



**Oide**

Tacú leis an bhFoghlaim  
Ghairmiúil i measc Ceannairí  
Scoile agus Múinteoirí

Supporting the Professional  
Learning of School Leaders  
and Teachers

# Introduction to the New Leaving Certificate Physics Specification

## Professional Learning Experience – Day 2



# Schedule

09:15 - 11:00	Understanding of the Physics Specification
11:00 - 11:20	Tea and Coffee
11:20 - 13:00	Focus on Action Verbs
13:00 - 14:00	Lunch
14:00 – 16:00	Planning to teach the new specification



# Welcome and Introductions



In your group.....

introduce yourself, saying something about your teaching experience in physics – or other subjects

share any thoughts you have regarding teaching the new specification

what are you hoping to get from today?





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# Introducing Oide – established 2023



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Lárionad

An tSraith Shóisearach do Mhúinteoirí



N

An Clár Náisiúnta  
The National Indicators



LE

ners



um Fhorbairt  
do Mhúinteoirí

## The Science Team

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# Leaving Certificate Science Subjects PLE Timeline

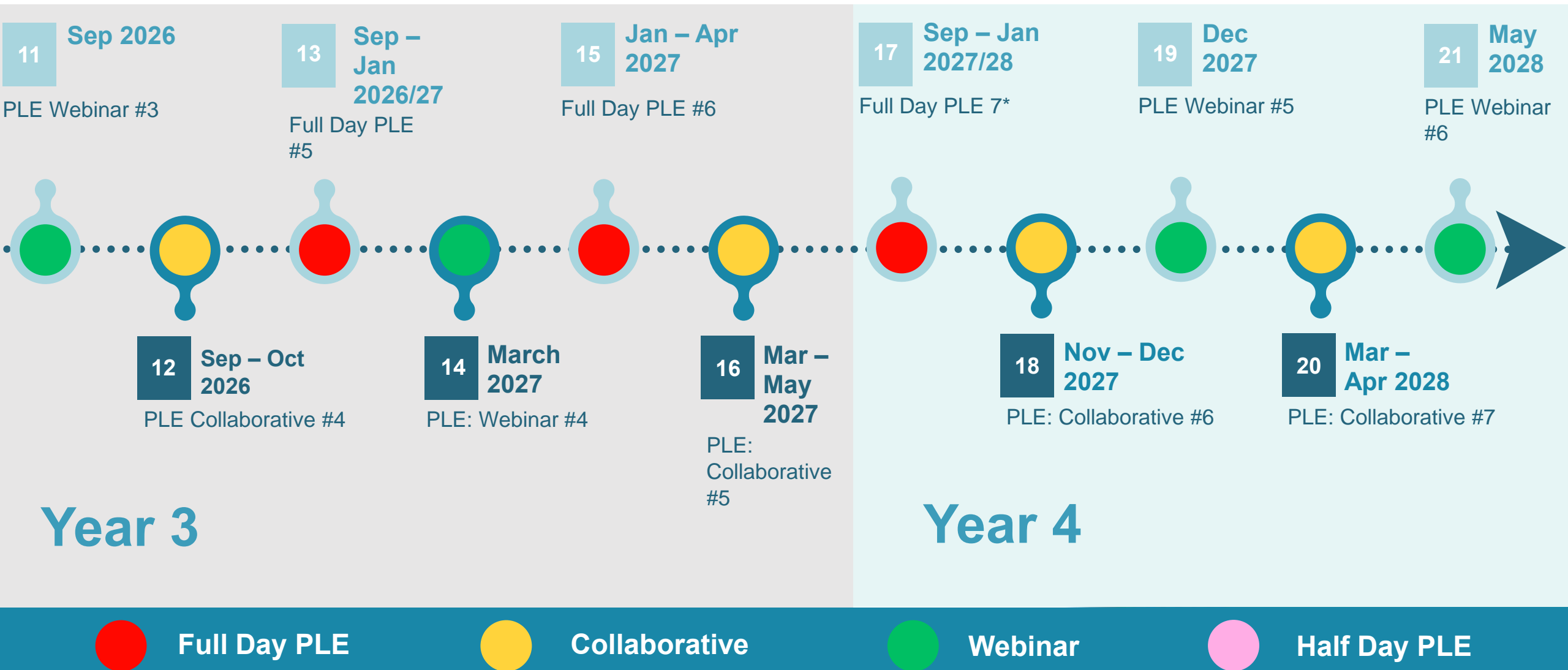


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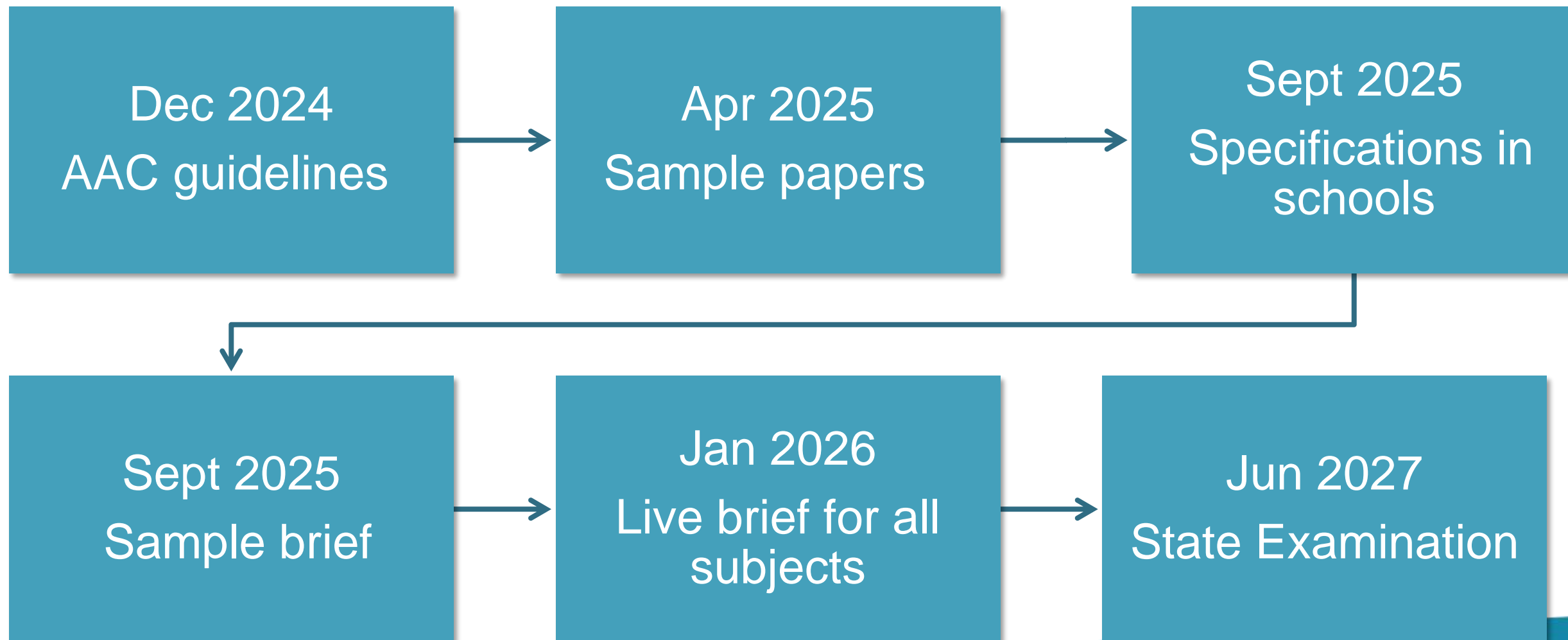


# Leaving Certificate Science Subjects PLE Timeline





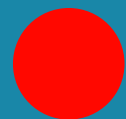
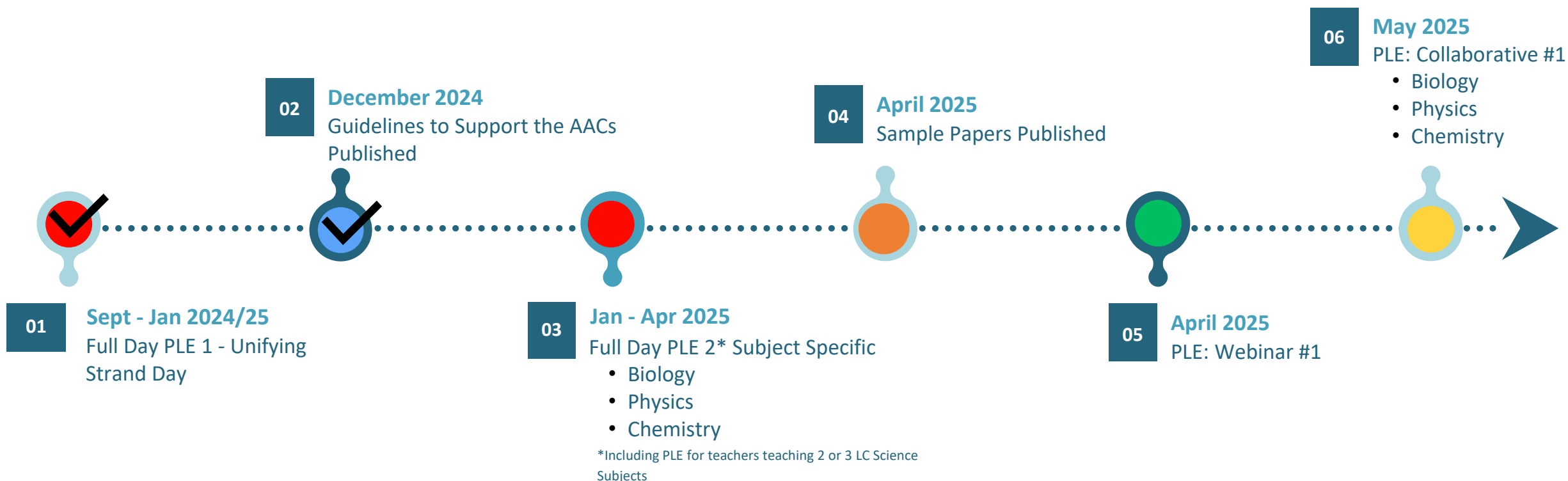
# Key Dates







# Leaving Certificate Science Subjects: Timeline: 2024/2025



Full Day PLE



Collaborative



Webinar



Half Day PLE



SEC Publications



AAC Publications



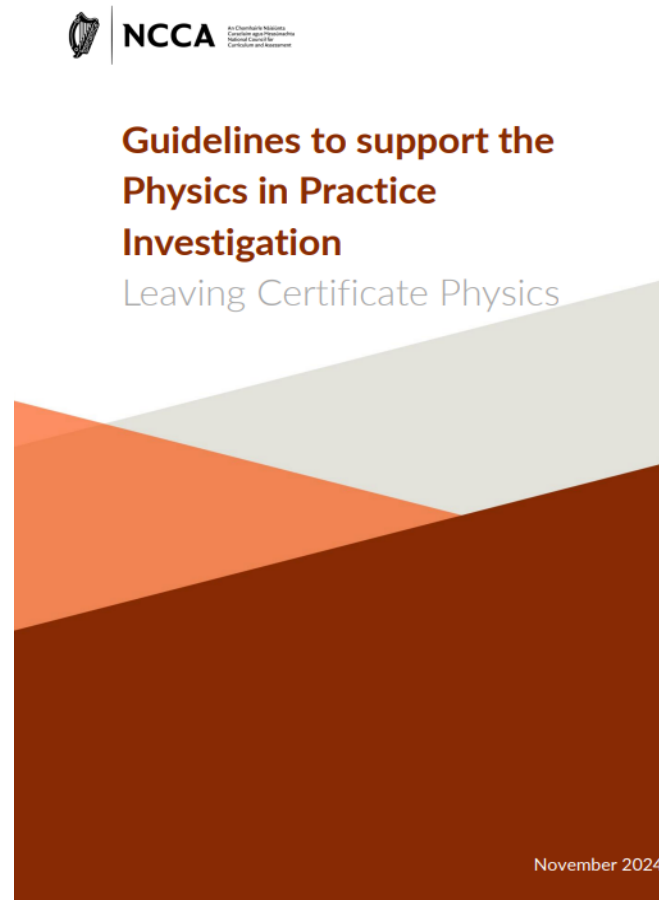
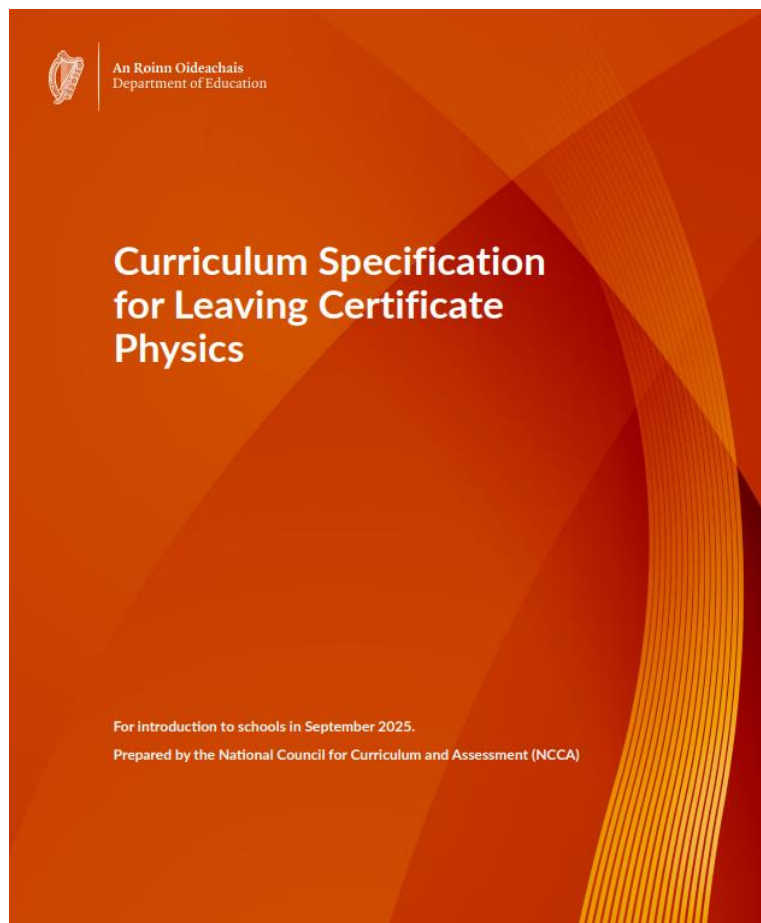


# Key Supporting Policy Documents





# Physics Specification and Additional Assessment Component Guidelines





# Senior Cycle Guiding Principles

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*‘Senior cycle education cultivates learning and contributes to human flourishing. It recognises the whole person, contributing to students’ growth and maturity, to their continuing intellectual, social and personal development and their overall health and wellbeing.’*

---

(Senior Cycle Review Advisory Report, NCCA, 2022, pp. 21-24)

(Senior Cycle Biology, Chemistry and Physics specifications, p. 2)



# Senior Cycle Guiding Principles

## Senior Cycle Guiding Principles

Wellbeing and relationships

Inclusive education and diversity

Challenge, engagement and creativity

Learning to learn, learning for life

Choice and flexibility

Continuity and transitions

Participation and citizenship

Learning environments and partnerships

(Senior Cycle Biology, Chemistry and Physics specifications, p. 2)



# 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



# Key Messages for today:



Consider the implementation the **new Physics specification**, and explore student-centred approaches to teaching, learning, and assessment

Consider **the use of action verbs** and - with a focus on modelling and reflecting on how this may affect teaching, learning and assessment in the Physics classroom

Building on PLE Day 1, continue the process of **developing a scheme of work**, ensuring access, support, and challenge for all students



## By the end of today, you will have:

- explored various learning outcomes of the physics specification
- considered the importance of Action Verbs in the teaching of the specification
- reflected on approaches to teaching and learning which address sequencing, overlapping and interleaving concepts.







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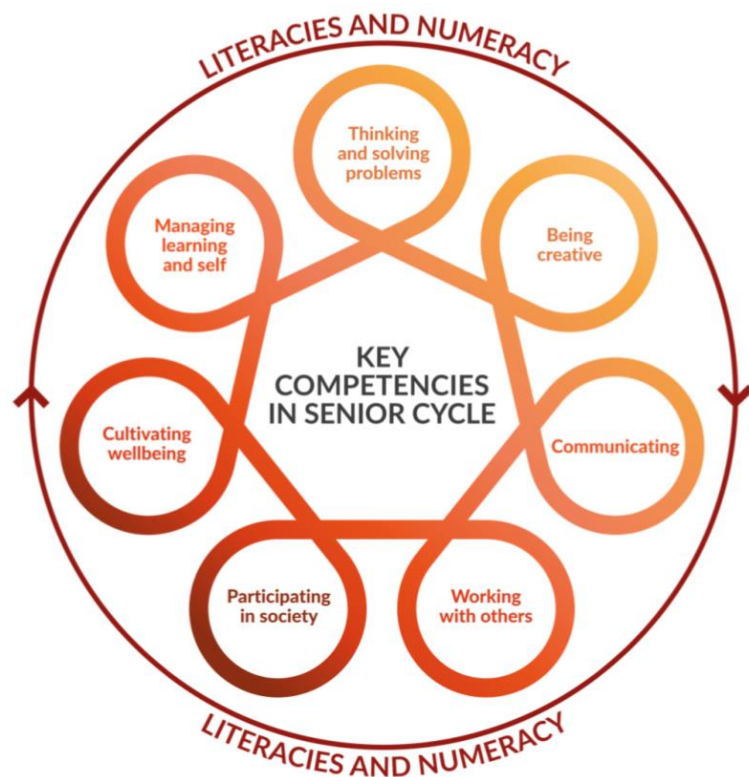
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# Session 1: Our Shared Understanding of the Physics Specification



# Key Competencies and the Physics Specification

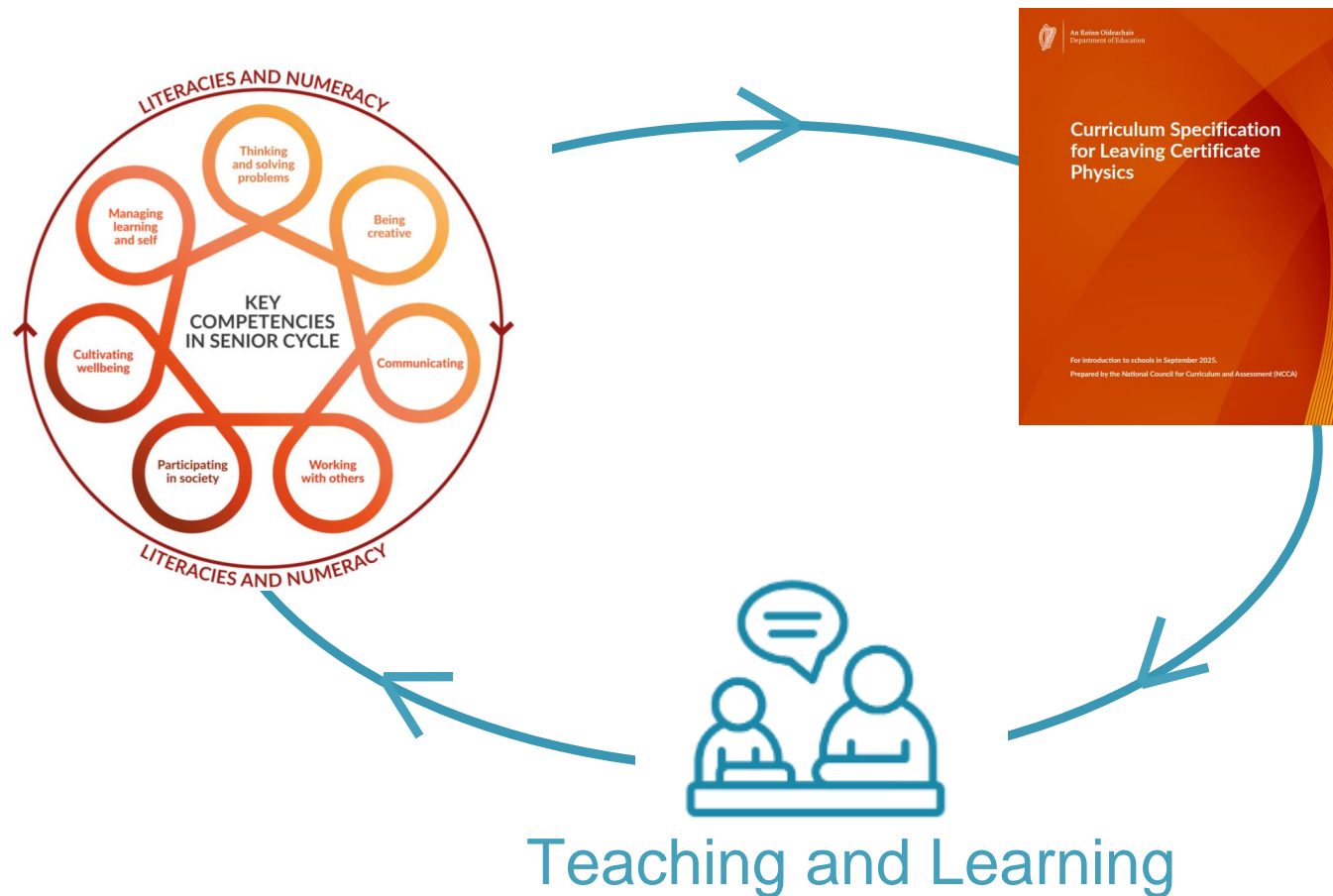


*"... it is vital to recognise that key competencies and subject or module learning are developed in an integrated way. By design, key competencies are integrated across the rationale, aims, learning outcomes and assessment sections of specifications."*

*(Physics Specification, p.6)*

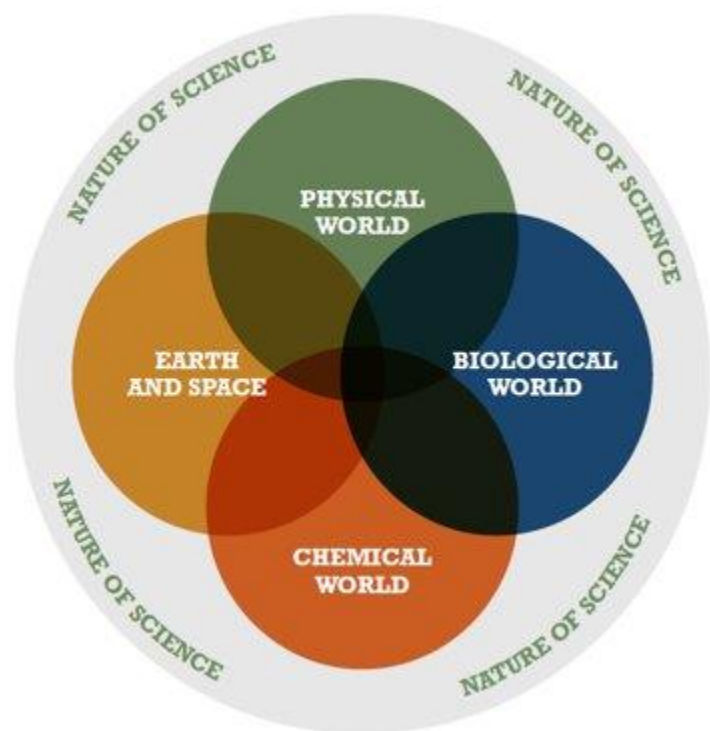


# Key Competencies and the Physics Specification

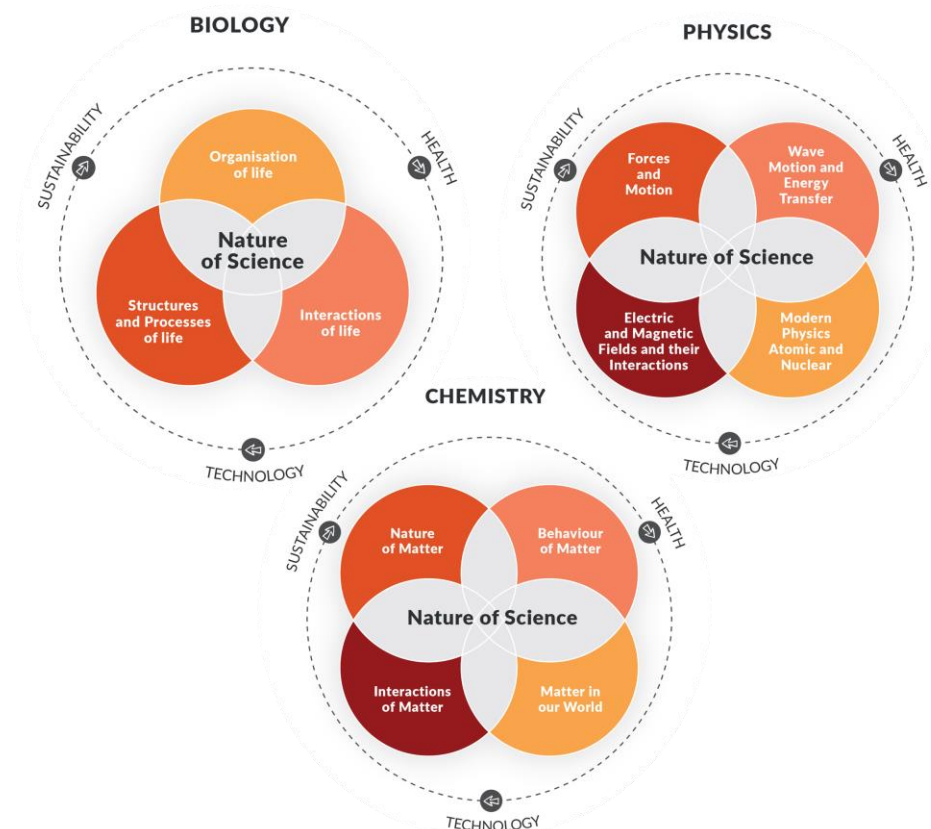




# Recap from day 1: Nature of Science



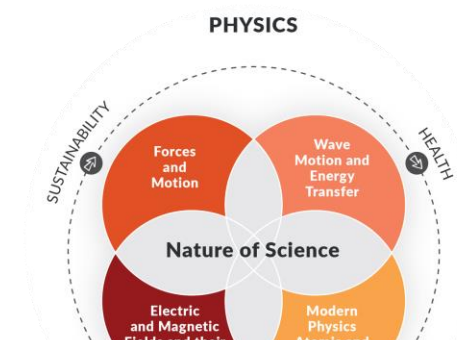
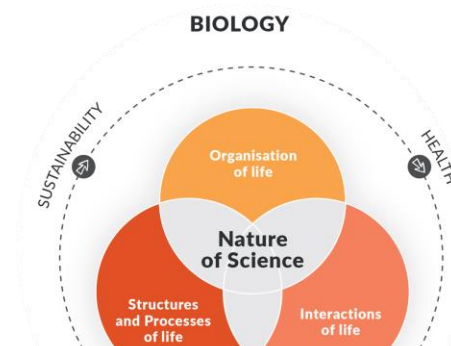
Junior Cycle Science Specification, 2015, p.10



Biology, Chemistry and Physics Specifications, 2024



# Recap from day 1: 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”*  
(Physics Specification, 2024, p.12)

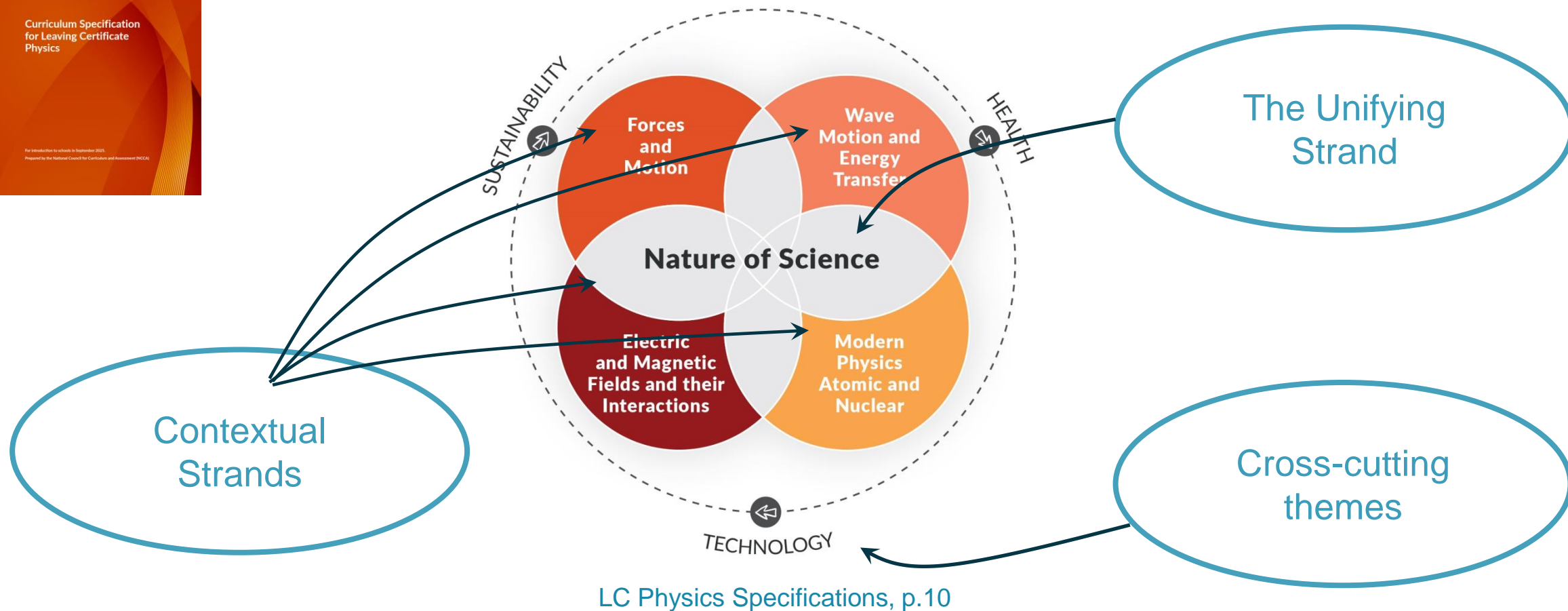
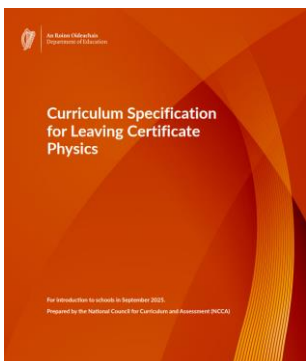
Junior Cycle Science Specification, 2015, p.10

Biology, Chemistry and Physics Specifications, 2024





# Overview of Physics Specification



LC Physics Specifications, p.10



# Overview of Physics Specification

specific areas that **students learn about**.  
(SLA)

....describes the knowledge, skills,  
values and dispositions students  
should be able to demonstrate after a  
period of learning

Students learn about

Students should be able to

Taken together, these provide clarity and coherence with the other sections of the specification.

*Physics, p 11*



# Key Messages from day 1

Through engagement with the learning outcomes set out in the Leaving Certificate science specifications, students will develop **key competencies** that they can apply to various tasks, contexts, situations and events.

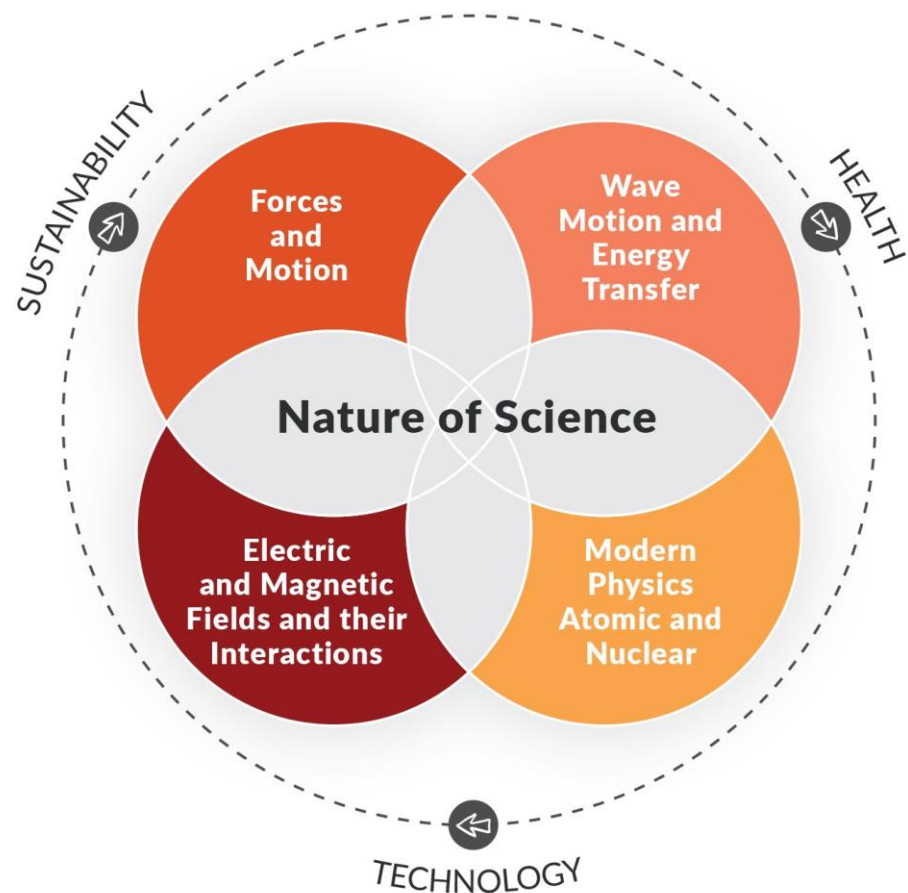
With their **student-centred design** and emphasis on scientific investigations, the Leaving Certificate science specifications accommodate a variety of learning, teaching and assessment methods, to meet the needs of all learners.

When planning for learning, teaching and assessment, teachers provide opportunities for students to engage with the **scientific practices set out in the unifying strand**.



# Looking at the Contextual Strands

## PHYSICS



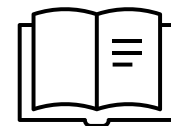
Engage with contextual strands

Form an expert group for each strand

Share insights



# Personal Reflection



Take a moment or two to jot down any thoughts or ideas, that you find relevant or useful to you



# Tea/Coffee Break





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# Session 2

A focus on Action Verbs in the Physics  
Specification



# Key Messages for today:

Consider the implementation the **new Physics specification**, and explore student-centred approaches to teaching, learning, and assessment



Consider **the use of action verbs** and - with a focus on modelling - reflect on how this may affect teaching, learning and assessment

Begin the process of **developing a scheme of work**, ensuring access, support, and challenge for all students



# By the end of this session you will have:

an increased awareness and understanding of

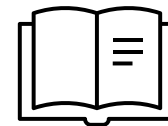
- the importance of action verbs in learning outcomes in relation to teaching, learning and assessment
- the use of modelling in physics
- the use of modelling in teaching, learning and assessment





# Model, Modelling in Physics

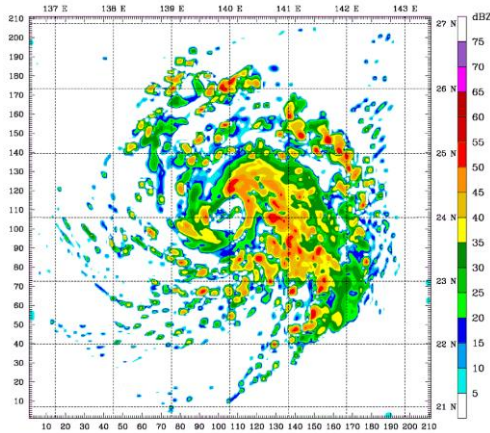
What do you understand by the verb 'to model'





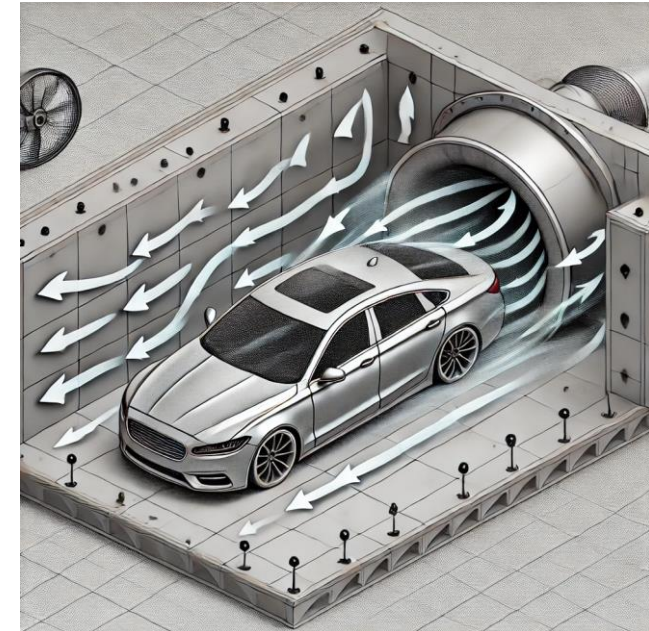
# Modelling in Physics

Are these valid examples of modelling, as the word is used in physics?



[Creative commons: About Baipin | Flickr](#)

[Creative commons](#)  
[Typhoon Mawar 2005 computer simulation thumbnail.gif](#)



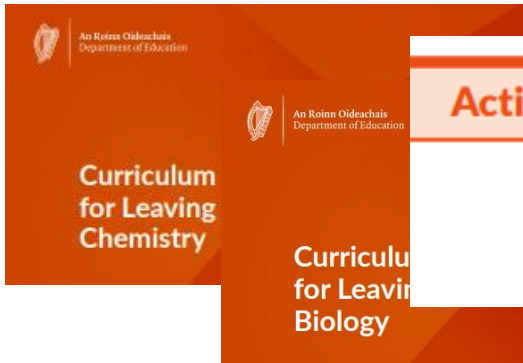
Wind tunnel: chatgpt AI image:

(What do you notice?)

# Model, Modelling in the Biology, Chemistry and Physics Specifications



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## Action verb

### Model

## Students should be able to

represent an idea, structure, process or system through a variety of means such as words, diagrams, equations, physical models or simulations; use models to describe, explain, make predictions and solve problems, recognising that all models have limitations



## Action verb

### Model

## Students should be able to

make justified predictions, describe phenomena and solve problems using words/diagrams/numbers/graphs/equations as appropriate



# Modelling: examples

R-number, as used for infectious diseases such as covid

R is the average number of people to whom that one infected person will pass on a virus.

$$R_o = \frac{\text{no. of new infections}}{\text{no. of original infections}}$$

<https://www.bbc.com/news/health-52473523>



# Modelling: examples

...but also

$$R_o = \beta \frac{S}{\gamma}$$

Number who are susceptible

Removal rate

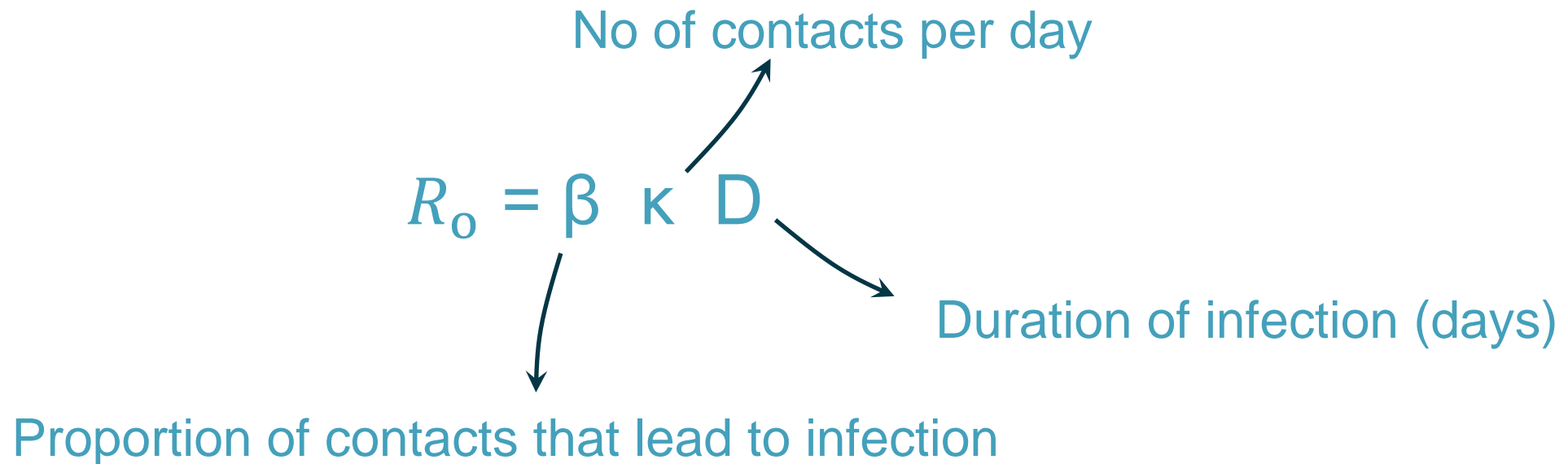
Transmission rate

<https://www.cebm.net/covid-19>



# Model, Modelling: examples

...and also:



<https://www.comap.com/>





# Model, Modelling: examples

## models

- are simplified representations of complex systems or phenomena with underlying assumptions
- can predict the behaviour of a system/phenomenon
- can be modified as more data becomes available from the system/phenomenon

*(Physics, Unifying Strand, 2024, p. 13)*





# Action Verbs in the Physics Specification

Appendix 1: Glossary of action verbs

Action verb	Students should be able to
Analyse	study or examine something in detail, break down in order to bring out the essential elements or structure; identify parts and relationships, and to interpret information to reach conclusions
Apply	select and use information and/or knowledge and understanding to explain a given situation or real circumstances
Appreciate	recognise the meaning of, have a practical understanding of
Calculate	obtain a numerical answer showing the relevant stages in the working
Classify	group things based on common characteristics
Compare	give an account of the referring to both (all) of
Define	give the precise meaning
Demonstrate	prove or make clear by
Derive	arrive at a statement or relationship to give a result
Describe	develop a detailed picture where appropriate; present
Determine	obtain the only possible quantities into a standard
Discuss	offer a considered, balanced opinion or conclusion
Estimate	give a reasoned order
Evaluate (data)	collect and examine data; does not support a conclusion; make judgment
Evaluate (ethical judgement)	collect and examine evidence; does not support a judgment about the issue
Explain	give a detailed account
Examine	consider an argument issue
Explore	observe or study in order
Identify	recognise patterns, facts and state briefly a distinction
Illustrate	use examples to describe
Investigate	observe, study, or make reach new conclusions
Justify	give valid reasons or evidence
Measure	quantify changes in system

Action verb	Students should be able to
Model	make justified predictions, describe phenomena and solve problems using words/diagrams/numbers/graphs/equations as appropriate
Outline	give the main points; restrict to essentials
Pose	put forward for consideration
Predict	give an expected result of an event; explain a new event based on observations or information using logical connections between pieces of information
Prove	use a sequence of logical steps to obtain the required result in a formal way
Provide evidence	provide data and documentation that support inferences or conclusions
Recognise	identify facts, characteristics or concepts that are critical (relevant/appropriate) to the understanding of a situation, event, process or phenomenon
Recall	remember or recognise from prior learning experiences
Relate	associate, giving reasons
Use	apply knowledge or rules to put theory into practice
Verify	give evidence to support the truth of a statement

All learning outcomes are expressed in terms of Action Verbs

Each specification ends with a glossary of Action Verbs



# Action Verbs in the Physics Specification

## 3.3. Electric circuits

- electric potential and current, work, power, potential difference, voltage and emf
  - $I = \frac{q}{t}$
  - $V = \frac{W}{q}$
  - $W = I^2 R t$
  - $P = I^2 R$
  - $P = VI$
- series and parallel circuits
- safety in mains electricity: earthing, MCBs and RCDs

### 1. model

- the relationship between current and charge
- the relationship between work, charge and potential difference
- the relationship between electric current, conventional current, power and resistance
- series and parallel circuits
- the rate of conversion of electrical energy in components of electric circuits
- fuses and circuit breakers





# Action Verbs in the Physics Specification

- doping; n type, p type and p-n junction, depletion layer
- transistors as switches
- circuit components: voltage source, switch, light bulb, resistor, variable resistor, ammeter, voltmeter, ohm meter, diode, LDR, LED, thermistor, transistor
- resistance and resistivity
  - Ohm's law  $V = IR$
  - $R = \rho \frac{1}{A}$

2. investigate the use of semi-conductors in real-world applications using secondary sources

3. model the relationship between current flowing through and the voltage across a diode in forward and reverse bias using primary and secondary data

4. verify the relationship between current flowing through and the voltage across an ohmic conductor using primary and secondary data



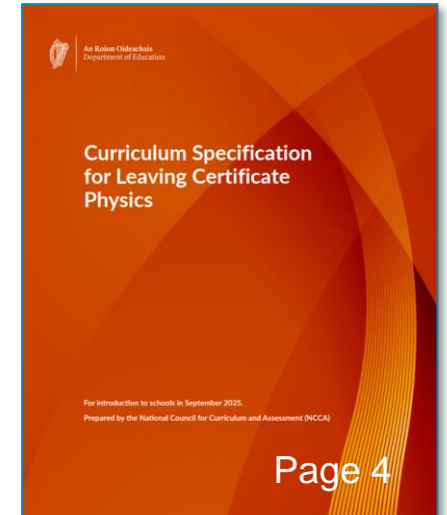
# Investigating in the Physics Classroom



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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’*



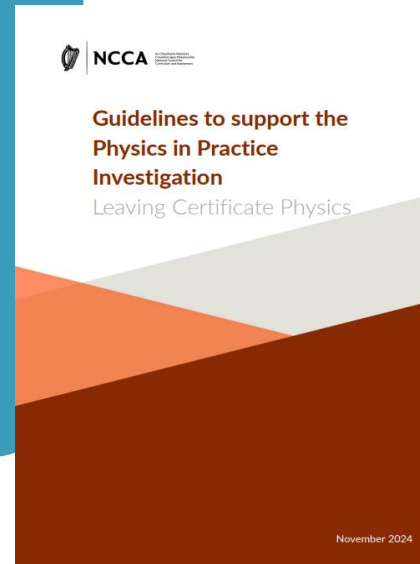
# Investigating in the Physics Classroom



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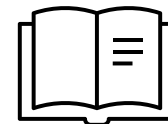
Students are encouraged to work like scientists, with a focus on outlining assumptions and decisions made during each stage, and to explain how these assumptions and decisions impact on reliability, validity, accuracy, precision, error, fairness, safety and integrity

(Guidelines to support Physics in Practice Investigation, p. 5)

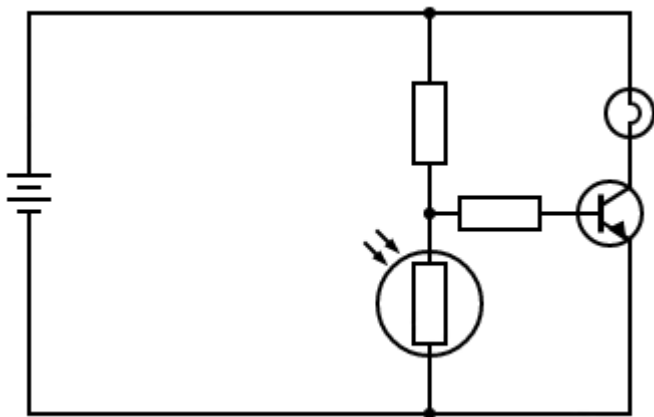




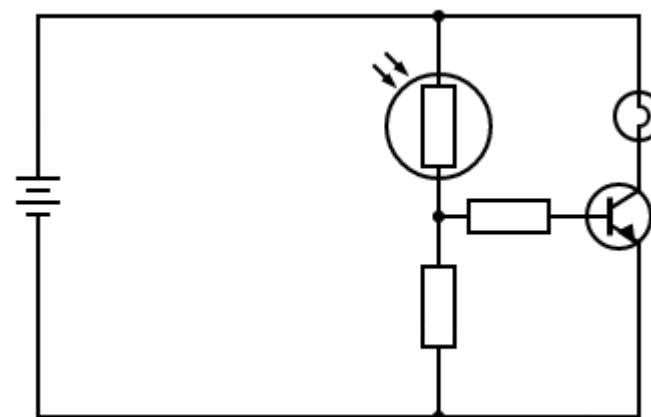
# Investigating in the Physics Classroom



Which circuit represents a street-light system?



A

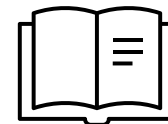


B

[www.circuit-diagram.org](http://www.circuit-diagram.org)

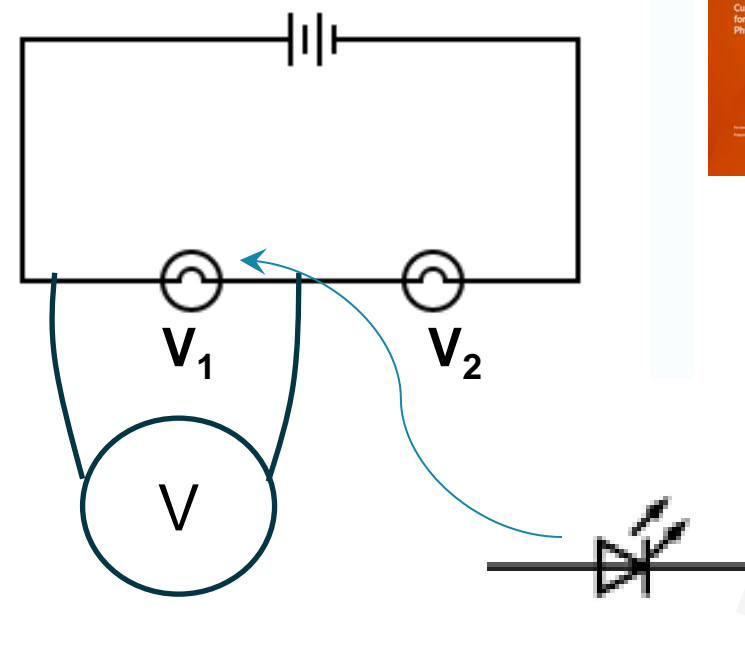


# Investigating in the Physics Classroom



Investigate these circuits, considering:

- the rate of conversion of electrical energy in components of electric circuits (3.3.1)
- resistances in series and parallel in electrical circuits using primary and secondary data (3.3.7)

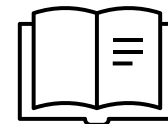


LED: Light emitting Diode



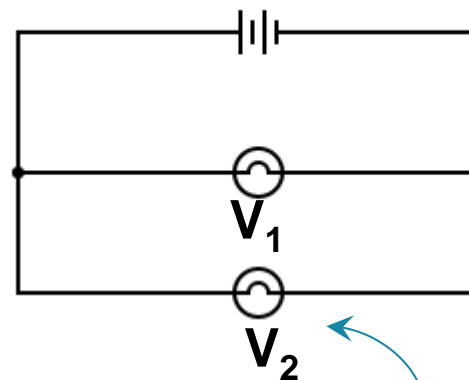


# Investigating in the Physics Classroom



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LED: Light emitting Diode



# Investigation: Sensor Board

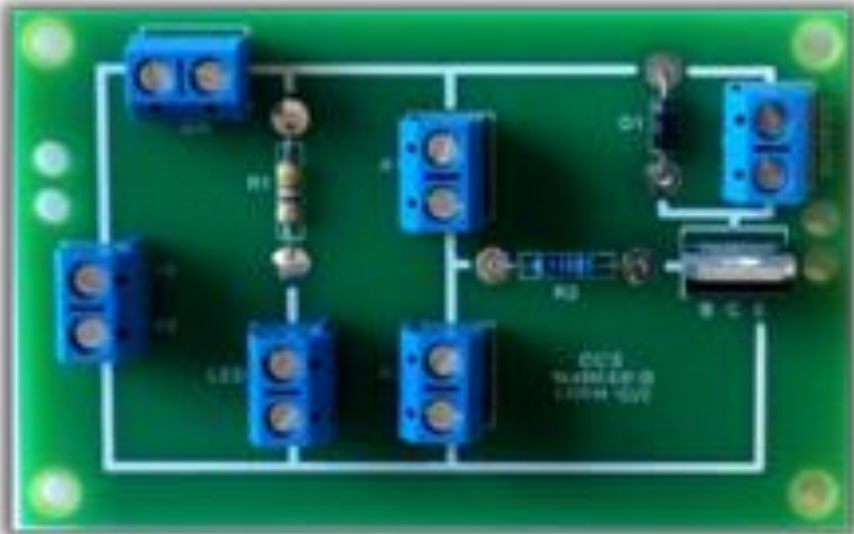
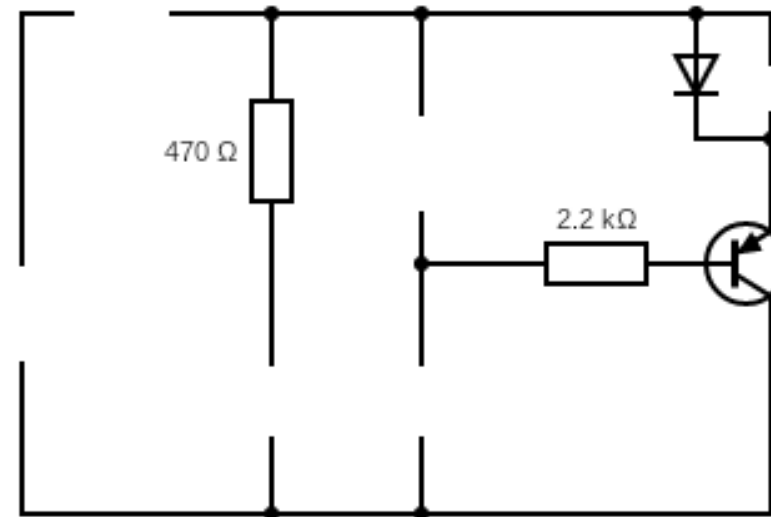


photo  
printed circuit board (pcb)

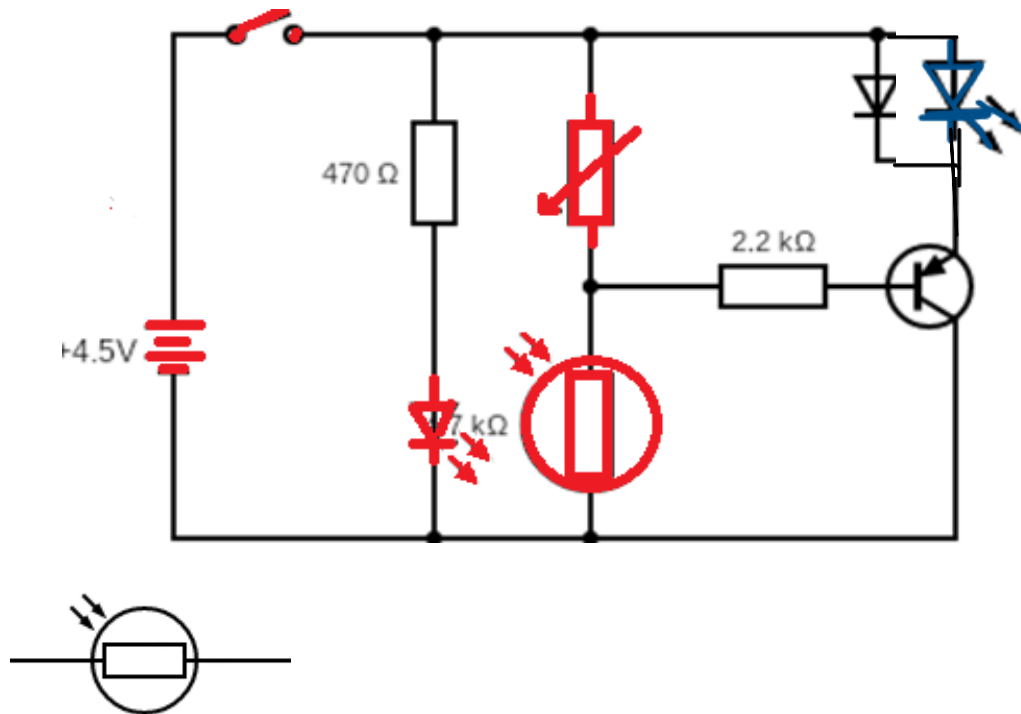
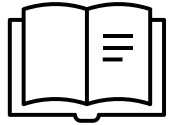


circuit diagram

Designed by the Oide Applied Technology team



# Investigation: Sensor Board



LDR: Light dependent resistor

Complete this circuit

Move your hand over the LDR

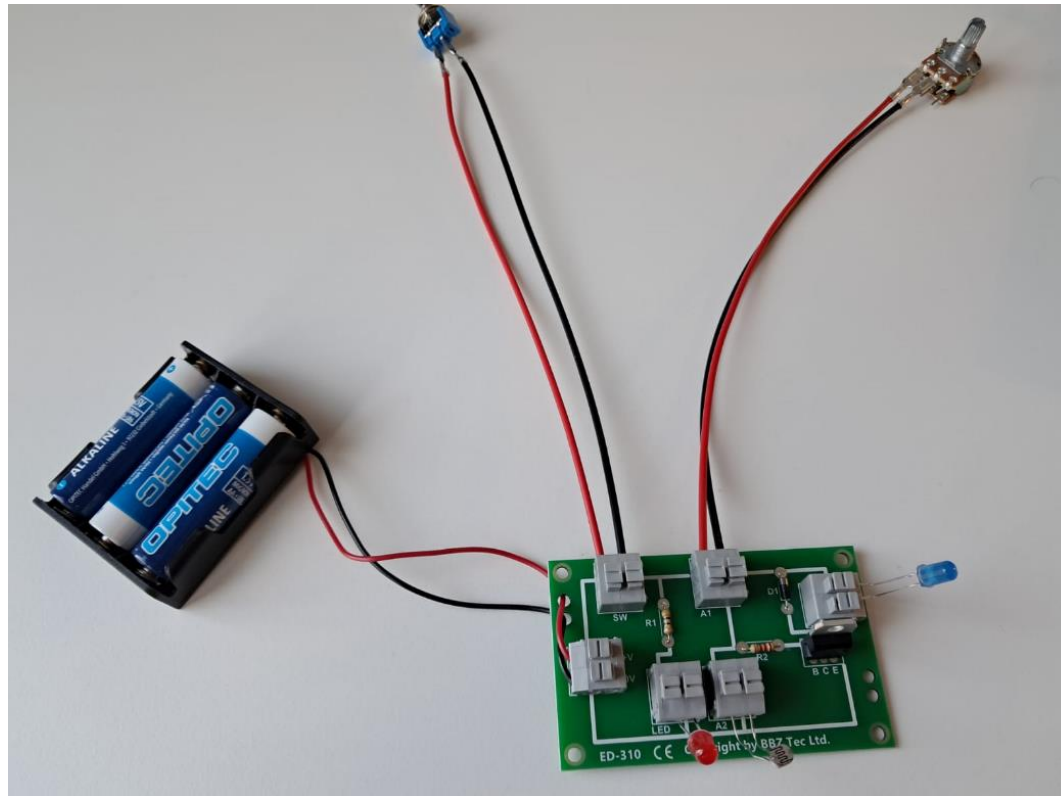
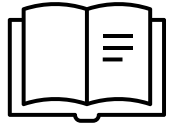
What do you notice?

Vary the resistance

What do you deduce?



# Investigation: Sensor Board



LDR: Light dependent resistor

Complete this circuit

Move your hand over the LDR

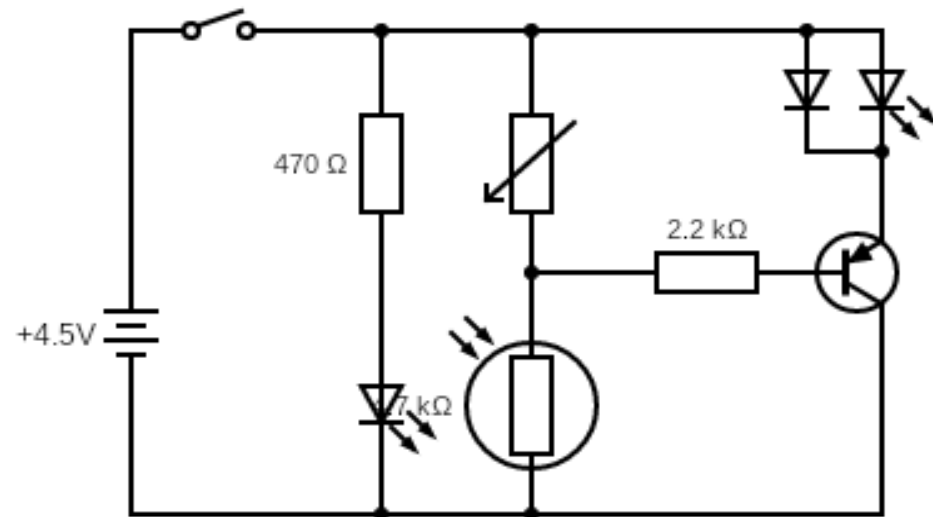
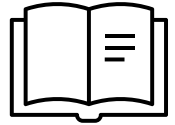
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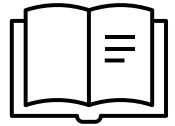


# Investigation: Sensor Board

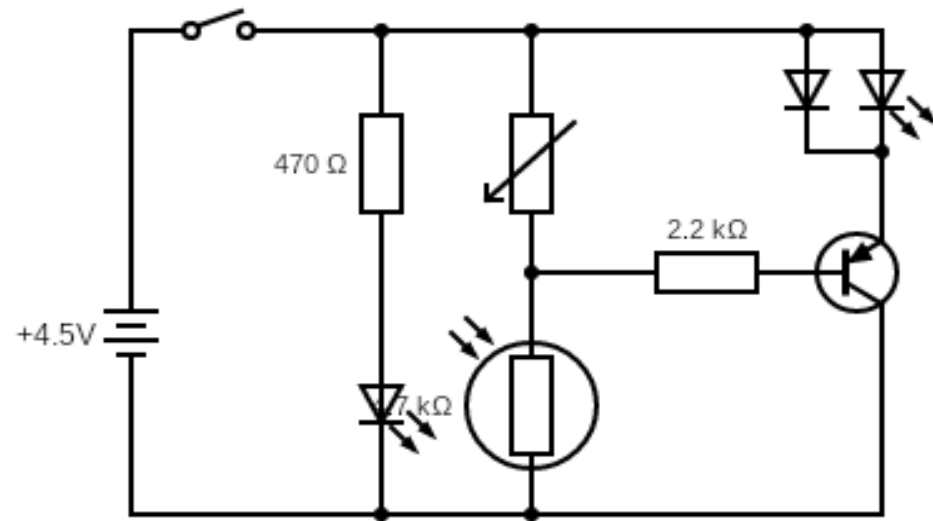


Measure the voltage across the output...

- When the LDR is in the dark
- When the LDR is in the light



# Investigation: Sensor Board

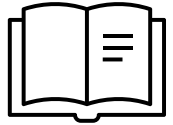


## Investigate

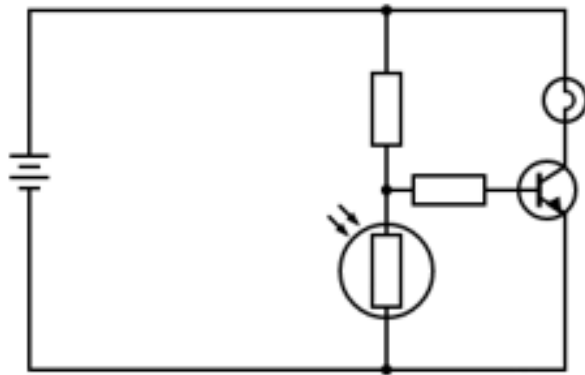
- Various outputs
- Various sensors



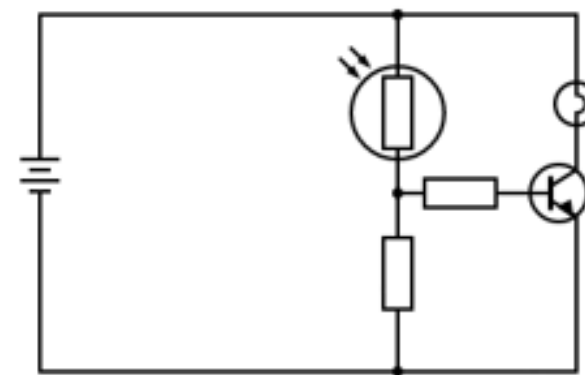
# Investigation



Which circuit represents a street light?  
When could the other circuit be used?



A: light comes on when dark



B: light comes on when bright

## Investigate

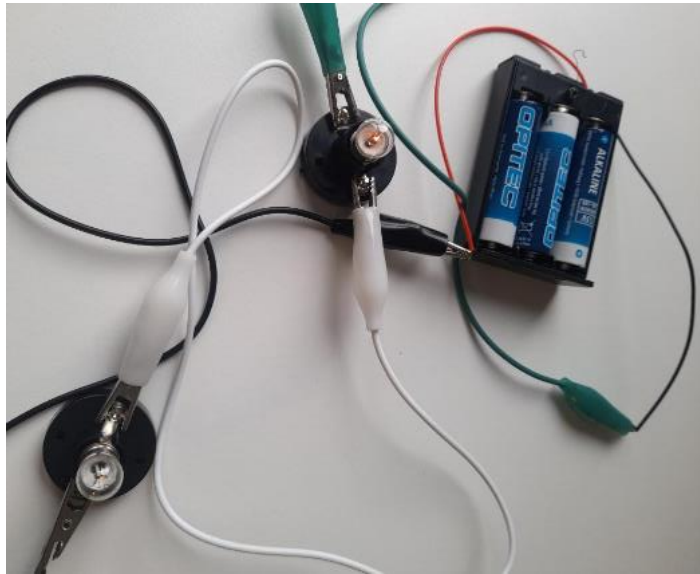
observe, study, or make a detailed and systematic examination, in order to establish facts and reach new conclusions



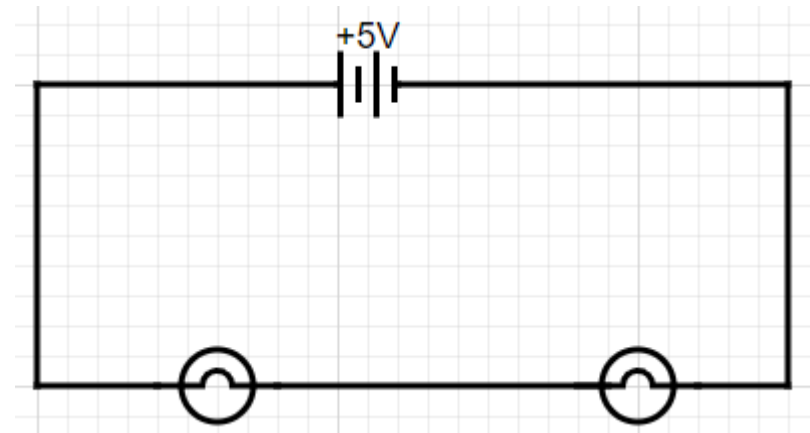


# Electric Circuits

In which ways can we model series and parallel circuits?



The reality.....

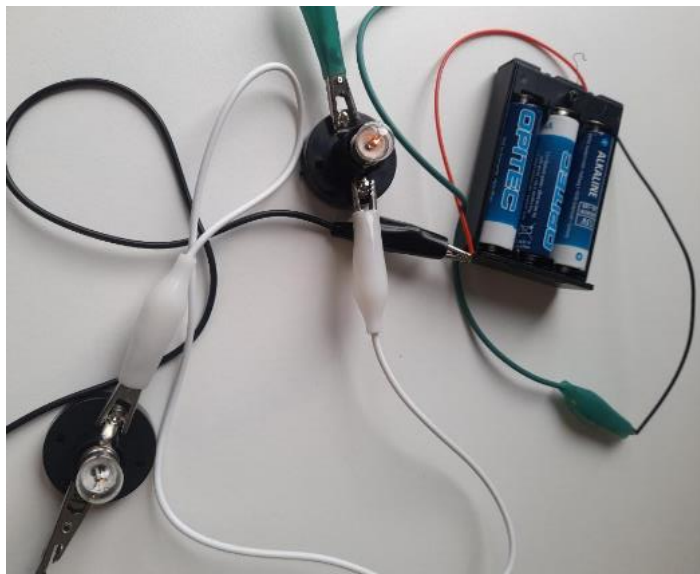


A model

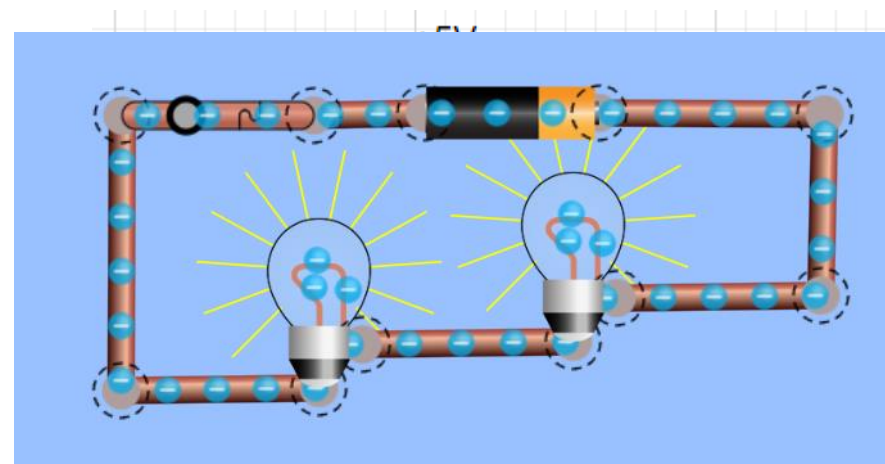


# Electric Circuits

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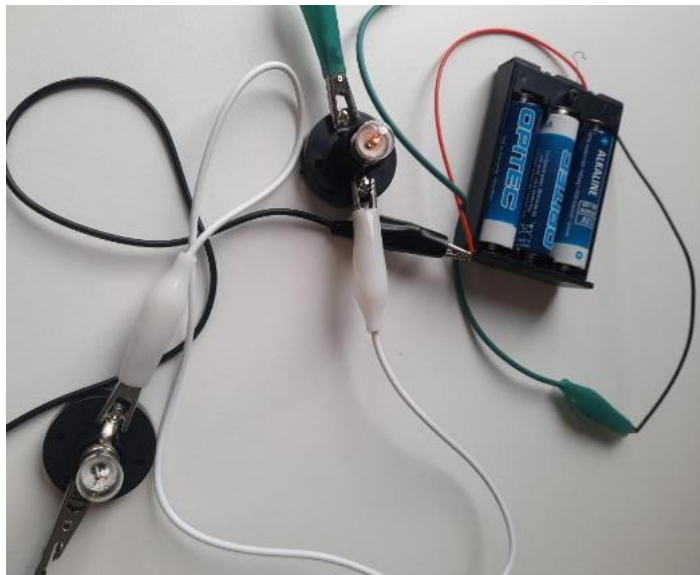


A model



# Models to match our circuits

In which ways can we model series and parallel circuits?



The reality.....

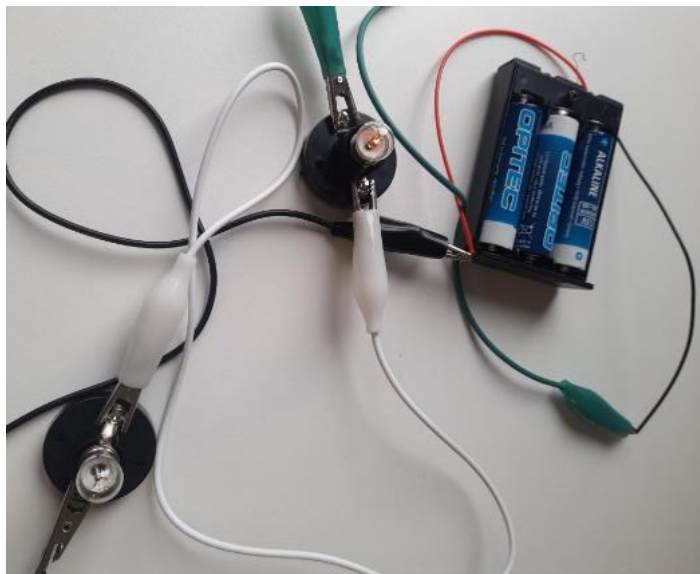
- $I = \frac{q}{t}$
- $V = \frac{W}{q}$
- $W = I^2 R t$
- $P = I^2 R$
- $P = VI$

A model

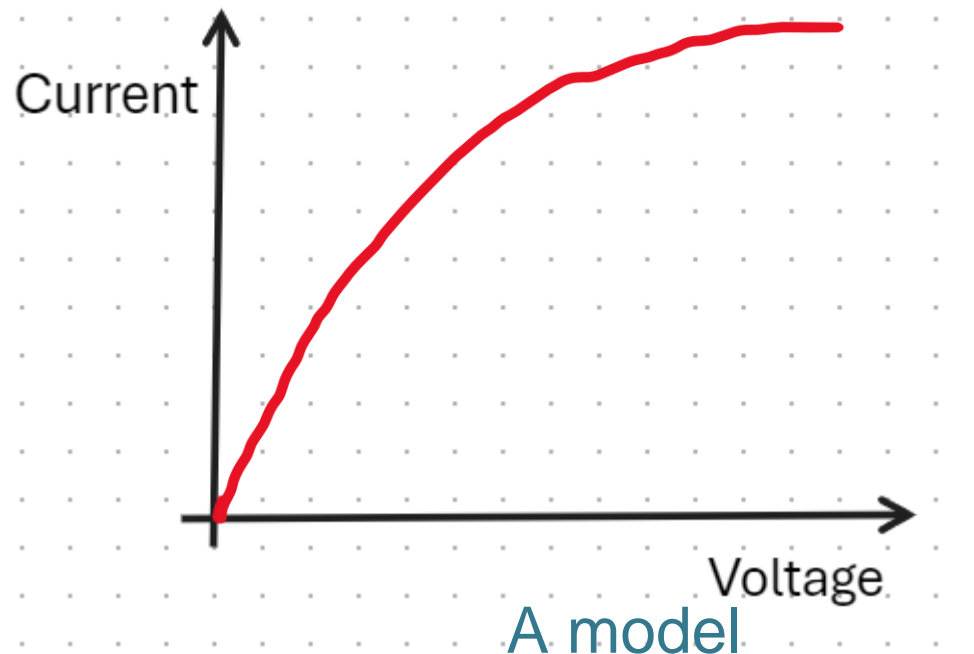


# Models to match our circuits

In which ways can we model series and parallel circuits?



The reality.....





## Action Verbs

*"Modelling is at the heart of what physicists do. Therefore, it is important that students learn to verify established models and to use words, diagrams, numbers, graphs and equations, where appropriate, to simplify complex systems, explain phenomena, make justified predictions and to provide justified solutions to problems."*

*"Scientific practices are best learned by doing, and in planning for teaching and learning, teachers should provide ample opportunity for students to engage with the scientific practices set out in a unifying strand."*

*(Physics Specification, teaching for Student Learning, p.29)*

# Action Verbs in the Physics Specification



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## Students learn about

- non-ohmic conductors: filament bulb, diode
- conservation of charge and energy in a circuit
  - $R = R_1 + R_2 + R_3 \dots$
  - $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots$

## Students should be able to

5. investigate the relationship between current flowing through and the voltage across non-ohmic conductors using primary and secondary data
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

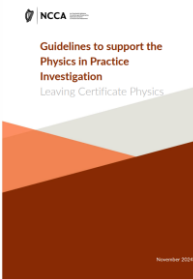




# Investigations

For the teacher, an initial exploration of the Investigation Brief can help inform planning for the coming year by identifying learning outcomes that relate to the context and physical phenomenon contained in the brief. In addition, opportunities to highlight relevant issues may be pinpointed in their plan as well as opportunities to point out to students how planned experimental and research activities relate to the brief.

AAC Guidelines 2024

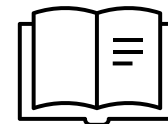






# Reflection

Which other learning outcomes could be addressed by these activities?



How does engagement with the action verbs affect teaching and learning in your physics classroom?

Thinking back to day 1, can you see the connections with:

- the unifying strand
- teaching and learning
- key competencies





# Lunch





Oide

Tacú leis an bhFoghlaim  
Ghairmiúil i measc Ceannairí  
Scoile agus Múinteoirí

Supporting the Professional  
Learning of School Leaders  
and Teachers

# Session 3

## Planning....



# Key Messages for today:

Consider the implementation the **new Physics specification**, and explore student-centred approaches to teaching, learning, and assessment

Consider **the use of action verbs** and - with a focus on modelling - reflect on how this may affect teaching, learning and assessment



Begin the process of **developing a scheme of work**, ensuring access, support, and challenge for all students



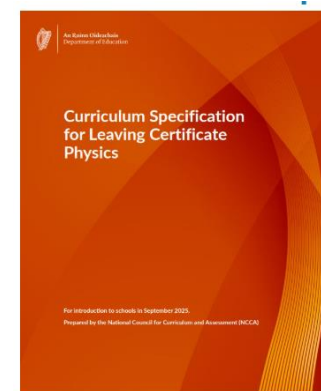
# By the end of this session you will have:

Discussed/reflected on key learning from student engagement to inform your content and pedagogical planning



Determined the need for allowing sufficient scope for change while developing a subject plan

Worked in groups to produce a unit of learning for autumn 2024





# Recall Day 1: Planning

In your departments consider the following:

A consistent and collaborative approach to teaching elements of the unifying strand to support students who may be engaging in more than one leaving certificate science subject

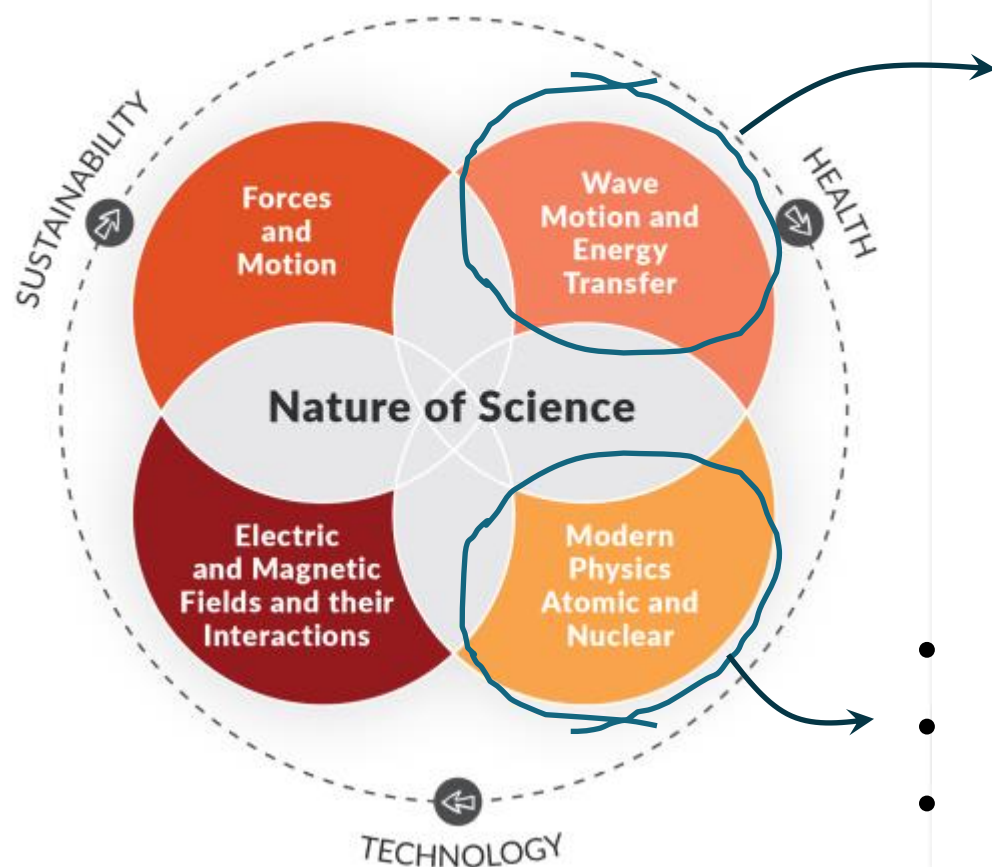
Opportunities to foster the development of scientific practices as students progress from Junior Cycle to Senior Cycle

The incremental development of scientific practices over time.



# Developing a Unit of Learning

Consider these topics:



- Wave characteristics
  - Wave Behaviour (reflection, refraction)
  - Optics (lenses)
  - Electromagnetic Spectrum
  - Sound Energy
  - Superposition of Waves, Standing Waves
  - Wave Nature of Light, Sound
  - Wave Effects (e.g. Doppler Effect)
- 
- Photoelectric Effect (Wave-Particle Duality)
  - Models of the Atom
  - Emission Spectra





# Waves: a theme-based approach

What would be the pros and cons of this approach?

2.2 Travelling Waves as ..... (waves intro)

2.3 Wave Behaviour..... (optics)

2.4 Electromagnetic Energy ....(em spectrum)

2.5 Sound Energy

2.6 Principle of Superposition...

2.7 Wave Effects (Doppler Effect)

Or.....



# Waves: a theme-based approach

What would be the pros and cons of this approach?

2.3 Wave Behaviour..... (optics)

2.2 Travelling Waves as ..... (waves intro)

2.6 Principle of Superposition...

2.4 Electromagnetic Energy ....(em spectrum)

2.5 Sound Energy

2.7 Wave Effects (Doppler Effect)

Or.....



# Waves: a theme-based approach

What would be the pros and cons of this approach?

2.3 Wave Behaviour..... (optics)

2.2 Travelling Waves as ..... (waves intro)

2.6 Principle of Superposition... (Young etc.)

2.4 Electromagnetic Energy ....(em spectrum)

2.5 Sound Energy

2.6 Principle of Superposition... (stn waves)

2.7 Wave Effects (Doppler Effect)

Or.....



# Waves: a theme-based approach

What would be the pros and cons of this approach?

2.3 Wave Behaviour..... (optics)

2.2 Travelling Waves as ..... (waves intro)

2.6 Principle of Superposition... (Young etc.)

2.4 Electromagnetic Energy ....(em spectrum)

4.2 Photoelectric emission....(wave-particle...)



# Sequencing of Topics within a Theme

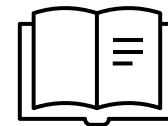
What challenges does this create for teachers?

What challenges does this create for students?

What opportunities does it create?



# Planning in Leaving Certificate Physics



What issues do you have to consider when planning?

How might you plan the work across the two years of senior cycle?

How might you plan for collecting primary data, and for the unifying strand?

How might you adapt to the requirements for the AAC?

Would you return to topics more than once?

Do you favour some topics over others?

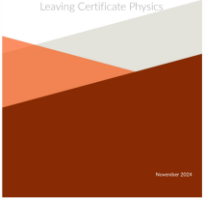


# Flexible Planning for Leaving Certificate Physics



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NCCA  
Guidelines to support the  
Physics in Practice  
Investigation  
Leaving Certificate Physics



*For the teacher, an initial exploration of the Investigation Brief can help inform planning for the coming year by identifying learning outcomes that relate to the context and physical phenomenon contained in the brief.*

AAC Guidelines, NCCA 2024



# Flexible Planning for Leaving Certificate Physics



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## A Good Plan...

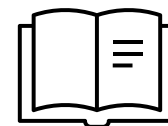
- can be simple and straightforward
- is flexible, not rigid.
- allows for development over time

## Principle of Flexibility

Though a plan is prepared after reflective thinking, this still allows a departure to be made in the course of its operation.



# 'Helicopter view' of Physics planning



External variables  
AAC  
Collaborative Meetings  
Cross-curricular  
Co-curricular Activities  
Adaptiveness & Flexibility  
Inclusion

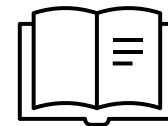


Strands  
Content & Links  
Students' knowledge  
Physics Modelling  
Resources & Materials  
T&L Approaches  
Assessment  
Time-lines





# Planning for Leaving Certificate Physics

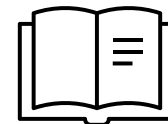


Construct a draft Skeleton Plan for the two years of Senior Cycle

Share your thoughts



# Getting started: Unit of Learning



How will you begin with 5<sup>th</sup> year students?

## Some points to consider:

- What learning outcomes will we include?
- What prior knowledge should students have?
- What other strands will this link to?
- What primary data must be collected?
- How to address cross-cutting themes
- How many lessons would we anticipate a topic will require?
- What flexibility do I need?





# Key Messages when using AI

## *Príomhtheachtaireachtaí*



Thoughtful consideration of ethical implications, such as bias, privacy, and accessibility, is critical when incorporating AI into education.



AI tools enable the creation of diverse, accessible content formats that engage students, support exploration, and allow varied forms of expression.



AI can support teachers create more inclusive and equitable learning environments that cater to diverse learner needs.



AI enhances teaching by providing students with more choices, supporting teachers with meaningful interactions and differentiated instruction aligned with UDL principles.



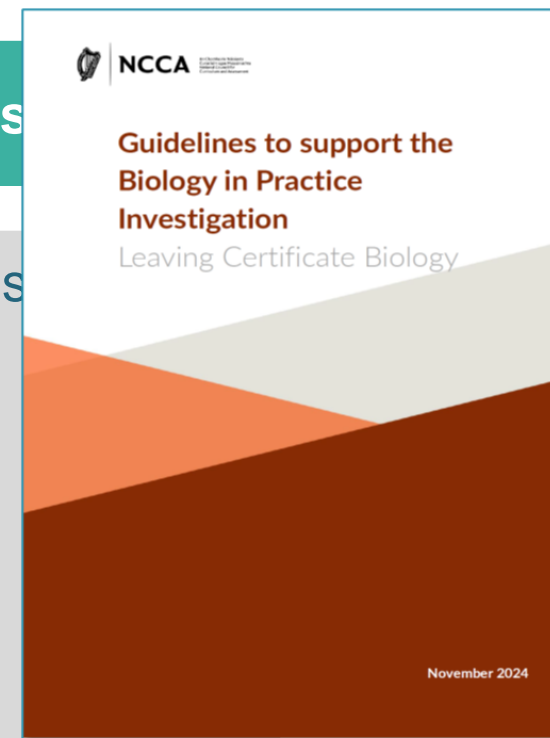
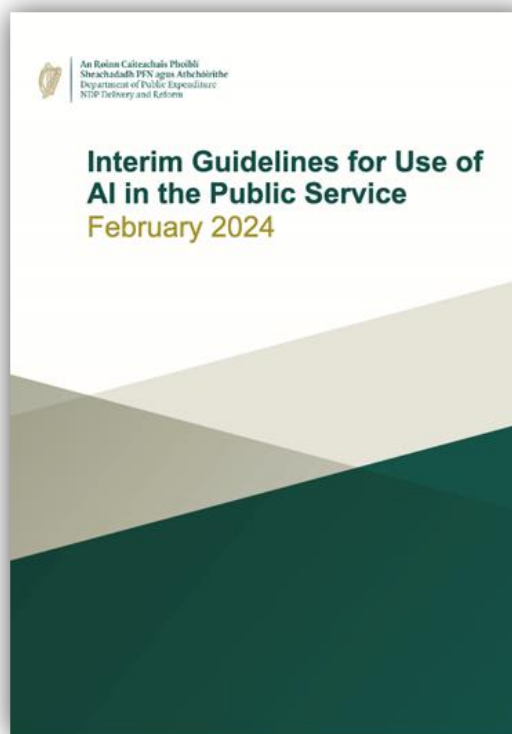
# AI: Critical Analysis and Limitations

**ARTIFICIAL INTELLIGENCE**  
Five Considerations for Teacher Use

- 1 ETHICAL DATA USE**  
Is the tool GDPR compliant?  
Do not use personal or student data.
- 2 EVIDENCE OF IMPACT**  
Will the AI tool improve learner outcomes or experiences? Are there examples or case studies?
- 3 ACCURACY OF OUTPUT**  
Have you checked the output against other sources before sharing with students?
- 4 POLICIES & GUIDELINES**  
Does the tool adhere to the relevant policies and guidelines of your school?
- 5 BIAS AWARENESS**  
What steps are you taking to identify and mitigate biases in your AI tools?

WEBWISE AI HUB  
webwise.ie/ai-hub/

Oide



Analysis

Guidelines

Accuracy of output

Accuracy of output





# AI Tools to Support Inclusion

## *Uirlisí IS chun tacú le cuimsiú*







# AI: Limitations and Critical Analysis

## Limitations

Bias: computational and human

Hallucinations

Explainability

Inability to think critically

Lack of personal experience

## Critical Analysis

Policies and guidelines

Ethical data use

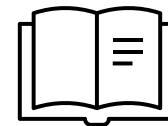
Evidence of impact

Bias awareness

Accuracy of output



# Getting started: Unit of Learning



How will you begin with 5<sup>th</sup> year students?

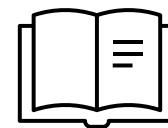
Construct a unit of learning for autumn 2025

Share your ideas





# Personal Reflection



Take a moment or two to jot down any thoughts or ideas, that you find relevant or useful to you



## Next Steps



# Leaving Certificate Science Subjects PLE Timeline



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