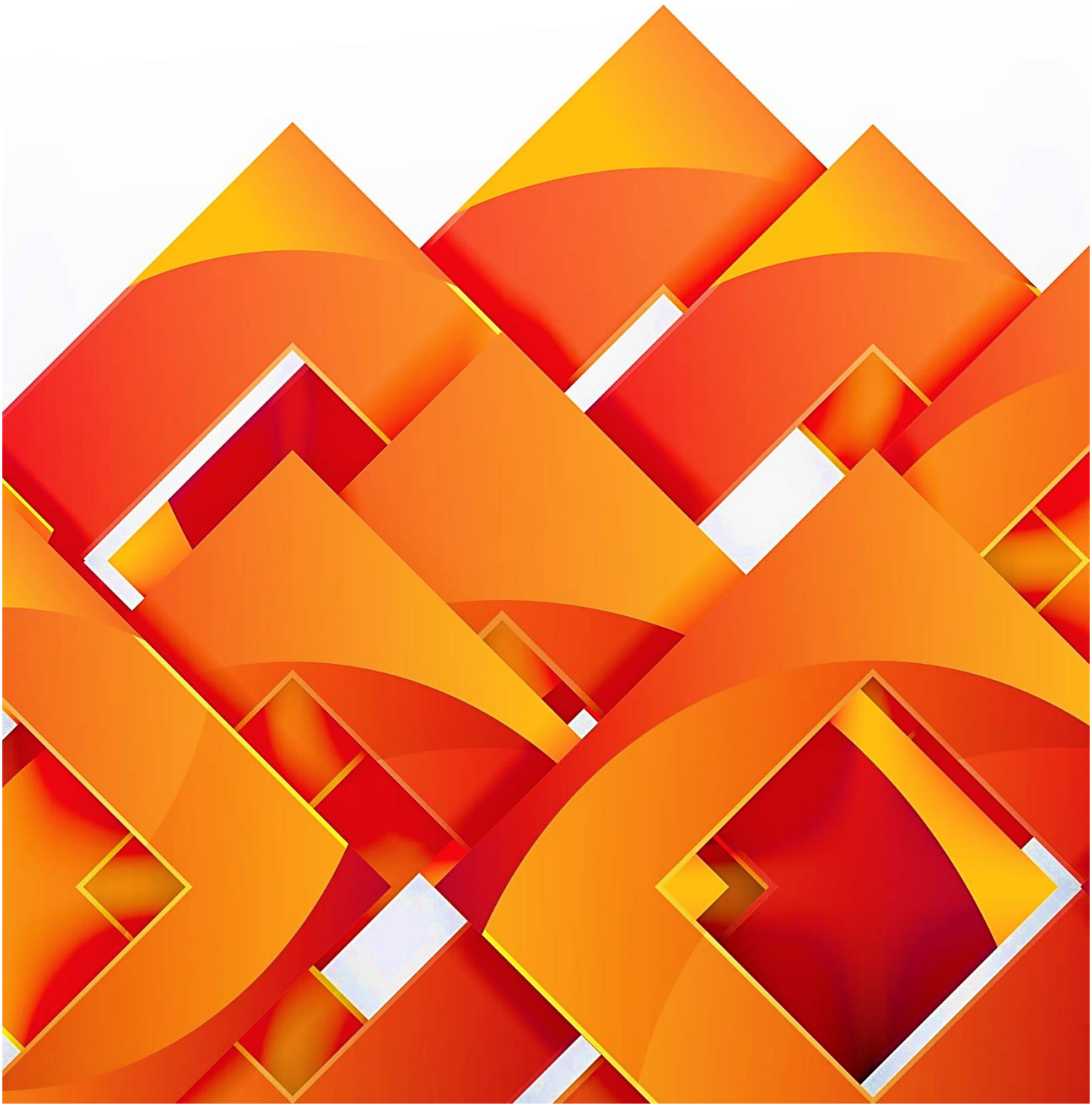
NCCA
An Chomhairle Náisiúnta Curaclaim agus Measúnachta
National Council for Curriculum and Assessment

Draft Leaving Certificate Biology Specification



Contents

Senior cycle

Senior cycle educates the whole person and students' experiences in senior cycle contribute to their intellectual, social and personal development and their overall wellbeing. During senior cycle students develop a stronger sense of their identity, learning with and from their peers, teachers, other adults, and various media. Senior cycle has eight guiding principles.

Senior Cycle Guiding Principles	
Wellbeing and relationships	Choice and flexibility
Inclusive education and diversity	Continuity and transitions
Challenge, engagement and creativity	Participation and citizenship
Learning to learn, learning for life	Learning environments and partnerships

These principles are a touchstone for schools and other educational settings, as they plan and design their senior cycle with the aim of enhancing the educational experience for all.

Senior cycle consists of an optional Transition Year, followed by a two-year course consisting of subjects and modules, key competencies, learning outcomes and a range of approaches to assessing student learning. Building on their learning in junior cycle, learning happens in schools, communities, educational settings, and other sites where students' increasing independence is recognised. Relationships with teachers are established on a more mature footing and students take more responsibility for their learning. Senior cycle provides a curriculum which challenges students to aim for the highest level of educational achievement, commensurate with their individual aptitudes and abilities. Students are supported to make informed choices as they choose different pathways through senior cycle. Their experiences in senior cycle should establish firm foundations for transition to further, adult and higher education, apprenticeships, traineeships and employment, and for meaningful participation in society, the economy and adult life.

The educational experience in senior cycle should be inclusive of every student, respond to their learning strengths and needs, and celebrate, value, and respect diversity. Students vary in their family and cultural backgrounds, languages, age, ethnic status, beliefs, gender, and sexual identity as well as their strengths, needs, interests, aptitudes and prior knowledge, skills, values and dispositions. Every student's identity should be celebrated, respected, and responded to throughout their time in senior cycle.

During senior cycle, students have opportunities to grapple with social, environmental, economic, and technological challenges and to deepen their understanding of human rights, social justice, equity, diversity and sustainability. Senior cycle gives every student opportunities to experience the joy of reaching significant milestones in their personal educational journey. Every subject and module students experience should contribute to the realisation of this overall vision for senior cycle.

At a practical level, senior cycle is supported by enhanced professional development; the involvement of teachers, students, parents, school leaders and other stakeholders; resources; research; clear communication; policy coherence; and a shared vision of what senior cycle seeks to achieve for our young people as they prepare to embark on their adult lives. It is brought to life in schools and other educational settings through:

- effective curriculum planning, development, organisation and evaluation
- teaching and learning approaches that motivate and interest students, that enable them to progress and improve and to deepen, apply and reflect on their learning and
- a school culture that respects students and promotes a love of learning.

Rationale

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. Students learn that science, as a discipline, is a process that requires logic and creativity to construct scientific knowledge through the sharing of ideas and by developing, refining, and critically analysing these ideas. Students experience science as a personal and collaborative activity that is exciting, challenging and powerful in transforming the world in which we live.

Biology is defined as the scientific study of life. Nature is remarkable and composed of a wide variety of simple and complex systems. Biology attempts to describe and explain these systems with regards to the organisation of life, its structures and processes and the interactions between living things and their environment. In doing so, biology allows us to understand all of life in the past, present and future.

The structures and processes of the cell are shared by all living organisms. Leaving Certificate Biology students develop an understanding of the cell as the unit of life. They are expected to understand the core concepts that govern the living world and apply them to various contexts within biology. They apply scientific knowledge and skills to solve problems and

generate solutions. They develop representations of the structure, functions and interactions of living things using the best available evidence as gained through scientific inquiry.

The exploratory nature of Leaving Certificate Biology is experienced by students in both practical and theoretical terms. They have the opportunity to manipulate and use tools, equipment and materials safely, as well as generate and analyse data to answer their questions.

Leaving Certificate Biology students develop a critical awareness of the impact of humankind's decisions on the living world - from our societal impact on species and ecosystems to the personal decisions that influence our health and wellness. They draw on their knowledge and understanding of a number of specified core concepts from different areas of biology to evaluate and use arguments about the place of biology in society. They develop an appreciation of the significance of biology in personal, social, environmental, economic and technological contexts and an awareness of advances in technology, relevant to biology.

Aims

The aim of Leaving Certificate Biology is to provide students with an experience that develops their interest in and enthusiasm for the scientific study of life. In doing so, it aims to build the knowledge, skills, values and dispositions necessary for students to become scientifically literate citizens who are well-prepared for the challenges and opportunities of their future, embracing life-long learning and sustainable living, as citizens in a technologically developing society.

More specifically, Leaving Certificate Biology aims to empower students to:

- build knowledge and understanding of a number of specified core concepts and fundamental principles of biology
- 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 biological world
- demonstrate inquiry and practical skills consistent with the principles and practices of biology
- understand how society and science are interwoven, the everyday relevance of biology and the ethical implications of biology.

Continuity and progression

Leaving Certificate Biology builds on the knowledge, skills, values and dispositions that stem from learners' early childhood education through to the junior cycle curriculum.

Junior Cycle

The learning at the core of junior cycle is described in the Statements of Learning, a number of which apply to scientific concepts, processes and practices, including problem-solving, design and communication skills, and to understanding and valuing the role and contribution of science and technology to society. Student learning in science is unified through the Nature of Science strand, which emphasises the development of a scientific habit of mind.

There is an emphasis on inquiry through which learners develop an understanding and appreciation of structures, processes and fundamental concepts that are essential to all science, as well as the ability to apply scientific principles to their everyday lives. All of the key skills developed across the curriculum during junior cycle support student learning in senior cycle. Many junior cycle subjects and short courses have close links with and support the learning in junior cycle science, particularly mathematics, geography, CSPE, PE, SPHE, home economics and the technologies (T4) subjects.

Junior Cycle Science has close links with Leaving Certificate Biology in helping students to continue to develop their evidence-based understanding of the natural world; to develop their capacity to gather and evaluate evidence; to consolidate and deepen their skills of working scientifically; to make them more self-aware as learners and to become more competent and confident in their ability to use and apply science in their everyday lives. Students build on theses scientific concepts, processes and practices as they progress through the two years of Leaving Certificate Biology.

Beyond Senior Cycle

Biology builds a solid foundation for students to progress to diverse futures, including participation in society, the worlds of work, further education and training, and higher education, in specialised areas such as science, engineering, technology-related jobs, computer science, education, mathematics, medicine, agriculture, business and finance.

The learning experienced while studying biology can lead to many exciting and rewarding careers in the discipline and also provide a foundation for a diverse range of opportunities in related areas, including biomedical, environmental, agricultural, food, health, sports, forensic sciences and biotechnology.

In addition, biology incorporates a broad range of skills, including systems thinking, observation, classification, creative design, synthesis, and evaluation. It teaches a range of generically useful skills in areas such as communication, time management, organisation, and teamwork. These skills are relevant to all further study, and indeed all learning beyond formal education.

Biology has an immediate relevance to our daily lives. Students develop an appreciation of the social and cultural perspectives of biology and of the impact of science and technology on people and on the environment. Biology lies at the heart of issues which challenge our confidence as a species now and in the future, including global disease prevention and control, sensible management of the environment and effective control of human populations. These challenges will require not only innovative science solutions, but also social, political and economic ones that are informed by knowledge of the science that underpins the challenges.

By studying biology, students appreciate the role of community and society in the complex ecology of the planet and of its sustainable development. They consider aspects of health and illness in terms of promoting health and reducing the risk of disease. The spread of disinformation is threatening democracies world-wide. Rationality and scepticism are important principles embedded in Leaving Certificate Biology. Students learn the importance of reliable sources, peer review, ethics and evidence in logical decision-making and are well poised to address these challenges.

Key competencies in senior cycle

Senior cycle helps students to become more engaged, enriched and competent, as they further develop their knowledge, skills, values and dispositions in an integrated way.

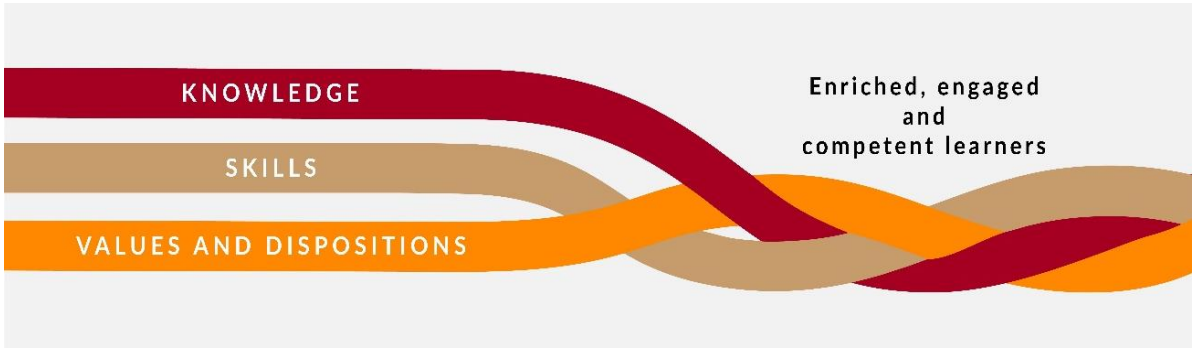


Figure 1 The components of key competencies and their desired impact

Key competencies[1] is an umbrella term which refers to the knowledge, skills, values and dispositions students develop during senior cycle.

Students develop key competencies within and across the curriculum during senior cycle. Their learning is deeper when they can draw upon, integrate and apply their knowledge, skills, values and dispositions to various tasks, contexts, situations and events. The competencies:

- are linked and blend together
- are visible and important across the curriculum
- can help students and teachers to make meaningful connections between and across different areas of learning
- can improve students' overall learning.

The development of students' literacies and numeracy contributes to the development of competencies and vice-versa. Key competencies are supported when:

- students' literacies are well developed, i.e., when they can meaningfully and effectively read, watch, write, speak, listen, interpret and mediate meaning in a range of contexts
- students' numeracy is well developed, i.e., when they can understand numbers, data and symbols meaningfully and interpret and use them effectively
- students make good use of various tools, including technologies, to support their learning.

[1] These are sometimes also referred to as capacities, or capabilities.

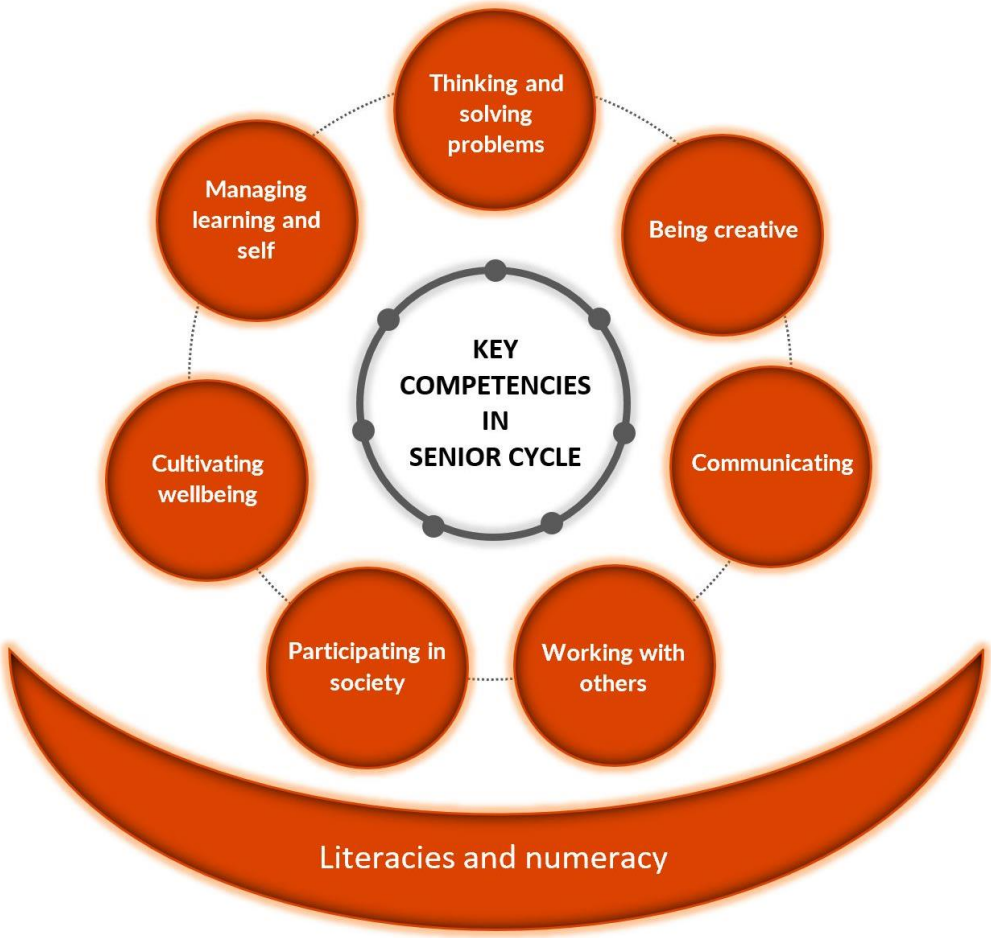


Figure 2 Key Competencies in Senior Cycle, supported by literacies and numeracy.

Key competencies can give young adults the power to meaningfully take part in their schools, families, communities, and society. As students mature, these key competencies can work together to help students handle and respond to more complex and varied tasks, as appropriate to their needs and abilities. They come to know what to do and how to do it, to know when to act and when not to act. Students whose key competencies are well-developed are better able to understand and learn; to deal with and respond to social opportunities and problems; to make the transition from school to further, adult and higher education, apprenticeships, traineeships and/or the world of work; and to embrace adult life.

The key competencies build on important learning from early childhood, primary and junior cycle. They come to life through the learning experiences and pedagogies teachers choose and through students' responses to them. Students can and should be helped to develop their key competencies no matter what path they follow through senior cycle or what subjects and modules they choose and irrespective of their past or present background, circumstances or

experiences. As part of teaching, learning and assessing, they should have many opportunities to make their key competencies visible. The transformative potential of key competencies is most likely to be realised when teachers and students analyse and discuss the competencies they are developing and when teachers offer students opportunities to make meaningful connections across their different subjects and modules.

These competencies can be developed in Leaving Certificate Biology in a range of ways.

Being creative

Scientific methods, research, interpretation of data and use of evidence and argument in evaluating information are central to both the practical activities and the theoretical concepts in Leaving Certificate Biology. As students become curious about the natural world, they learn to express their curiosities in the form of scientific questions. They seek answers to these questions through the practices of investigation, trying out new approaches in response to situations and being creative in their investigate methods. Through the creation and use of models, they use their imagination but also evidence and knowledge to develop representations that describe, explain and predict biological phenomena.

Thinking and solving problems

Through the experience of Leaving Certificate Biology, students develop a scientific habit of mind. This involves drawing on a set of established practices, in which thinking and solving problems is of great significance. They access, gather and process information from a variety of sources in both familiar and new situations. They do so with an open mind, underpinned by a natural curiosity about how the world works as they ask questions, gather and explore data, observe, and investigate the living and non-living worlds. As critical thinkers, students need to continually examine their lines of argument, the evidence for their claims, and the motivations behind their beliefs.

Communicating

Communicating scientific concepts and discoveries is an important aspect of the work of a scientist. As Leaving Certificate Biology students prepare scientific communications, they develop an awareness of the need to present ideas in ways that are true to the claims being made but also appropriate to the intended audience. They develop an understanding of the various forms in which scientists communicate their claims including experimental and/or research reports, conference presentations, posters, offline and online conversations with peers, and more formal communications in peer-reviewed journals. They frame scientific arguments by making claims and using logical reasoning based on evidence, using relevant

scientific language and terminology. Through developing their scientific communication skills, students also learn to listen actively, to question evidence and to seek clarity and understanding.

Working with others, managing learning and self

Students appreciate that whilst scientists may at times and necessarily work alone, working with others allows members of the scientific community to check each other's work, encourage new ideas stemming from knowledge claims, promote advocacy for each other's work and enhance the integrity of the scientific community through identification of bias and invalid claims. Through their classroom experiences, students learn to work co-operatively in pairs, groups and teams. They take on different roles, work together to achieve shared goals, give and respond to feedback from their teachers and peers, and interact safely and responsibly. These behaviours increase students' sense of self-efficacy as they become flexible, adaptable and willing to learn from mistakes. These attributes positively contribute to managing learning and self in the biology classroom.

Participating in society

Biology provides an opportunity for students to critique and challenge systems that damage the natural world, and leads to the creation of knowledge for sustainable futures. Through becoming scientists, students are participating in society, contributing to a sustainable world in their schools, communities, wider society, and through their own personal behaviours and choices.

Cultivating wellbeing

In their study of biology, students may face challenges and difficulties in their engagement with primary and secondary data. Scientific investigation is not a linear process and sometimes unexpected results and errors may occur. As students work through challenges, they build their individual and group resilience as investigators, assessing and responding to risks and errors in healthy ways. This helps in cultivating wellbeing in biology classrooms, as students learn to support and help each other. They further cultivate wellbeing through applying their knowledge of biology to live healthy personal lives, and in their care for the living world through their career pursuits and everyday lifestyle choices.

Literacies and numeracy

Literacies and numeracy support the development of key competencies in the Leaving Certificate Biology classroom, and vice-versa. This is particularly relevant where students

gather and interpret primary data, using a variety of analogue and digital means. Through their critical evaluation of secondary data from reliable sources, students' scientific literacy is further enhanced. As they develop data-driven representations to explain scientific phenomena, students draw on and develop their various competencies in subject specific and cross-disciplinary ways.

Teaching and learning

Senior cycle students are encouraged to develop the knowledge, skills, values and dispositions that will enable them to become more independent in their learning and to develop a lifelong commitment to improving their learning.

Leaving Certificate Biology supports the use of a wide range of teaching and learning approaches that respond to the strengths, needs and interests of all students. The course is student-centred in its design and emphasises a practical experience of biology for each learner. As students progress, they will develop competencies that are transferable across different tasks and different disciplines, enabling them to make connections between biology, other subjects, and everyday experiences. Providing opportunities for students to develop a range of inquiry skills will be necessary to progress along the continuum of inquiry. 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. By engaging in well-structured group discussions, students will develop skills in reasoned argument, listening to each other and reflecting on their own work and that of others.

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 the unifying strand. Whilst the contextual strands set out situations where students are required to gather primary data to verify observations and mathematical relationships, this is a minimum requirement and it is not expected that practical opportunities would be limited to these situations.

Through cross-cutting themes, students will integrate their knowledge and understanding of biology with the ethical, social, economic and environmental implications and applications of biology. Increasingly, arguments between scientists extend into the public domain. By critically evaluating scientific texts and debating public statements about science, students will engage with contemporary issues in biology that affect their everyday lives. They will learn to interrogate and interpret data—primary data that they collect themselves as well as

secondary data collected by others—a skill which has a value far beyond biology wherever data are used as evidence to support argument. By providing an opportunity to examine and debate reports about contemporary issues in science, Leaving Certificate Biology will enable students to develop an appreciation of the social context of science. They will develop skills in scientific communication by collaborating to generate perspectives and present them to their peers.

The variety of activities that students engage in will enable them to take charge of their own learning by setting goals, developing action plans, and receiving and responding to assessment feedback. Students vary in the amount and type of support they need to be successful. Levels of demand in any learning activity will differ as students bring different ideas and levels of understanding to it. The use of strategies such as adjusting the level of skills required, varying the amount and the nature of teacher intervention, and varying the pace and sequence of learning promotes inclusivity. As well as varied teaching strategies, varied assessment strategies will support learning and provide information that can be used as feedback so that teaching and learning activities can be modified in ways that best suit individual students. By setting appropriate and engaging tasks, asking questions of varying cognitive demand and giving feedback that promotes learner autonomy, assessment will support learning as well as summarising achievement.

Digital technology

Digital technology can enhance learning, teaching and assessment, creating opportunities for students to develop scientific knowledge and skills and digital media literacy in ways that cannot be achieved without the use of technology. As students engage with Leaving Certificate Biology, they have opportunities to use digital technology in a range of ways. For example, they may use digital technology to:

- collect, record, analyse and display data and information appropriately
- visualise, predict, explain, and model the organisation, structures, processes, and interactions of living things
- access and analyse large datasets (e.g. databases of genetic information) in ways that non-digital techniques of data collection/analysis cannot
- develop a deeper understanding of data through choosing the right tools for data collation, visualisation, analysis, and representation of results
- develop and improve investigative research, communication, and report writing skills
- become more independent learners through, for example, appropriate online supports
- enhance their experience in the biology laboratory

- develop their understanding of how biologists use digital technology in their work.

Strands of study and learning outcomes

The Leaving Certificate Biology specification sets out the knowledge that is of most worth for Leaving Certificate Biology students in strands and through the identification of cross-cutting themes. There are four strands; a unifying strand, The Nature of Science, and three contextual strands, The Organisation of Life, The Structures and Processes of Life, and The Interactions of Life.

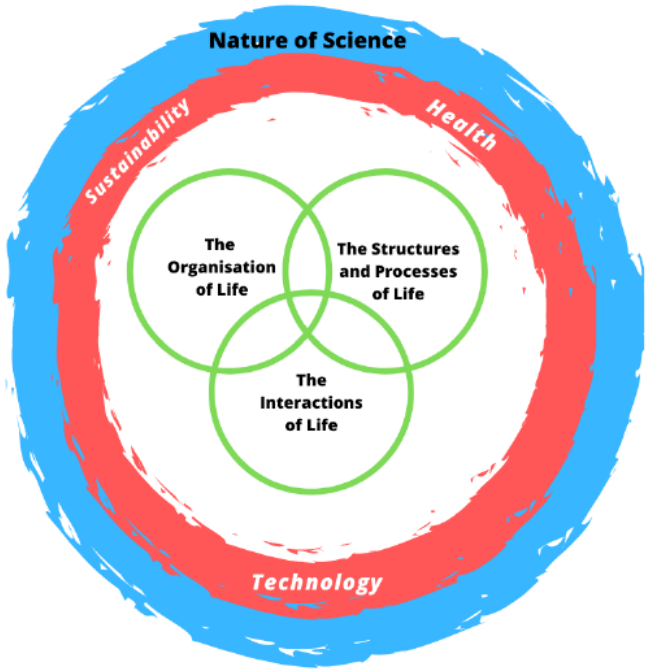


Figure 3 Overview of Leaving Certificate Biology

The unifying strand, Nature of Science, reflects continuity and progression from Junior Cycle Science and involves students applying the principles and practices of science to their biology learning in the three contextual strands. The learning outcomes in the unifying strand identify the knowledge, skills, values and dispositions related to scientific practices which are essential to students' learning *about* science throughout the course, underpinning the activities and content in the other strands.

The learning outcomes in the other three contextual strands—The Organisation of Life, The Structures and Processes of Life, and The Interactions of Life—identify the knowledge *of* biology which includes its core concepts, models and theories that explain and predict biological phenomena.

The specification identifies three crosscutting themes – *Health*, *Sustainability* and *Technology*. These themes, illustrated as surrounding the contextual strands, permeate and provide contexts for the study of these strands. They act as lenses through which students explore the application of knowledge *from* biology. Through these lenses, students engage with contemporary issues in biology as they pose questions and integrate and apply their learning from across the specification.

The specification is presented in the form of learning outcomes. The outcomes are statements of what the student should be able to do having completed the unit of study. The sequence in which the strands and learning outcomes are presented does not imply any particular order of teaching and/or learning, although it should follow a logical and coherent approach. Appropriate links should be made between the strands.

Learning outcomes should be achievable relative to each student's individual aptitudes and abilities. Learning outcomes promote teaching and learning processes that develop students' knowledge, skills, values and dispositions incrementally, enabling them to apply their key competencies to different situations as they progress. Students studying at both Ordinary level and Higher level will critically engage with Biology, but the context, information and results associated with that analysis are presented at different levels.

Ordinary level	Higher level
Only the learning outcomes that are presented in normal type.	All learning outcomes including those **in bold type**.
Students engage with a broad range of knowledge, mainly concrete in nature, but with some elements of abstraction or theory.	Students engage with a broad range of knowledge, including theoretical concepts and abstract thinking with significant depth in some areas.
Students demonstrate and use a moderate range of cognitive skills and tools and select from a range of procedures and apply known solutions to a variety of problems in both familiar and unfamiliar contexts.	Students demonstrate and use a broad range of specialised skills to evaluate, and use information, to plan and develop investigative strategies, and to determine solutions to varied, unfamiliar problems. They identify and apply skills and knowledge in a wide variety of both familiar and unfamiliar contexts.
Students develop scientific literacy skills and use evidence and data to communicate findings and draw conclusions to questions posed by themselves and others.	Students develop scientific literacy skills and use appropriate evidence and data to effectively communicate findings and draw valid conclusions to questions posed by themselves and others.

Table 1: Design of learning outcomes for ordinary and higher level

The Leaving Certificate Biology specification is designed for a minimum of 180 hours of class contact time. An overview of each strand is provided below, followed by a table. The right-hand column contains learning outcomes which describe the knowledge, skills, values and dispositions students should be able to demonstrate after a period of learning. The left-hand column outlines specific areas that students learn about. Taken together, these provide clarity and coherence with the other sections of the specification.

Unifying Strand: The Nature of Science

This strand builds on the unifying strand from Junior Cycle Science and continues to bring to life the practices and norms underpinning the facts, concepts, laws, and theories of science. Building on existing knowledge, students develop an appreciation of science as a process; a way of knowing and doing and an understanding that the discipline of science includes understanding the nature of scientific knowledge as well as how this knowledge is generated, established and communicated. In senior cycle it is expected that students will be able to meet these learning outcomes with a greater degree of independence.

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[2] and test their ideas on how the natural world works. It becomes apparent that the process of science is often complex and iterative, following many different paths. Students will learn to obtain and evaluate primary data (i.e., collected by themselves) and secondary data (data collected by somebody else).

Students develop an understanding that whilst science is powerful, generating knowledge that forms the basis for many advances and innovations in society, it has limitations and that the application of scientific knowledge to problem-solving can be influenced by considerations such as economic, social, sustainability and ethical factors.

[2] In science a model is a representation of an idea, an object, a process or a system that is used to describe and explain phenomena that cannot be experienced directly. Models are central to what scientists do, they guide research by being simplified representations of an imagined reality and as such, enable predictions to be developed and tested by experiment. It is through the process of validation or arguing the correctness of the model that the model evolves , demonstrating the tentative nature of scientific knowledge. The use of models involves the understanding that all models contain approximations and assumptions limiting their validity and predictive power.

Unifying Strand Learning Outcomes

Students learn about	Students should be able to
U1 Scientific knowledge The nature of scientific knowledge Science as a global enterprise that relies on clear communication, international conventions, peer review and reproducibility Recognising bias	a. appreciate how scientists work and how scientific ideas are modified over time b. conduct research relevant to a scientific issue, evaluate different sources of information including secondary data, understanding that a source may lack detail or show bias
U2 Investigating in Science Questioning and predicting	a. recognise questions that are appropriate for scientific investigation b. pose testable hypotheses developed using scientific theories, and explanations and evaluate and compare strategies for investigating hypotheses
Objectivity • identifying potential sources of random and systematic error • evaluating data in terms of repeatability and reproducibility • distinguishing between fundamental and derived units, using SI units, prefixes and powers of ten for order of magnitude, converting units and using an appropriate number of significant figures in calculations	c. design, plan and conduct investigations; explain how reliability, accuracy, precision, error, fairness, safety, integrity, and the selection of suitable equipment have been considered d. produce and select data (qualitatively/quantitatively), critically analyse data to identify patterns and relationships, identify anomalous observations, draw and justify conclusions e. review and reflect on the skills and thinking used in carrying out investigations, and apply their learning and skills to solving problems in unfamiliar contexts
Communicating results to a range of audiences	f. organise and communicate their research and investigative findings in a variety of ways fit for purpose and audience, using relevant scientific terminology and representations

Students learn about	Students should be able to
U3 Science in society Evaluating evidence for relevance, accuracy, bias Relating science to society by considering economic, social, sustainability and ethical factors	a. evaluate media-based arguments concerning science and technology b. research and present information on the contribution that scientists make to scientific discovery and invention, and evaluate its impact on society
U4 biological reasoning Means by which to explain biological phenomena: • Systems • Interdependence, unity and diversity of life • Form fits function • Transfer of information, matter, and energy…	a. Explain biological phenomena using appropriate means

Strand 1: The Organisation of Life

In this strand, students gain knowledge and understanding of a number of core concepts to explain the organisation and diversity of life. They learn about life's characteristics, cellular basis, chemicals, genetic information and origins.

Students learn about characteristics of living things and how they relate to what constitutes life. Referring to viruses, they engage with evidence that argues the case for living and non-living.

Through the study of kingdoms, students learn how to classify living things. They appreciate that classification systems have, and continue to, change based on emerging evidence and new technologies that help us to understand evolutionary connections and common ancestry in greater detail.

Students are introduced to the cellular basis for life and the complexity of life, based on cells. They learn about the structures and functions of cell organelles through the analysis of primary and secondary data. They appreciate that all life is organised into cells and that the structures and processes of cells are shared by all organisms. In Strand 3 students explore how these cellular components work together to carry out functions and how cellular processes enable organisms to maintain homeostasis.

Students appreciate the structure and role of various biomolecules in nutrition, structure, control of metabolic pathways and transfer of information. In Strands 3 and 4 they explore processes through which these biomolecules are transferred through the living world.

Students learn how genetic information is organised and transferred. They use Mendel's Laws and its associated concepts as a mechanism for explaining genetic inheritance. They develop and use models to explain, analyse and predict genetic inheritance in various contexts.

As students learn about the theory of evolution by means of natural selection, they appreciate it remains the best explanation for the progression and diversity of life. They consider evidence from a variety of sources to support this robust theory. They appreciate the explanatory and predictive power of natural selection in a range of areas including farming, medicine, and environmental conservation.

Strand 1 Learning outcomes

Students learn about	Students should be able to
OrgL1 The characteristics of life	
Characteristics of living things • Organisation, response, respiration, nutrition, excretion, reproduction, growth, metabolism, homeostasis, heredity, cellular basis	a. evaluate the characteristics of living things
Structure and functions of a virus (DNA, RNA, protein coat)	b. explain how viruses replicate within cells
	c. discuss the difficulty of defining viruses, their economic and medical importance
Classification systems as evolving and important systems in biology Phylogeny – classification based on evolutionary development Three domains of life	d. use classification principles to identify and classify living things in known and unknown contexts; examine the importance of classification systems in biology
OrgL2 The unit of life – cells	
The cellular basis for life	a. describe the complexity of multicellular organisms
Cell microstructure and ultrastructure	b. compare the ultrastructure of prokaryotic and eukaryotic cells
Cell wall, cell membrane, cytoplasm, vacuole, mitochondrion, chloroplast, nucleus, nuclear pore, ribosome and chromosome	c. investigate, using primary and secondary data, the structures and organelles of animal and plant cells and relate them to their functions
OrgL3 The chemicals of life: biomolecules	
Living organisms composed of elements which combine in different ratios to form biomolecules	a. outline a nutritional source, and the structural and metabolic roles, of carbohydrate, lipid and protein
Structures • Carbohydrates (Cx(H2O)y) • lipids (triglyceride unit and different combinations in fats, oils and phospholipids) • proteins (CHONR), • nucleic acid (nucleotides)	b. recognise the roles of vitamins and minerals in biological processes
	c. outline the main roles of water in living organisms

Metabolic roles • hormones as regulators • proteins as enzymes • carbohydrates and lipids in catabolic, anabolic, respiratory, photosynthetic functions	
Biomolecular components and sources of nutritional molecules (proteins, lipids, carbohydrates, water-soluble and fat-soluble vitamins, minerals)	d. investigate qualitatively the level of any one constituent in a range of food samples, use primary data to support conclusions
Energy and electron transfer in cell activities	e. describe the role of ATP and NAD+/NADP+ in metabolic pathways
• two strand double helix with adenine, thymine, cytosine and guanine base pairs. • RNA basic structure with reference to uracil	f. describe the basic structure and function of DNA and RNA
The concept of the genetic code	**g. relate genes, proteins and traits in organisms; outline the concept of the genetic code**
OrgL4 The information of life- genetic inheritance	
Key concepts related to transfer of information • species, • gamete, • sexual reproduction, • fertilisation, • heredity, • chromosome, • allele, • gene expression, • epigenetic expression • dominance, • recessive, • genotype, phenotype, • incomplete dominance, • linkage, sex-linkage	a. describe the structure of a chromosome and the role of a gene; compare nuclear and non-nuclear inheritance b. compare genetic and epigenetic mechanisms c. predict inheritance to the first generation of a single unlinked trait in crosses involving homozygous and heterozygous parents d. predict a cross involving incomplete dominance
Nuclear inheritance via transfer of DNA vs non-nuclear inheritance in mitochondrial and chloroplast DNA	**e. illustrate Mendel's Laws of Segregation and Independent Assortment**

Monohybrid and **dihybrid crosses** Mendel's Laws of Segregation and Independent Assortment • Linkage • Crossing over not required	**f. predict inheritance to the second generation of two unlinked traits in crosses involving homozygous and heterozygous parents** **g. explain how linkage affects Mendel's Law of Independent Assortment (knowledge of crossing over not required)** h. describe sex determination by X and Y chromosomes in humans i. develop and use models to explain and predict the inheritance of sex-linked traits from known examples
OrgL5 The origins of life – evolution Evolutionary theory as a mechanism for explaining and predicting common origins and future directions for highly specialised organisms Natural vs artificial selection; Mutations (gene and chromosome) Sources of evidence such as: • embryology • fossil records • phylogeny • comparative anatomy • antibiotic resistance • speciation, etc. The value of the theory of evolution in understanding the modern world.	a. explain the variations that come from sexual reproduction and mutations b. discuss the rationale for, and basis of, the theory of evolution by natural selection c. consider evidence that supports the theory of evolution by natural selection; recognise the value of the theory of evolution in understanding the modern world d. evaluate the practical applications of artificial selection; discuss ethical and societal issues

Strand 2: The Structures and Processes of Life

In this strand students learn how the unique and diverse structures within living things allow life to function through a number of processes taking place within cells, organs and systems. As students investigate the structures and processes of living things, they appreciate that all life depends on the transfer of energy and matter through these processes. They recognise that all organisms store information and rely on proteins in their cells, including enzymes, to carry out specific functions. They learn about the cellular processes of photosynthesis, respiration, cell division and protein synthesis as fundamental for transference of energy, matter and information through the living world.

In Strand 1, students learn about biomolecules involved in transfer, including ATP and NADH/NADPH. In Strand 2, they consider these molecules in the context of cellular processes as they investigate photosynthesis and respiration. They learn how cells, organs and systems interact to facilitate the transport and transfer of biomolecules within organisms, as well as their exchange with the external environment. In Strand 3, students explore the transfer of biomolecules between living things and their recycling through habitats, ecosystems and the biosphere.

In Strand 1, students apply their knowledge of genetic laws to model genetic inheritance through generations. In Strand 2, they consider the structures and function of cell division and protein synthesis to further understand how transfer of information occurs. They explore the mechanisms of reproduction to allow for the transfer of information and continuity of life. They learn about the centrality of the genetic code to our understanding of life and its continuation, including our understanding of health and disease. In Strand 3, they consider modern advancements in the manipulation of genetic code, as well as the ethical and societal implications of these advancements.

Students appreciate the importance of homeostasis as a fundamental characteristic of living things. As they explore how different organs and systems function and interact, they appreciate how the structures and processes within organisms are designed to function both individually and collectively to facilitate the organism responding to internal and external change.

Strand 2 Learning outcomes

Students learn about	Students should be able to
SPL1 Enzymes	a. explain how enzymes function to facilitate the catalysis of biochemical reactions
3D structure **Induced Fit model**	**b. illustrate enzyme specificity using the Induced Fit model.**
Rate of activity (1/t) of enzymes	c. investigate factors that affect the rate of enzyme-catalysed reactions, use primary and secondary data to support conclusions
Use of enzymes in bioreactors for a wide range of industries including • Food and beverages • Biofuels • Medicine • Pharmaceuticals	d. evaluate the use of enzymes in a known enterprise; appreciate the central role of enzymes in industrial applications
Different approaches to the use of enzymes in industry	
SPL2 Cellular processes - photosynthesis and respiration	a. outline the processes of anaerobic respiration, aerobic respiration and photosynthesis
Temperature, light intensity, CO_2 levels	b. investigate factors that affect the rate of photosynthesis, use primary and secondary data to support conclusions
	c. investigate the conditions necessary for fermentation, use primary and secondary data to support conclusions
	d. examine how leaf structure is adapted for photosynthetic efficiency; discuss the role that manipulation of photosynthesis can play in horticulture
Key stages and processes of photosynthesis and respiration • First and second stage (respiration)	**e. develop and use models to explain the two-stage processes of photosynthesis and respiration; make particular reference to the role of transfer molecules**

Students learn about	Students should be able to
• Light and dark stage (photosynthesis) • Concentration gradients • Electron transport chain	f. **recognise the significance of the internal structures of mitochondria and chloroplasts in facilitating the processes of photosynthesis and respiration**
SPL3 Information of life - cell division, protein synthesis	
Cell division as a transmission of genetic code to the next generation: • Mitosis - retains genetic code (diploid number) • Meiosis - varies and transmits new code (haploid number)	a. describe simply the process of mitosis and meiosis; compare the roles of mitosis and meiosis b. explain the role of DNA replication and mitosis in the cell cycle c. describe how DNA is replicated and the flow of information through mRNA to protein d. describe how gene and chromosomal mutations occur, making reference to known examples of both
Roles of • **DNA** • **mRNA** • **tRNA** • **Ribosomes** **in translating genetic code into amino acids**	**e. describe the processes of transcription and translation**
Characteristics and growth of cancer cells Emerging evidence in cancer research offering solutions • Early detection • Drugs • Treatments • Lifestyle changes	f. outline how uncontrolled cell growth and proliferation can lead to development of cancers g. examine the role of infectious agents, environmental factors and/or genetic susceptibility in the development of different cancers in an organism; evaluate solutions to address the development of cancers
SPL4 Response	
Hormonal and nervous system Role of the main parts of the brain: • cerebral cortex	a. relate the structure of the parts of the central nervous system and the peripheral nervous system to their functions; compare nervous and hormonal coordination

Students learn about	Students should be able to
• cerebellum • thalamus • epithalamus • hypothalamus • brain stem	b. describe the roles of the main parts of the brain
Neurotransmission • Enzyme inhibition at synapse • Endorphins and dopamine	c. describe the structure of a neuron and the mechanisms of impulse transfer
Maintaining homeostasis • Exocrine and endocrine glands • **Negative feedback**	**d. develop and use models to explore the interaction of the hormonal and nervous systems to maintain homeostasis** e. illustrate the location and function of the major glands in the endocrine system and their associated hormones
Uses of hormonal manipulation • Commercial • Sport • Health	f. recognise the impact of hormonal manipulation on organisms
Immunity	g. distinguish between innate and acquired immunity; outline the strategies applied to prevent and treat microbial diseases **h. distinguish between the roles of B and T lymphocytes in the body's immune response** i. explore how new diseases emerge; discuss the importance of emerging diseases for society
SPL5 Reproduction	
Asexual and sexual reproduction in plants and animals	a. relate the general structure of the male and female mammalian reproductive systems to their functions **b. outline the relationship between hormonal levels and stages of the menstrual cycle**
Anatomical and physiological processes of pregnancy	c. describe pregnancy from the development of fertilised embryo to

Students learn about	Students should be able to
• Copulation • Fertilisation • Implantation • Placenta formation • Foetus development (including germ layers and stem cells) • Labour and birth • Milk production	birth; relate the structure of the placenta to its functions
Role of hormones in controlling reproduction • Testosterone • **FSH** • **LH** • Progesterone • Oestrogen • Oxytocin	d. develop and use models to illustrate the role of hormones before, during and after pregnancy
Monitoring the health of the developing foetus • Antenatal screening • Genetic screening • Postnatal screening (including for PKU)	e. appreciate the impact of advancements in modern technology on prenatal and postnatal care
Fertile periods Contraception Infertility treatment	f. discuss the use and medical implications of strategies to control fertility and treatments for infertility
Reproductive structures and processes in plants • Flowers, seeds, fruits • Methods of pollination • Growth regulators in seeds • Methods of fruit and seed dispersal • Dormancy and germination • Vegetative production	g. investigate the structures of insect and wind pollinated plants and relate them to their functions, use primary and secondary data to support conclusions h. investigate the digestive activity of seeds during germination, use primary data to support conclusions
SPL6 Transport and transfer (physiological processes)	
Transport and transfer of materials across membranes • Diffusion • Osmosis • Active transport	a. distinguish between diffusion, osmosis and active transport; examine the role of osmosis in food preservation and plant health b. investigate factors affecting rates of osmosis across semi-permeable membranes, use primary data to support conclusions

Students learn about	Students should be able to
Transport and transfer of nutrients and wastes between the internal and external environment in animals • Urinary system • Formation of urine • **Nephron structure and blood supply (role of ADH not required)**	c. relate the macrostructure of the urinary system to its function in filtering and removing waste; outline the filtration of blood in the nephron
Digestive system • Physical and chemical breakdown of food ▪ Bile salts ▪ Amalyse • Absorption of nutrients into the blood ▪ Villi ▪ Hepatic portal vein	d. describe how the macrostructure of the human digestive system and associated organs and glands carry out the process of digesting fats, carbohydrates and proteins e. describe the absorption, transport and storage of the products of digestion
Balanced diet importance as related to age, gender, activity, variety of foods, sufficient water, role of dietary fibre	f. consider the biological implications of dietary choices
Transport and transfer of gases between the internal and external environment • Breathing system • Breathing mechanism • CO_2 as a controlling factor	g. relate the anatomy and physiology of the breathing system to its role in gaseous exchange in the lungs h. outline the role of carbon dioxide concentration as a controlling factor in stomatal opening and in the human breathing system
Transport of materials within animals • Circulatory system (closed) • Pathways of blood circulation • Cardiac cycle • Lymphatic system	i. investigate the structures of the heart and relate them to their functions, use primary and secondary data to support conclusions j. develop and use models to describe the interaction between the circulatory and other human body systems in facilitating transport of materials around the body k. explain heartbeat and its control by the pacemaker, pulse, blood

Students learn about	Students should be able to
	pressure and the cardiac blood supply l. relate the composition of the blood to its functions; appreciate the value of knowledge on blood grouping for human health m. distinguish between arteries, veins and capillaries based on their macrostructures and role in the circulatory system of humans
Transport and transfer in plants • Leaves and lenticels • Root shoot system • Plant tissues (dermal, ground, vascular) Processes involved in transport and transfer of materials • Osmosis • Diffusion • Root pressure • Transpiration • Stoma activity (CO_2 as a controlling factor)	n. relate the structure of the lymphatic system to its functions o. relate the structure of the root, stem and leaf and their associated tissues with their functions p. describe the transport of water, minerals, carbon dioxide and photosynthetic products in the plant

Strand 3: The Interactions of Life

In this strand, students look at the systems of the living world at different scales. As they investigate interactions of individuals and groups in ecosystems, they learn that no organism in nature is independent of the systems in which it lives, functions and dies.

From common matter to diverse ecosystems, students develop and use models to explain interdependence in nature and the transfer of matter and energy through the biosphere. Through a knowledge of evolution, they explain how adaptations of living things suit specific functions allowing for species survival.

As they learn how the living and non-living worlds interact to cycle and recycle nutrients, they appreciate no biological process can exist in isolation from its surroundings.

In this strand, students learn how life interacts with life, with the non-living world and with the modern world. They learn how knowledge and innovation interact with the information of life through genetic engineering, DNA sequencing and bioinformatics. They consider the role of microorganisms and how their structures and functions make them suitable for many advances in biotechnology.

Strand 3 Learning outcomes

Students learn about	Students should be able to
IL1 Ecology, ecosystems, biodiversity	
The biosphere, ecosystems, habitats Exploring local ecosystems through engagement with current news and local media Conservation through emerging technologies and collaboration across multiple disciplines	a. discuss the ways in which science interacts with social, economic, cultural and ethical factors to inform the making of decisions on local ecological issues
Species diversity index, Ds, the variety of species in a given area, calculated using $Ds = 1 - \frac{\Sigma n(n-1)}{N(N-1)}$ n = total number of organisms o f a particular species N = total number of organisms of all species	**b. analyse evidence of species diversity in ecosystems using a mathematical model**
Modelling the movement of matter and energy through ecosystems to explain and predict the impact of change	**c. interpret pyramids of biomass to explain and make predictions about**

Students learn about	Students should be able to
○ Food chains and webs ○ **Pyramids of biomass**	**the carrying capacity of ecosystems at different scales**
	d. interpret primary or secondary data relating to the effects of human activity on species diversity; evaluate associated benefits and risks
Ecological techniques • Collection methods • Classification systems • Qualitative and quantitative surveys • Measurement of abiotic factors (air, ground, aquatic, edaphic) • Biotic factors (predation, competition, symbiosis, parasitism)	e. using primary data from a chosen ecosystem: ○ construct a model of the ecosystem illustrating species, relevant **biotic** and abiotic factors ○ investigate the influence of a range of abiotic factors on the distribution of a species ○ investigate **quantitatively** the impact of variation in abiotic factors on the distribution of a species ○ describe the transfer of matter and energy from producers to at least 3 trophic levels ○ describe how an organism's adaptations enable it to exploit a niche in the ecosystem ○ explain the feeding and symbiotic relationships that occur between organisms
IL2 Nutrient cycling	
Cellular nature of bacteria/fungi (prokaryotic/eukaryotic)	a. distinguish between bacteria and fungi in terms of structure, nutrition, reproduction and **cellular nature**
Growth curves of microorganisms Factors influencing growth of microorganisms (pH, nutrients, water, oxygen concentration, external solute concentrations, pressure, temperature, presence of antibacterial/antifungal chemicals)	b. investigate factors affecting the growth of microorganisms, use primary and secondary data to support conclusions
Common mechanisms of molecular genetics in microorganisms and humans	c. discuss the economic, medical and pharmaceutical importance of microorganisms

Students learn about	Students should be able to
Biogeochemical cycles (names of microorganisms not required)	d. illustrate and explain the carbon and nitrogen cycles
Decomposers (bacteria and fungi)	**e. evaluate ethical and sustainability issues associated with the cycling of nutrients**
Plants as carbon sinks	f. discuss the link between atmospheric carbon dioxide, methane and climate change; evaluate biological strategies to reduce atmospheric levels of these gases
IL3 The information of life - biotechnology	
Gene isolation, cutting transformation, introduction of base sequence changes, phenotype expression	a. describe the principles and processes involved in genetic engineering
Interdisciplinary approaches to study and analysis of biological data	
Polymerase chain reaction and its uses Genetic data access and use (agriculture, health, industry, reproduction, forensics…)	b. describe the process of DNA profiling and its potential uses
Sequencing data (nucleotide bases)	c. outline the principle of DNA sequencing and its use in bioinformatics
	d. use a genome database to search for alleles that are known to cause (or be responsible for) specific genetic diseases
	e. investigate patterns using a DNA profile, use primary and/or secondary data to support conclusions
Genetic modification DNA testing Cellular therapies Use of stem cells (pluripotent, multipotent, therapeutic/cloning)	f. discuss the ethical and sustainability issues arising from advancements in genetic technologies

Assessment

Assessment in senior cycle involves gathering, interpreting, using and reporting information about the processes and outcomes of learning. It takes different forms and is used for a variety of purposes. It is used to determine the appropriate route for students through a differentiated curriculum, to identify specific areas of strength or difficulty for a given student and to test and certify achievement. Assessment supports and improves learning by helping students and teachers to identify next steps in the teaching and learning process.

As well as varied teaching strategies, varied assessment strategies will support student learning and provide information to teachers and students that can be used as feedback so that teaching and learning activities can be modified in ways that best suit individual learners. By setting appropriate and engaging tasks, asking questions and giving feedback that promotes learner autonomy, assessment will support learning and promote progression, support the development of student key competencies and summarise achievement.

Assessment for certification

Assessment for certification is based on the rationale, aim and learning outcomes of this specification. There are two assessment components: a written examination and an additional assessment component comprising a Biology in Practice Investigation. The written examination will be at higher and ordinary level. The Biology in Practice Investigation will be based on a common brief. Each component will be set and examined by the State Examinations Commission (SEC).

In the written assessment, Leaving Certificate Biology will be assessed at two levels, Higher and Ordinary (Table 1, page 13). Examination questions will require students to demonstrate learning appropriate to each level. Differentiation at the point of assessment will also be achieved through the stimulus material used, and the extent of the structured support provided for students at different levels.

Assessment Component	Weighting	Level
Biology in Practice Investigation	40%	Higher and Ordinary
Written examination	60%	Higher and Ordinary

Table 2 Overview of Assessment for Certification

Additional assessment component: Biology in Practice Investigation

The Biology in Practice Investigation provides students with an opportunity to work like scientists as they develop a deeper understanding of the science underpinning biological practice in an integrated way, while also developing and refining their practical biology skills. The senior cycle key competencies of thinking and solving problems, being creative, communication, working with others, and managing learning and self, developed through all the learning in this course, will be applied through the student's engagement in the investigation. The Biology in Practice Investigation provides opportunities for students to pursue their interests in biology, to make their own investigative decisions, acquire a depth of conceptual understanding and self-regulate their own learning. It is envisaged that the additional assessment component will take up to 20 hours of class time to complete. Schools will have a level of autonomy over how these hours are allocated.

The investigation provides opportunities for students to demonstrate learning related to the learning outcomes of the unifying strand, Nature of Science. Building on their learning to date, students will learn more about the nature of investigation through research and experimentation.

The investigation will relate to a concept within a brief issued annually by the SEC in two parts.

Part 1

A broad thematic overview is published in term 1 of fifth year, the purpose of which is to provide the broad context that will inform the more detailed brief given early in term 1 of sixth year. This will help to

- allow students to develop their thinking and ideas on areas they would like to investigate during the specified completion period
- facilitate teachers in their planning
- signpost, for teachers and students, issues related to specific real world applications of biology
- signpost relevant documents or real scientific texts and data that might be useful to support the learning throughout the course
- allow students to develop a research log that they can draw upon and expand during the specified completion period for their investigation.

Part 2

A thematic brief is issued early in term 1 of sixth year, the purpose of which is to set out the specific requirements of the Biology in Practice Investigation. The brief narrows the focus from the thematic overview, whilst maintaining students' agency to choose a topic that may be relevant, motivating and engaging for them. This approach will provide students with some choice to conduct an investigation of their own design.

The investigation is carried out in two phases, both of which are completed in up to 20 hours of class time. In phase one, students carry out scientific research on an issue related to the brief. They develop a research question and gather, process and evaluate information from secondary sources to take an informed position on this question. The knowledge gained from this phase of the investigation may help to inform the experimental work conducted in phase two.

In phase two, students carry out an experiment (lab or field based) related to a concept(s) within the brief. They generate a hypothesis and plan, design and carry out their own experiment(s), gathering and analysing primary data and forming a conclusion(s).

Students should be empowered in realising that research and experimentation is more about engaging with and learning from the process, rather than seeking a *perfect answer*. Students should give an authentic account of how their investigative work unfolds, discuss and explain the outcomes of their investigation and how they might revise aspects of the process.

The time allocation for the additional assessment component is up to 20 hours of class time. Students develop an evidence-based argument in response to the brief. Upon completion, students submit an evidence-based argument on the outcomes of their investigation in a format prescribed by the SEC.

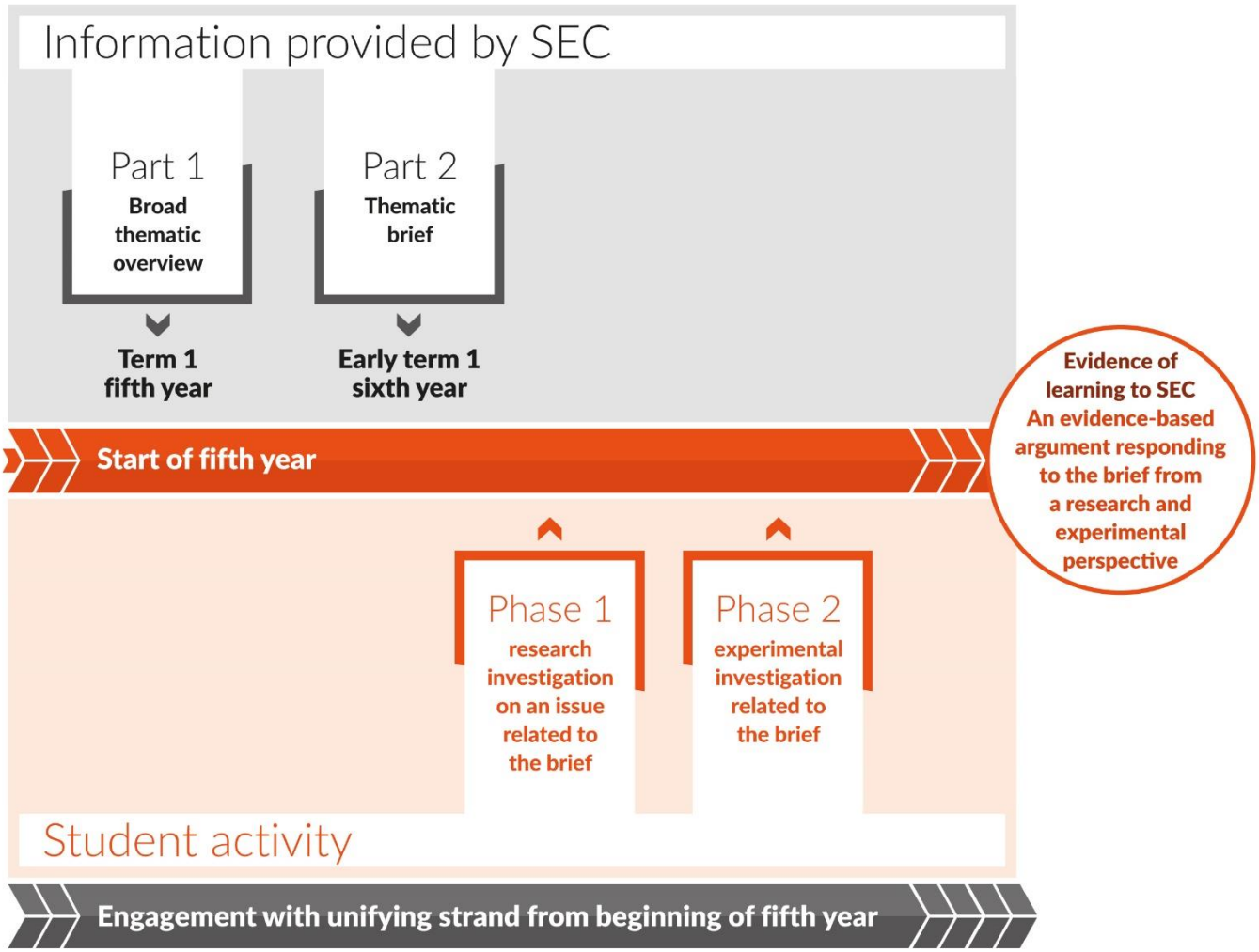


Figure 4 Timeline of activity for Biology in Practice Investigation.

Descriptors of quality for the Biology in Practice investigation

The descriptors below relate to the learning achieved in the Biology in Practice Investigation. In particular, the investigation requires students to:

- reason about biological phenomena
- demonstrate investigative skills
- relate their investigative work to the work of scientists in society.

	Students demonstrating a high level of achievement	Students demonstrating a moderate level of achievement	Students demonstrating a low level of achievement
Reason about biological phenomena	engage thoroughly with the concepts being investigated; explain clearly and accurately, using appropriate means, the biological phenomena involved. Where applicable, they pose a testable hypothesis that is underpinned by biological theory and clearly describe the purpose of the investigation.	have a good engagement with the concepts being investigated; describe the biological phenomena involved. Where applicable, they pose a testable hypothesis, and the purpose of the investigation is outlined.	have a limited engagement with the concepts being investigated; outline the biological phenomena involved. Where applicable, a testable hypothesis is provided by the teacher for the student to investigate.
Demonstrate investigative skills (design and method)	use clear, thorough, and appropriate investigative design and methods to collect primary data, leading to high quality data, presentation, and analysis.	use clear and appropriate investigative design and methods to collect primary data, leading to good quality data, presentation, and analysis.	use unclear investigate design and methods to collect primary data, leading to limited data, presentation, and analysis.
Demonstrate investigative skills (analysis and conclusions)	draw valid conclusions justified by the data and relating to any hypotheses made. A thorough evaluation of the investigation acknowledges limitations in design and data gathering.	draw conclusions that relate to any hypotheses made. Potential sources of error in the investigative design are identified.	draw limited conclusions. Potential sources of error in the investigative design are not identified.
Relate their investigative work to the work of scientists in society	offer a considered reflection that locates the outcomes of the investigation within broader issues relating to the work of a scientist or science and society.	reflect on how the outcomes of the investigation relate to the work of a scientist or science and society.	make limited links between the outcomes of the investigation and the work of a scientist or science and society.

Table 3 Descriptors of Quality: Biology in Practice Investigation

Written examination

The written examination will consist of a range of question types. The senior cycle key competencies (Figure 2) are embedded in the learning outcomes of this specification and will be assessed in the context of the learning outcomes. The written examination paper will include a selection of questions that will assess, appropriate to each level:

- the learning described in the three contextual strands of the specification and the unifying strand
- application of biology to issues relating to the cross-cutting themes—sustainability health, and technology.

Reasonable accommodations

This Leaving Certificate Biology specification requires that students engage with the nature of the subject on an ongoing basis throughout the course. In addition, the assessment involves an additional component, which accounts for 40% of the total marks awarded. In this context, the scheme of *Reasonable Accommodations*, operated by the State Examinations Commission SEC), is designed to assist candidates in the Leaving Certificate who have physical/medical/sensory and/or specific learning difficulties.

Reasonable accommodations are designed to remove as far as possible the impact of a disability on a student's performance, so that he or she can demonstrate in an examination his or her level of achievement—they are not designed to compensate for a possible lack of achievement arising from a disability.

Leaving Certificate grading

Leaving Certificate Biology will be graded using an 8-point grading scale. The highest grade is a Grade 1; the lowest grade is a Grade 8. The highest seven grades (1-7) divide the marks range 100% to 30% into seven equal grade bands 10% wide, with a grade 8 being awarded for percentage marks of less than 30%. The grades at Higher level and Ordinary level are distinguished by prefixing the grade with H or O respectively, giving H1-H8 at Higher level, and O1-O8 at Ordinary level.

Grade	% marks
H1/O1	90-100
H2/O2	80<90
H3/O3	70<80
H4/O4	60<70

H5/O5	50<60
H6/O6	40<50
H7/O7	30<40
H8/O8	<30

Table 4 Leaving Certificate grading scale.

Appendix 1 Glossary of action verbs

This glossary is designed to clarify the learning outcomes. Each action verb is described in terms of what the learner should be able to do once they have achieved the learning outcome. This glossary will be aligned with the command words used in the assessment.

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
Classify	group things based on common characteristics
Compare	give an account of the similarities and (or) differences between two (or more) items or situations, referring to both (all) of them throughout
Describe	develop a detailed picture or image of, for example a structure or a process, using words or diagrams where appropriate; produce a plan, simulation or model
Discuss	offer a considered, balanced review that includes a range of arguments, factors or hypotheses; opinions or conclusions should be presented clearly and supported by appropriate evidence
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
Evaluate (ethical judgement)	collect and examine evidence to make judgments and appraisals; describe how evidence supports or does not support a judgement; identify the limitations of evidence in conclusions; make judgments about the ideas, solutions or methods
Explain	give a detailed account including reasons or causes
Examine	consider an argument or concept in a way that uncovers the assumptions and relationships of the issue

Identify	recognise patterns, facts, or details; provide an answer from a number of possibilities; recognize and state briefly a distinguishing fact or feature
Illustrate	use examples to describe something
Investigate	observe, study, or make a detailed and systematic examination, in order to establish facts and reach new conclusions
Justify	give valid reasons or evidence to support an answer or conclusion
Measure	quantify changes in systems by reading a measuring tool
Outline	give the main points; restrict to essentials
Predict	give an expected result of an event; explain a new event based on observations or information using logical connections between pieces of information
Recognise	identify facts, characteristics or concepts that are critical (relevant/appropriate) to the understanding of a situation, event, process or phenomenon
Relate	associate, giving reasons
Use	apply knowledge or rules to put theory into practice