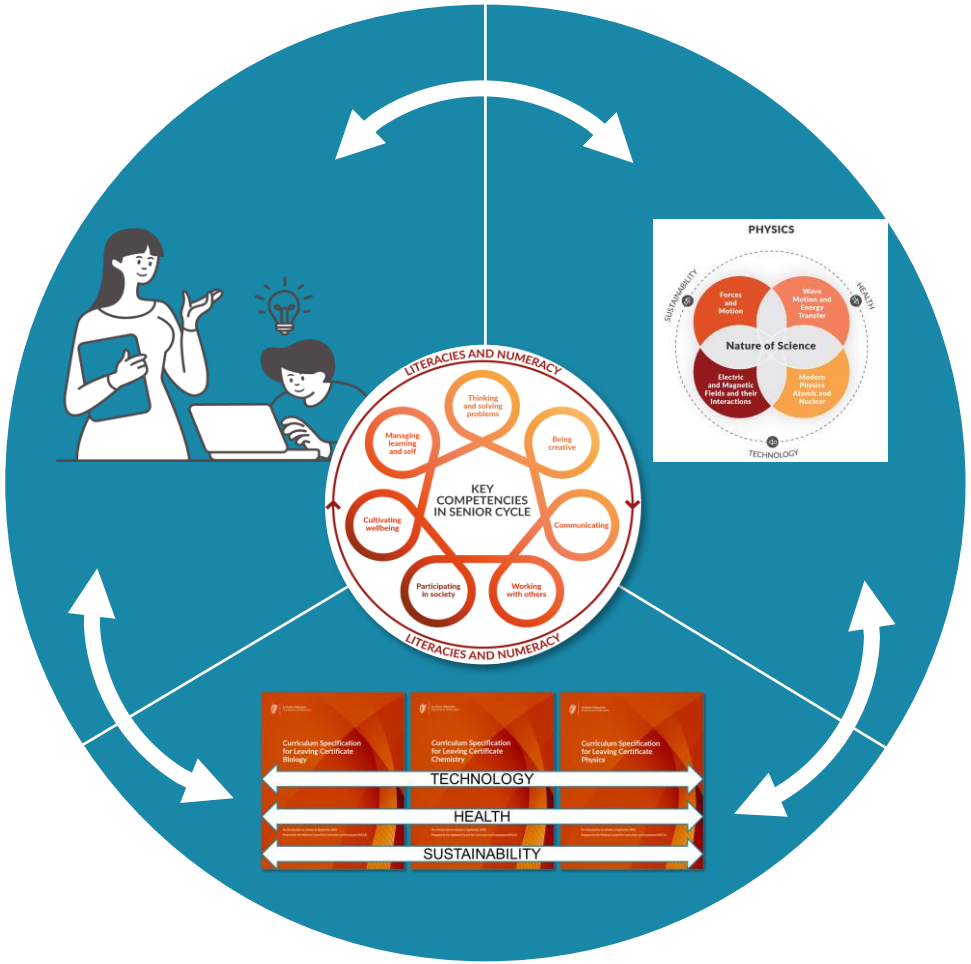
- Choose a real-world issue related to the brief.
- Identify a key physics idea and explain its scientific or societal importance.
- Could you begin to shape a research question?



Reflection

Which learning outcomes from the Unifying and Contextual Strands are being explored through the AAC process?

How does engaging students in the stages of the AAC help them develop the key competencies?

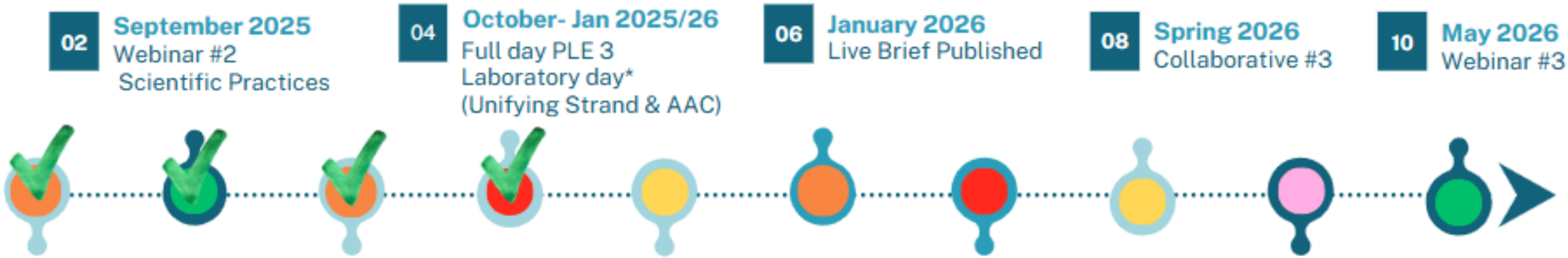


Senior Cycle Redevelopment - Science PLE Timeline

Oide

Next Steps

Year 2 - 2025/2026



01 September 2025
Specifications in schools

02 September 2025
Webinar #2
Scientific Practices

03 September 2025
Sample Brief Published

04 October- Jan 2025/26
Full day PLE 3
Laboratory day*
(Unifying Strand & AAC)

05 Nov - Dec 2025
Collaborative #2

06 January 2026
Live Brief Published

07 Term 2 2026
PLE3 Second/Third Subject

08 Spring 2026
Collaborative #3

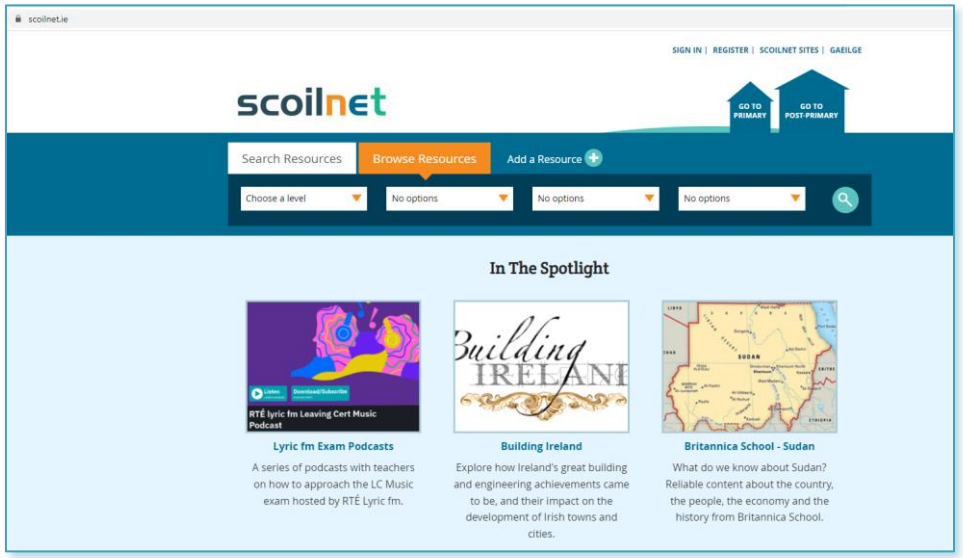
09 March -April 2026
1/2 Day PLE

10 May 2026
Webinar #3

Full Day PLE | Collaborative | Webinar | Half Day PLE | SEC Publications | AAC Publications

Contact Us and Feedback

www.scoilnet.ie



sciences@oide.ie

@Oide_Science

Link to Feedback:
https://registration.oide.ie/feedback