An Roinn Oideachais
agus Scileanna

Junior Cycle Science

Curriculum Specification

Contents

Introduction to junior cycle

Junior cycle education places students at the centre of the educational experience, enabling them to actively participate in their communities and in society, and to be resourceful and confident learners in all aspects and stages of their lives. Junior cycle is inclusive of all students and contributes to equality of opportunity, participation and outcome for all.

The junior cycle allows students to make a greater connection with learning by focusing on the quality of learning that takes place, and by offering experiences that are engaging and enjoyable for them, and are relevant to their lives. These experiences are of a high quality: they contribute directly to the physical, mental and social wellbeing of learners; and where possible, provide opportunities for them to develop their abilities and talents in the areas of creativity, innovation and enterprise. The junior cycle programme builds on students' learning to date and actively supports their progress; it enables them to develop the learning skills that will assist them in meeting the challenges of life beyond school.

Rationale

Science is a collaborative and creative human endeavour arising from our desire to understand the world around us and the wider universe. Essentially, it is curiosity in thoughtful and deliberate action. Learning science through inquiry enables students to ask more questions, and to develop and evaluate explanations of events and phenomena they encounter.

The study of science enables students to build on their learning in primary school and to further develop their knowledge of and about science. Students enhance their scientific literacy by developing their ability to explain phenomena scientifically; their understanding of scientific inquiry; and their ability to interpret and analyse scientific evidence and data to draw appropriate conclusions.

Developing scientific literacy is important to social development. As part of this process students develop the competence and confidence needed to meet the opportunities and challenges of senior cycle sciences, employment, further education and life. The wider benefits of scientific literacy are well established, including giving students the capacity to make contributions to political, social and cultural life as thoughtful and active citizens who appreciate the cultural and ethical values of science. This supports students to make informed decisions about many of the local, national and global challenges and opportunities they will be presented with as they live and work in a world increasingly shaped by scientists and their work.

Science is not just a tidy package of knowledge, nor is it a step-by-step approach to discovery. Nonetheless, science is able to promote the development of analytical thinking skills such as problem-solving, reasoning, and decision-making. Learning science in junior cycle can afford students opportunities to build on their learning of primary science and to activate intuitive knowledge to generate, explore and refine solutions for solving problems. This may not always yield the expected result, but this, in turn, can be the focus for deeper learning and help the student to develop an understanding of risk and a realisation that different approaches can be adopted. As students develop their investigative skills, they will be encouraged to examine scientific evidence from their own experiments and draw justifiable conclusions based on the actual evidence. In reviewing and evaluating their own and others' scientific evidence and data, they will learn to identify limitations and improvements in their investigations. This collaborative approach will increase students' motivation, and provide opportunities for working in groups and to develop the key skills of junior cycle.

In addition to its practical applications, learning science is a rewarding enterprise in its own right. Students' natural curiosity and wonder about the world around them can be nurtured and developed through experiencing the joy of scientific discovery.

The development of this specification has been informed by the eight principles for junior cycle education that underpin the *Framework for Junior Cycle*, all of which have significance for the learning of science as promoted by this specification.

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Aim

Science in junior cycle aims to develop students' evidence-based understanding of the natural world and their ability to gather and evaluate evidence: to consolidate and deepen their skills of working scientifically; to make them more self-aware as learners and become competent and confident in their ability to use and apply science in their everyday lives.

More specifically it encourages all students:

- to develop a sense of enjoyment in the learning of science, leading to a lifelong interest in science
- to develop scientific literacy and apply this in cognitive, affective and psychomotor dimensions to the analysis of science issues relevant to society, the environment and sustainability
- to develop a scientific habit of mind and inquiry orientation through class, laboratory and/or off-site activities that foster investigation, imagination, curiosity and creativity in solving engaging, relevant problems, and to improve their reasoning and decision-making abilities
- to develop the key skills of junior cycle to find, use, manage, synthesise, and evaluate data; to communicate scientific understanding and findings using a variety of media; and to justify ideas on the basis of evidence
- to acquire a body of scientific knowledge; to develop an understanding of Earth and space and their place in the physical, biological, and chemical world and to help establish a foundation for more advanced learning.

Overview: Links

The tables on the following pages show how junior cycle science is linked to central features of learning and teaching outlined in the *Framework for Junior Cycle*.

Table 1: Links between junior cycle science and the statements of learning

STATEMENTS OF LEARNING

The statement	Examples of relevant learning
SOL 9. The student understands the origins and impacts of social, economic, and environmental aspects of the world around her/him.	Students will collect and examine data to make appraisals about ideas, solutions or methods by which humans can successfully conserve ecological biodiversity.
SOL 10. The student has the awareness, knowledge, skills, values and motivation to live sustainably.	Students will engage critically in a balanced review of scientific texts relating to the sustainability issues that arise from our generation and consumption of electricity.
SOL 13. The student understands the importance of food and diet in making healthy lifestyle choices.	Students will collect and examine evidence to make judgements on how human health can be affected by inherited factors and environmental factors, including nutrition and lifestyle choices.
SOL 15. The student recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning.	Students will participate in a wide range of mathematical activities as they analyse data presented in mathematical form, and use appropriate mathematical models, formulae or techniques to draw relevant conclusions.
SOL 16. The student describes, illustrates, interprets, predicts and explains patterns and relationships.	Through investigation, students will learn how to describe, illustrate, interpret, predict and explain patterns and relationships between physical observables.
SOL 17. The student devises and evaluates strategies for investigating and solving problems using mathematical knowledge, reasoning and skills.	Through planning and conducting scientific investigations, students will learn to develop their critical thinking and reasoning skills as they apply their knowledge and understanding to generate questions and answers rather than to recall answers.
SOL 18. The student observes and evaluates empirical events and processes and draws valid deductions and conclusions.	Students will engage in an analysis of natural processes: through observation and evaluation of the processes they will generate questions as they seek to draw valid deductions and conclusions.
SOL 19. The student values the role and contribution of science and technology to society, and their personal, social and global importance.	Students will research and present information on the contributions that scientists make to scientific discovery and invention, and the impact of these on society.

LINKS BETWEEN JUNIOR CYCLE SCIENCE AND THE KEY SKILLS OF JUNIOR CYCLE

In addition to their specific content and knowledge, the subjects and short courses of junior cycle provide students with opportunities to develop a range of key skills. There are opportunities to support all key skills in this course but some are particularly significant. The examples below identify some of the elements that are related to learning activities in science. Teachers can also build many of the other elements of particular key skills into their classroom planning. The eight key skills are set out in detail in Key Skills of Junior Cycle.

The junior cycle curriculum focuses on eight key skills:

- Being creative
- Being literate
- Being numerate
- Communicating
- Managing information and thinking
- Managing myself
- Staying well
- Working with others

Figure 1: The elements of the eight key skills of junior cycle

Table 2: Links between junior cycle science and key skills

JUNIOR CYCLE SCIENCE AND KEY SKILLS

Key skill	Key skill element	Student learning activity
Being creative	Exploring options and alternatives	As students engage in scientific inquiry, they generate and seek to answer their own questions. They try out different approaches when working on a task and evaluate what works best.
Being literate	Expressing ideas clearly and accurately	Students will plan, draft and present scientific arguments, express opinions supported by evidence, and explain and describe scientific phenomena and relationships.
Being numerate	Developing a positive disposition towards investigating, reasoning and problem-solving	As students engage with science, they will come to appreciate the fun of exploring mathematical problems in the context of a scientific idea and the satisfaction of arriving at a solution.
Communicating	Using numbers and data	Students will interpret, compare, and present information and data using a variety of charts/ diagrams fit for purpose and audience, using relevant scientific terminology.
Managing information and thinking	Being curious	As students research socio-scientific issues, they will ask questions to probe the problem more deeply and to challenge how they think about the issue.
Managing myself	Making considered decisions	Students enjoy a wide range of collaborative discussions, providing them with opportunities to listen to different perspectives when considering their options.
Staying well	Being safe	Students will engage frequently with planning and conducting practical activities: they will learn to recognise when their personal safety is threatened and respond appropriately.
Working with others	Contributing to making the world a better place	Students enjoy frequent opportunities to discuss and debate issues relating to sustainability. They will learn to think critically about the world and its problems and propose solutions.

LINKS BETWEEN JUNIOR CYCLE SCIENCE AND SCIENTIFIC LITERACY

One of the aims of this specification is to help students to develop their scientific literacy. The *PISA 2015 Draft Science Framework* includes the following definition for scientific literacy:

> Scientific literacy is the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen.

A scientifically-literate person is described as someone who is willing to engage in reasoned discourse about science and technology. This requires them to be able to explain phenomena scientifically, evaluate and design scientific inquiry, and interpret data and evidence scientifically.

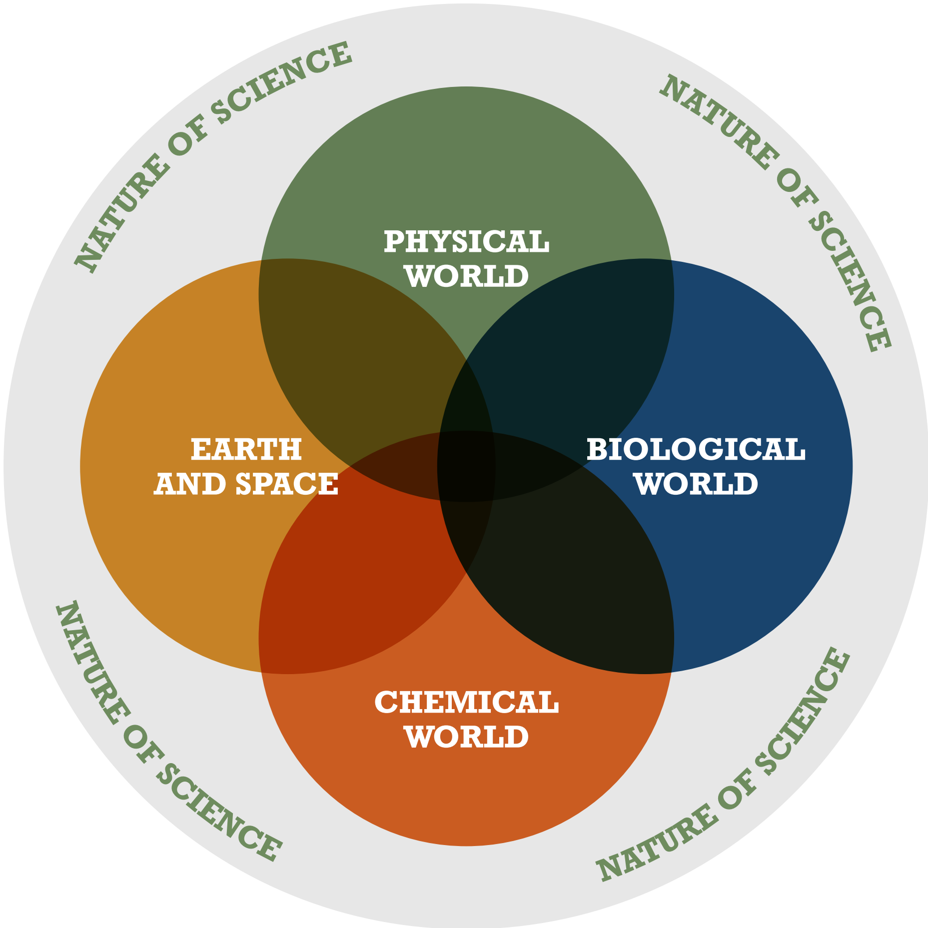
Table 3: Links to scientific literacy

SCIENTIFIC LITERACY	
Explain phenomena scientifically	Students will recall and apply appropriate scientific knowledge to identify, use and generate explanatory models.
Understand scientific inquiry	Students will distinguish questions that are possible to investigate scientifically; propose a way of exploring a given question scientifically; pose testable hypotheses and evaluate and compare strategies for investigating hypotheses.
Interpret scientific evidence	Students will engage critically in a balanced review of scientific texts. Through this they will learn to identify the assumptions, evidence and reasoning in science-related texts, and distinguish between arguments which are based on scientific evidence and theory, and those which are not.

Overview: Course

The specification for junior cycle science focuses on the development of students' knowledge of and about science through the unifying strand, **Nature of science**, and the four contextual strands: **Physical world, Chemical world, Biological world, and Earth and space**. It has been designed for a minimum of 200 hours of timetabled student engagement across the three years of junior cycle.

Figure 2: The strands of the specification for junior cycle science



Nature of science

This is the unifying strand; it permeates all the strands of the specification. The elements of this strand place a focus on how science works; carrying out investigations; communicating in science; and developing an appreciation of the role and contribution of science and scientists to society. There is a strong focus on scientific inquiry. There is no specific content linked to the Nature of science strand itself, and its learning outcomes underpin the activities and content in the contextual strands. The learning outcomes are pursued through the contextual strands as students develop their content knowledge of science through scientific inquiry. In doing so, students construct a coherent body of facts, learn how and where to access knowledge, and develop scientific habits of mind and reasoning skills to build a foundation for understanding the events and phenomena they encounter in everyday life. This makes the science classroom a dynamic and interactive space, in which students are active participants in their development. They can engage not only in experimental activities and discussion within the classroom, but also in researching and evaluating information to look beyond claims and opinions to analyse the evidence which supports them.

Earth and space

This strand provides an ideal setting for developing generalising principles and crosscutting concepts. To develop a sense of the structure of the universe and some organising principles of astronomy, students explore relationships between many kinds of astronomical objects and evidence for the history of the universe. Students use data to discern patterns in the motion of the Sun, Moon, and stars and develop models to explain and predict phenomena such as day and night, seasons, and lunar phases. The cycling of matter, with carbon and water cycles as well-known examples, provides a rich setting for students to develop an understanding of many physical and chemical processes including energy conservation and energy resources, weather and climate, and the idea of cycling itself. They will come to appreciate the impact of human activity on Earth and explore the role and implications of human space exploration.

Chemical world

This strand involves the study of matter and the changes it undergoes. As students study this strand they will develop understandings of the composition and properties of matter, the changes it undergoes, and the energy involved. They learn to interpret their observations by considering the properties and behaviour of atoms, molecules, and ions. They learn to communicate their understandings using representations, and the symbols and conventions of chemistry. Our way of life depends on a wide range of materials produced from natural resources. In this strand students will learn about assessing the resources used to produce a material over its lifecycle (extraction, use, disposal and recycling). Using this, they are better able to understand science-related challenges, such as environmental sustainability and the development of new materials, and sources of energy.

Physical world

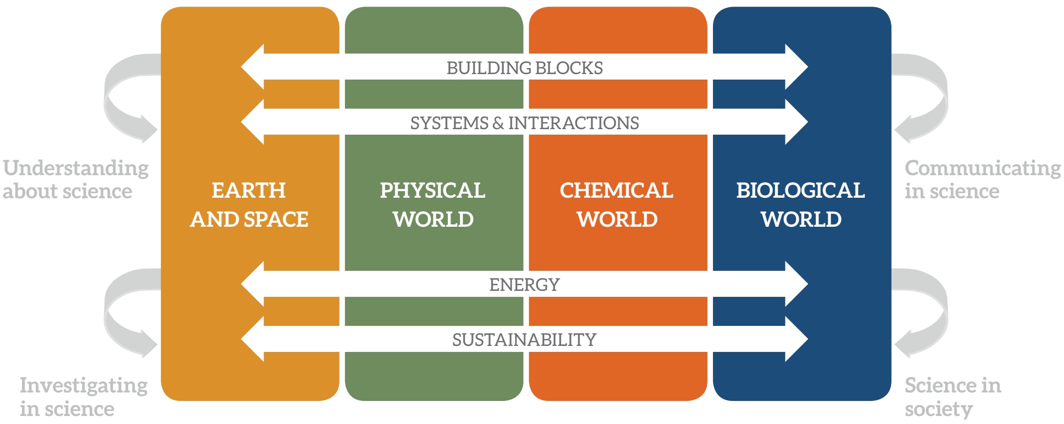
This involves the exploration of physical observables, often in relation to motion, energy, and electricity. Students gain an understanding of fundamental concepts such as length, time, mass and temperature through appropriate experiments. This allows them to develop simultaneously a sense of scaling and proportional reasoning, to recognise the need for common units, and to select and use appropriate measuring equipment. Exploring concepts such as area, density, current, and energy helps students develop the ability to identify and measure a range of physical observables, and through experimenting, to investigate patterns and relationships between them. Students also design and build simple electronic circuits. Students develop an understanding of the concept of energy and how it is transformed from one form to another without loss. They also research sustainability issues that arise from modern physics and technologies, and our generation and consumption of electricity.

Biological world

This strand leads students to an understanding of living things and how they interact with each other and the environment. In this strand students are introduced to the cell as the basic unit of life, and how characteristics are inherited from one generation to the next. Students develop an understanding of the diversity of life, life processes and how life has evolved. Students will explore body systems and how they interact, and learn about human health. They will investigate living things and their interdependence and interactions with ecosystems. They will learn about issues of social importance, such as the impact of humans on the natural world.

While the learning outcomes associated with each strand are set out separately here, this should not be taken to imply that the strands are to be studied in isolation. To give further emphasis to the integrated nature of learning science, the outcomes for each of the contextual strands are grouped by reference to four elements: Building blocks, Systems and interactions, Energy, and Sustainability (Figure 3).

Figure 3: The elements of the contextual strands and the unify strand, showing the integrated nature of the specification



Within each strand, content areas and skills have been selected that all students should engage with while maintaining a balance between depth and breadth.

Table 4: The elements of the contextual strands

Elements	
Building blocks	Focuses on the essential scientific ideas that underpin each strand.
Systems and interactions	Examines how a collection of living and/or non-living things and processes interact to perform some function/s: there is a focus on the input, outputs, and relationships among system components.
Energy	A unifying concept that students can develop across the strands: it is an obvious integrating element as all phenomena we observe on earth and in space involve the transformation and variation of energy.
Sustainability	Focuses on the concept of meeting the needs of the present without compromising the ability of future generations to meet their needs.

Teaching and learning

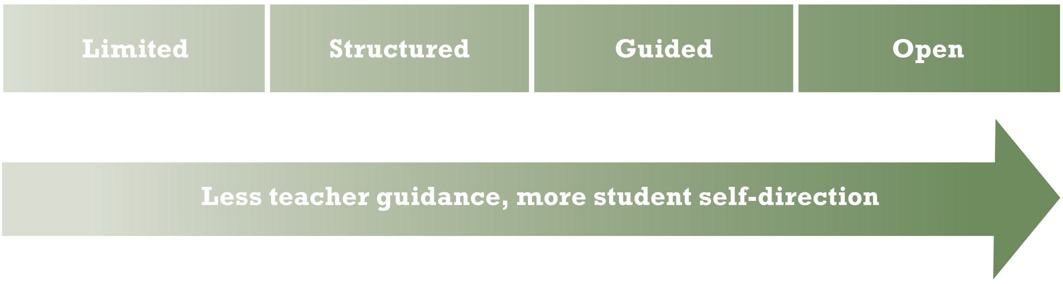
This specification allows teachers to employ a variety of teaching strategies depending on the targeted learning outcomes, the needs of their students, and their personal preferences.

The importance of the processes of science as well as knowledge and understanding of concepts are reflected throughout the learning outcomes, which describe the understanding, skills and values that students should be able to demonstrate at the end of junior cycle. It is envisaged that opportunities for student-led inquiry, with appropriate levels of scaffolding, will be provided within each year. In this way students may pursue the outcomes of the Nature of science strand through the content and skills identified in the contextual strands. It is recognised that the skills, knowledge and understanding of the scientific concepts as set out in the learning outcomes take time to develop and often need to be carefully revisited and reinforced. Any one activity would seldom require students to develop the full range of skills.

SCIENTIFIC INQUIRY

The inquiry-based design emphasises the practical experience of science for each student. It supports the use of a wide range of teaching, learning, and assessment approaches that support different levels of inquiry. Most students will need frequent practice to develop their understanding of scientific processes to use evidence to support explanations and to develop their inquiry skills to a point where they can conduct their own investigations from start to finish. Providing opportunities for students to develop a range of inquiry skills will be necessary to progress along the continuum of inquiry. The levels on the continuum are often categorised as limited inquiry, structured inquiry, guided inquiry and open inquiry.

Figure 4: Continuum of inquiry



The first two levels are lower-level inquiries but they can be used to develop students' inquiry skills so that they can engage in scientific inquiry which has less teacher guidance and more student self-direction. Students often engage with these two levels of inquiry before more open forms of inquiry are used; however, this practice merely reflects a common order of adopting inquiry approaches, and extending the range of approaches available to teaching classes; it does not suggest a progression or improvement along the way. Opportunities to apply inquiry skills in increasingly complex learning situations can be included when students have developed confidence and capacity in inquiry processes.

CONTEMPORARY ISSUES IN SCIENCE

Increasingly, arguments between scientists are discourses that extend into the public domain. This specification enables teachers to provide opportunities for students to investigate contemporary scientific issues, supporting students to make connections between science, other subjects and everyday experiences. Students will engage with contemporary issues in science that affect everyday life. They will learn, interpret and analyse data—a skill that has a value far beyond science wherever data are used as evidence to support argument. In presenting evidence and findings, they will engage in objectively justifying and discussing conclusions.

Science also develops by people pursuing their individual interests and this specification affords a reasonable degree of flexibility for teachers and students to make their own choices and pursue their interests. For example, aspects from the different contextual strands may be woven together and large pieces of the specification may be organised around themes or 'big ideas' that focus on areas of personal, local, national, and/or global interest. This specification offers many possible routes for an integrated science approach; the most obvious are provided by the crosscutting elements, Energy and Sustainability.

INQUIRY AND ASSESSMENT

As well as varied teaching approaches, varied assessment approaches can be designed to support learning and provide information that can be used as feedback, so that teaching and learning activities can be modified to meet individual needs. Through engaging tasks, asking higher-order questions, and giving feedback that promotes student autonomy, assessment can support learning as well as summarising achievement.

Expectations for Students

'Expectations for students' is an umbrella term that links learning outcomes with annotated examples of student work in the subject or short course specification. When teachers, students or parents looking at the online specification scroll through the learning outcomes, a link will sometimes be available to examples of work associated with a specific learning outcome or with a group of learning outcomes. The examples of student work will have been selected to illustrate expectations and will have been annotated by teachers. The examples will include work that is:

- in line with expectations
- above expectations
- exceptional

The purpose of the examples of student work is to show the extent to which the learning outcomes are being realised in actual cases.

Learning outcomes

Learning outcomes are statements that describe the understanding, skills and values students should be able to demonstrate after a period of learning. Junior cycle science is offered at a common level. The examples of student work linked to learning outcomes will offer commentary and insights that support differentiation. The learning outcomes set out in the following tables apply to all students. As set out here they represent outcomes for students at the end of their three years of study. The specification stresses that the learning outcomes are for three years and therefore the learning outcomes focused on at a point in time will not have been 'completed' but will continue to support the students' learning of science up to the end of junior cycle.

To support the exploration of the learning outcomes by teachers, parents, and students a glossary of the action verbs used in the specification is included. The outcomes are numbered within each strand. The numbering is intended to support teacher planning in the first instance and does not imply any hierarchy of importance across the outcomes themselves; it also does not suggest an order to which the learning outcomes should be developed in class.

Strand one: The nature of science

ELEMENT: Understanding about science

Students should be able to:

1. appreciate how scientists work and how scientific ideas are modified over time.

ELEMENT: Investigating in science

Students should be able to:

2. recognise questions that are appropriate for scientific investigation, pose testable hypotheses, and evaluate and compare strategies for investigating hypotheses

3. design, plan and conduct investigations; explain how reliability, accuracy, precision, fairness, safety, ethics, and the selection of suitable equipment have been considered

4. produce and select data (qualitatively/quantitatively), critically analyse data to identify patterns and relationships, identify anomalous observations, draw and justify conclusions

5. 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.

ELEMENT: Communicating in science

Students should be able to:

6. 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

7. organise and communicate their research and investigative findings in a variety of ways fit for purpose and audience, using relevant scientific terminology and representations

8. evaluate media-based arguments concerning science and technology.

ELEMENT: Science in society

Students should be able to:

9. research and present information on the contribution that scientists make to scientific discovery and invention, and its impact on society

10. appreciate the role of science in society; and its personal, social and global importance; and how society influences scientific research.

Strand two: Earth and space

ELEMENT: Building blocks

Students should be able to:

1. describe the relationships between various celestial objects including moons, asteroids, comets, planets, stars, solar systems, galaxies and space
2. explore a scientific model to illustrate the origin of the universe
3. interpret data to compare the Earth with other planets and moons in the solar system, with respect to properties including mass, gravity, size, and composition.

ELEMENT: Systems and interactions

Students should be able to:

4. develop and use a model of Earth-Sun-Moon system to describe predictable phenomena observable on Earth, including seasons, lunar phases, and eclipses of the Sun and the Moon
5. describe the cycling of matter, including that of carbon and water, associating it with biological and atmospheric phenomena.

ELEMENT: Energy

Students should be able to:

6. research different energy sources; formulate and communicate an informed view of ways that current and future energy needs on Earth can be met.

ELEMENT: Sustainability

Students should be able to:

7. illustrate how earth processes and human factors influence Earth's climate, evaluate effects of climate change and initiatives that attempt to address those effects
8. examine some of the current hazards and benefits of space exploration and discuss the future role and implications of space exploration in society.

Strand three: Chemical world

ELEMENT: Building blocks

Students should be able to:

1. investigate whether mass is unchanged when chemical and physical changes take place
2. develop and use models to describe the atomic nature of matter; demonstrate how they provide a simple way to account for the conservation of mass, changes of state, physical change, chemical change, mixtures, and their separation
3. describe and model the structure of the atom in terms of the nucleus, protons, neutrons and electrons; comparing mass and charge of protons neutrons and electrons
4. classify substances as elements, compounds, mixtures, metals, non-metals, solids, liquids, gases and solutions.

ELEMENT: Systems and interactions

Students should be able to:

5. use the Periodic Table to predict the ratio of atoms in compounds of two elements
6. investigate the properties of different materials including solubilities, conductivity, melting points and boiling points
7. investigate the effect of a number of variables on the rate of chemical reactions including the production of common gases and biochemical reactions
8. investigate reactions between acids and bases; use indicators and the pH scale.

ELEMENT: Energy

Students should be able to:

9. consider chemical reactions in terms of energy, using the terms exothermic, endothermic and activation energy, and use simple energy profile diagrams to illustrate energy changes.

ELEMENT: Sustainability

Students should be able to:

10. evaluate how humans contribute to sustainability through the extraction, use, disposal, and recycling of materials.

Strand four: Physical world

ELEMENT: Building blocks

Students should be able to:

1. select and use appropriate measuring instruments
2. identify and measure/calculate length, mass, time, temperature, area, volume, density, speed, acceleration, force, potential difference, current, resistance, electrical power.

ELEMENT: Systems and interactions

Students should be able to:

3. investigate patterns and relationships between physical observables
4. research and discuss a technological application of physics in terms of scientific, societal and environmental impact
5. design and build simple electronic circuits.

ELEMENT: Energy

Students should be able to:

6. explain energy conservation and analyse processes in terms of energy changes and dissipation
7. design, build, and test a device that transforms energy from one form to another in order to perform a function; describe the energy changes and ways of improving efficiency.

ELEMENT: Sustainability

Students should be able to:

8. research and discuss the ethical and sustainability issues that arise from our generation and consumption of electricity.

Strand five: Biological world

ELEMENT: Building blocks

Students should be able to:

1. investigate the structures of animal and plant cells and relate them to their functions
2. describe asexual and sexual reproduction; explore patterns in the inheritance and variation of genetically controlled characteristics
3. outline evolution by natural selection and how it explains the diversity of living things.

ELEMENT: Systems and interactions

Students should be able to:

4. describe the structure, function, and interactions of the organs of the human digestive, circulatory, and respiratory systems
5. conduct a habitat study; research and investigate the adaptation, competition and interdependence of organisms within specific habitats and communities
6. evaluate how human health is affected by: inherited factors and environmental factors including nutrition; lifestyle choices; examine the role of micro-organisms in human health.

ELEMENT: Energy

Students should be able to:

7. describe respiration and photosynthesis as both chemical and biological processes; investigate factors that affect respiration and photosynthesis
8. explain how matter and energy flow through ecosystems.

ELEMENT: Sustainability

Students should be able to:

9. explain human sexual reproduction; discuss medical, ethical, and societal issues
10. evaluate how humans can successfully conserve ecological biodiversity and contribute to global food production; appreciate the benefits that people obtain from ecosystems.

Assessment & Reporting

Assessment in education involves gathering, interpreting and using information about the processes and outcomes of learning. It takes different forms and can be used in a variety of ways, such as to record and report achievement, to determine appropriate routes for learners to take through a differentiated curriculum, or to identify specific areas of difficulty or strength for a given learner. While different techniques may be employed for formative, diagnostic and summative purposes, the focus of the assessment and reporting is on the improvement of student learning. To do this it must fully reflect the aim of the curriculum.

The junior cycle places a strong emphasis on assessment as part of the learning process. This approach requires a more varied approach to assessment in ensuring that the assessment method or methods chosen are fit for purpose, timely and relevant to the students. Assessment in junior cycle science will optimise the opportunity for students to become reflective and active participants in their learning and for teachers to support this. This rests upon the provision for learners of opportunities to negotiate success criteria against which the quality of their work can be judged by peer, self, and teacher assessment; and upon the quality of the focused feedback they get in support of their learning.

Providing focused feedback on their learning to students is a critical component of high-quality assessment and a key factor in building students' capacity to manage their own learning and their motivation to stick with a complex task or problem. Assessment is most effective when it moves beyond marks and grades and reporting focuses not just on how the student has done in the past but on the next steps for further learning. This approach will ensure that assessment takes place as close as possible to the point of learning. Final assessment still has a role to play, but is only one element of a broader approach to assessment.

Essentially, the purpose of assessment and reporting at this stage of education is to support learning. Parents/guardians should be given a comprehensive picture of student learning. Linking classroom assessment and other assessment with a new system of reporting that culminates in the awarding of the Junior Cycle Profile of Achievement (JCPA) will offer parents/guardians a clear and broad picture of their child's learning journey over the three years of junior cycle. To support, this teachers and schools will have access to an Assessment Toolkit. Along with the guide to the Subject Learning and Assessment Review (SLAR) process, the Assessment Toolkit will include learning, teaching and assessment support material, including:

- formative assessment
- planning for and designing assessment
- ongoing assessments for classroom use
- judging student work – looking at expectations for students and features of quality
- reporting to parents and students
- thinking about assessment: ideas, research and reflections
- a glossary.

The contents of the Assessment Toolkit will include a range of assessment supports, advice and guidelines that will enable schools and teachers to engage with the new assessment system and reporting arrangements in an informed way, with confidence and clarity.

Assessment for the JCPA

RATIONALE FOR THE CLASSROOM-BASED ASSESSMENTS IN SCIENCE

Over the three years of junior cycle, students will have many opportunities to enjoy and learn science. They will work like a scientist as they formulate scientific questions and hypotheses, initiate research, plan and conduct investigations, process and analyse data and information, evaluate evidence to draw valid conclusions, and report and reflect on the process. Students will collaborate as they prepare scientific communications for a variety of purposes and audiences. They will learn about, and make informed decisions about, their own health and wellbeing, and about science-related issues of social and global importance. Through these activities they will develop their science knowledge, understanding, skills, and values, thereby achieving the learning outcomes across the strands.

The Classroom-Based Assessments, outlined in Table 5 below, link to important aspects of that development and relate to priorities for learning and teaching such as **investigating**, and **communicating** in science, while at the same time developing their **knowledge** and **understanding** of science, which are vital to working like a scientist. Students need to develop a sense of what is appropriate for scientific investigation and research, plan and conduct investigations and research topics, process and analyse data and information, draw evidence-based conclusions, evaluate the process, and prepare scientific communications. The Classroom-Based Assessments offer students the chance to demonstrate their achievements as creators of scientific research reports by selecting a topic or problem to investigate.

Table 5: Classroom-Based Assessments in science

CBA	Format	Student preparation	Completion of the assessment	SLAR[1] Meeting
Extended experimental investigation (EEI)	Reports which may be presented in a wide range of formats.	Students will, over a three-week period; formulate a scientific hypothesis, plan and conduct an experimental investigation to test their hypotheses, generate and analyse primary data, and reflect on the process, with support/ guidance by the teacher.	End of second year.	One review meeting.
Science in society investigation (SSI)	Reports which may be presented in a wide range of formats.	Student will, over a three-week period: research a socio-scientific issue, analyse the information/ secondary data collected, and evaluate the claims and opinions studied and draw evidence-based conclusions about the issues involved, with support/guidance by the teacher.	End of first term or early in the second term in third year.	One review meeting.

1 **S**ubject **L**earning and **A**ssessment **R**eview

The presentation formats for each of the above Classroom-Based Assessments can include the following (this is not an exhaustive list):

- a hand-written/ typed report
- model building
- multimodal presentation
- podcasts
- webpage.

Students should receive a copy of the features of quality as early as possible, so that they are aware of what they need to do to generate work of the highest possible standard. It is also acceptable, and in some respects encouraged, that the evidence of learning presented for the Classroom-Based Assessment could be used as part of a student's entry to a local or national science fair.

ASSESSING THE CLASSROOM-BASED ASSESSMENTS

More detailed material on assessment for reporting in junior cycle science, setting out details of the practical arrangements related to assessment of the Classroom-Based Assessments, will be available in a separate *Assessment Guidelines* document. This will include, for example, the suggested length and formats for student pieces of work, support in using 'on-balance' judgement in relation to the features of quality. The NCCA's Assessment Toolkit will also include substantial resource material for use and reference in ongoing classroom assessment of junior cycle science, as well as providing a detailed account of the Subject Learning and Assessment Review process.

THE ASSESSMENT TASK

The Assessment Task is a written task completed by students during class time, which is not marked by the class teacher, but is sent to the State Examinations Commission for marking. It will be allocated 10% of the marks used to determine the grade awarded by the SEC. The Assessment Task is specified by the NCCA and is related to the learning outcomes on which the second Classroom-Based Assessment is based. The content and format of the Assessment Task may vary from year to year.

INCLUSIVE ASSESSMENT PRACTICES

Where a school judges that a student has a specific physical or learning difficulty, reasonable accommodations may be put in place to remove as far as possible the impact of the disability on the student's performance in Classroom-Based Assessments. The accommodations (e.g. the support provided by a Special Needs Assistant or the support of assistive technologies) should be line with the arrangements the school has put in place to support the student's learning throughout the year.

THE FINAL ASSESSMENT

There will be one examination paper at a common level, set by the State Examinations Commission (SEC). The examination will be two hours in duration and will take place at the end of third year. During this assessment students will be required to engage with, demonstrate comprehension of, and provide written responses to stimulus material. The content and format of the final examination may vary from year to year. In any year, the learning outcomes to be assessed will constitute a sample of the outcomes from the tables of learning outcomes.

Glossary of Action Verbs

Action verb	Students should be able to
Analyse	study or examine something in detail, break down something in order to bring out the essential elements or structure; identify parts and relationships, and 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 similarities and/or differences between two (or more) items or situations, referring to both/all of them throughout
Conduct	to perform an activity
Consider	describe patterns in data; use knowledge and understanding to interpret patterns; make predictions and check reliability
Demonstrate	prove or make clear by reasoning or evidence, illustrating with examples or practical application
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
Design	to conceive, create and execute according to plan
Develop	to evolve; to make apparent or expand in detail
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

Action verb	Students should be able to
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 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 ideas, solutions or methods
Examine	consider an argument or concept in a way that uncovers the assumptions and relationships of the issue
Explain	give a detailed account including reasons or causes
Explore	observe or study in order to establish facts
Formulate	express the relevant concept(s) or argument(s) precisely and systematically
Identify	recognise patterns, facts, or details; provide an answer from a number of possibilities; recognise and state briefly a distinguishing fact or feature
Illustrate	use examples to describe something
Interpret	use knowledge and understanding to recognise trends and draw conclusions from given information
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
Model	generate a mathematical representation (e.g., number, graph, equation, geometric figure); diagrams; physical replicas for real world or mathematical objects; properties; actions or relationships
Organise	to arrange; to systematise or methodise
Outline	to make a summary of the significant features of a subject
Plan	to devise or project a method or a course of action

Action verb	Students should be able to
Produce	to bring into existence by intellectual or creative ability
Research	to inquire specifically, using involved and critical investigation
Review	to re-examine deliberately or critically, usually with a view to approval or dissent; to analyse results for the purpose of giving an opinion
Recognise	identify facts, characteristics or concepts that are critical (relevant/ appropriate) to the understanding of a situation, event, process or phenomenon
Reflect	to consider in order to correct or improve
Use	apply knowledge or rules to put theory into practice
Verify	give evidence to support the truth of a statement

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

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DEPARTMENT OF EDUCATION AND SKILLS