An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

Resource Booklet

Science

Day 1

Ionad Oideachais Mhúinteachán

AN ROINN OIDEACHAIS AGUS SCILEANNA | DEPARTMENT OF EDUCATION AND SKILLS

www.jct.ie

Science in the Framework

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.

Science…

….. is a subject within the Junior Cycle. The development of the Science 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. The subject Science has direct links with 8 of the 24 Statements of Learning

Contact Information

Lots of information and resources available on our website: www.jct.ie

For any queries, please contact us on one of the following:

Email: info@jct.ie

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Follow us on Twitter @JCforTeachers

Science specification available on www.curriculumonline.ie

24 Statements of Learning

The student:	✓
1. communicates effectively using a variety of means in a range of contexts in L1*	
2. listens, speaks, reads and writes in L2* and one other language at a level of proficiency that is appropriate to her or his ability	
3. creates, appreciates and critically interprets a wide range of texts	
4. creates and presents artistic works and appreciates the process and skills involved	
5. has an awareness of personal values and an understanding of the process of moral decision making	
6. appreciates and respects how diverse values, beliefs and traditions have contributed to the communities and culture in which she/he lives	
7. values what it means to be an active citizen, with rights and responsibilities in local and wider contexts	
8. values local, national and international heritage, understands the importance of the relationship between past and current events and the forces that drive change	
9. understands the origins and impacts of social, economic, and environmental aspects of the world around her/him	
10. has the awareness, knowledge, skills, values and motivation to live sustainably	
11. takes action to safeguard and promote her/his wellbeing and that of others	
12. is a confident and competent participant in physical activity and is motivated to be physically active	
13. understands the importance of food and diet in making healthy lifestyle choices	
14. makes informed financial decisions and develops good consumer skills	
15. recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning	
16. describes, illustrates, interprets, predicts and explains patterns and relationships	
17. devises and evaluates strategies for investigating and solving problems using mathematical knowledge, reasoning and skills	
18. observes and evaluates empirical events and processes and draws valid deductions and conclusions	
19. values the role and contribution of science and technology to society, and their personal, social and global importance	
20. uses appropriate technologies in meeting a design challenge	
21. applies practical skills as she/he develop models and products using a variety of materials and technologies	
22. takes initiative, is innovative and develops entrepreneurial skills	
23. brings an idea from conception to realisation	
24. uses technology and digital media tools to learn, communicate, work and think collaboratively and creatively in a responsible and ethical manner	

*L1 is the language medium of the school (Irish in Irish-medium schools). L2 is the second language (English in Irish-medium schools).

Learning Log

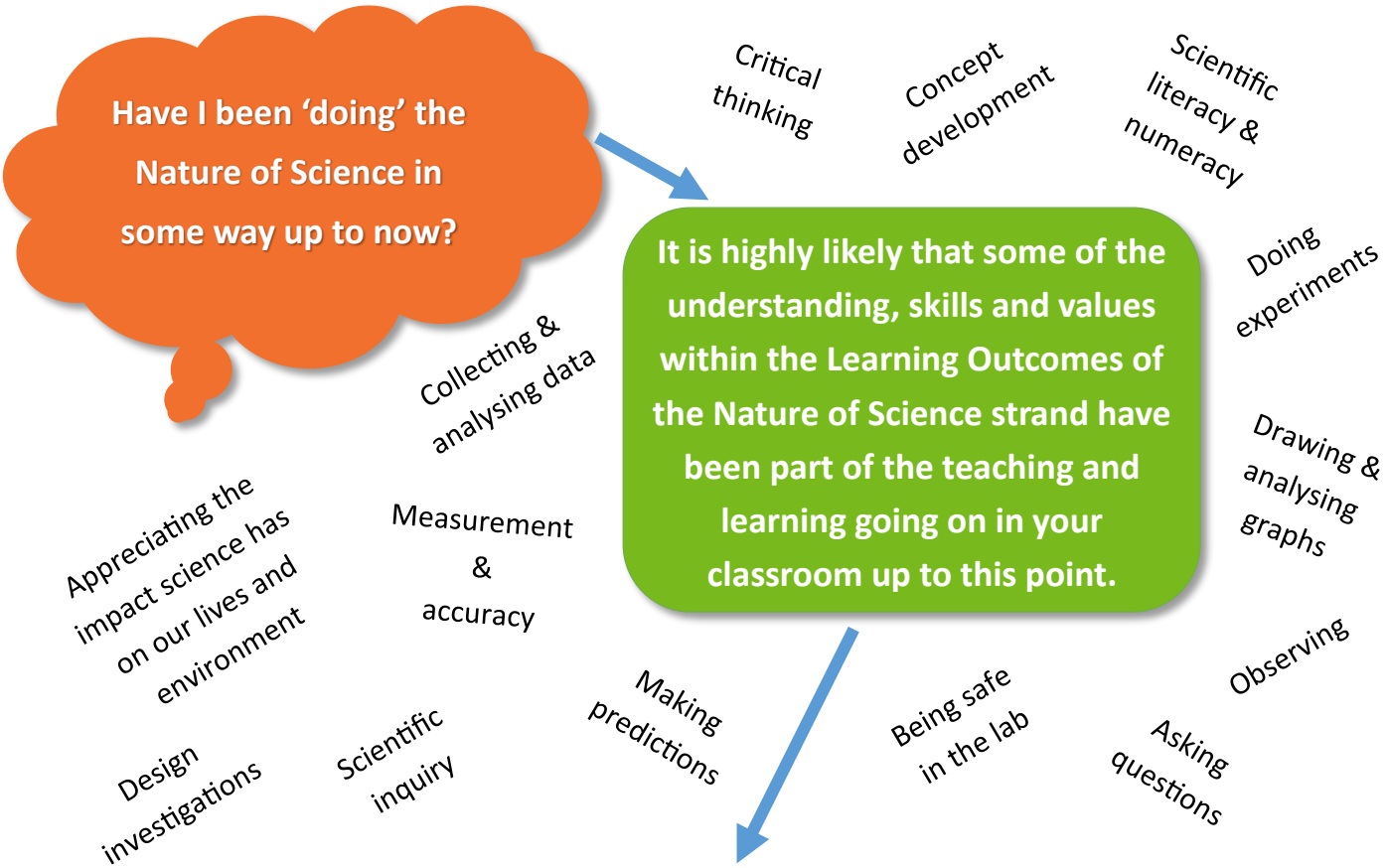
Session 1

Session 2

Session 3

Plan of Action

The Nature of Science in Your Classroom



BUT – Remember – The Nature of Science is not something that 'just happens'….it must be planned for in teaching, learning and assessment.

The Learning Outcomes of the Nature of Science strand are realised through the content and activities in the contextual strands.

Nature of Science should be a part of EVERY LESSON that you teach, rather than something that is done separate to the learning in the contextual strands

In other words –
Nature of Science
IS NOT
all of it some of the time…..
IT IS
some of it, ALL OF THE TIME

Thoughts on Inquiry Based Learning

You decide….

How comfortable am I with this group?

How inquiry ready are they?

What are my Learning Intentions?

Inquiry must be "minds on", not just "hands on"

Can you drive the learning forward through questioning?

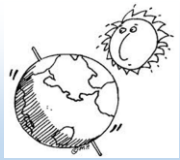
Who decides the question to be researched or investigated?

Remember that Inquiry does not have to mean practical work

The level of teacher or student direction

How can you encourage student – student dialogue?

Is there an opportunity for students to communicate and justify findings?



Earth and Space

The reason for the seasons

Examples of common misconceptions:

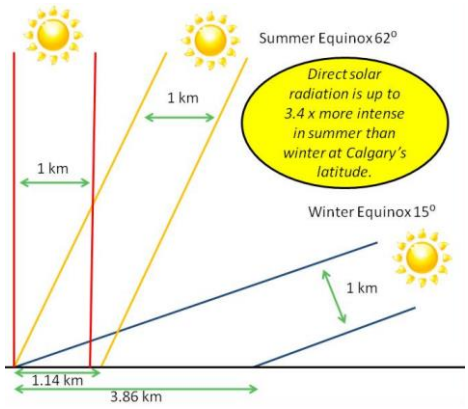
1. That we get summer because the Earth moves in an elliptical orbit that places the hemispheres closer to the sun during their summers.

2. As the tilt of the Earth on its axis places the Northern Hemisphere closer to the sun than the Southern Hemisphere during June/July, and the Southern Hemisphere is closer to the sun than the Northern Hemisphere in January/February, it is the distance of the Northern or Southern Hemisphere from the sun which is the cause of the seasons.

Other misconceptions you may have identified:

What proof do we have that distance from the sun is not the cause of the seasons?

1. There are no seasons at the equator.
2. The Northern Hemisphere has its summer when the Earth is furthest away from the sun.



What causes the seasons?

1. The tilt of the earth results in the sun's energy being spread over a larger area in winter.
2. The tilt means that daytime is shorter in winter.

That's less energy for a shorter time!

Possible extension activities to explain the reasons for the seasons:

- Studying shadows at different times of day.
- Comparing length of shadows to those recorded at different latitudes.

Other activities you might think of:

JCT Science and Formative Assessment

Changes in assessment practice are an integral part of Junior Cycle reform. A number of formative assessment practices were modelled throughout CPD Day 1. These will be elaborated upon in subsequent CPD for Science. The JCT are providing Whole School CPD in schools to include formative assessment. We will include some engagement with formative assessment in Science on CPD Day 2 to dovetail with the Whole School CPD. Support in Science will continue, as part of the process of Junior Cycle reform, for a number of years. There is much to consider and so we provide here a brief reference in advance of Science CPD Day 2 and in support of Whole School CPD.

Many of us are familiar with some basic ideas about formative assessment and may have put them into practice in our classrooms. Extensive research has shown a greater impact on student learning when teachers have a clear understanding of 5 key principles which underlie formative assessment practices. These 5 principles are set out below:

<table>
<tr><th></th><th>Where the learner is going</th><th>Where the learner is</th><th>How to get there</th></tr>
<tr><td>Teacher</td><td rowspan="3">Clarifying, sharing and understanding learning intentions</td><td>Engineering effective discussions, tasks and activities that elicit evidence of learning</td><td>Providing feedback that moves learners forward</td></tr>
<tr><td>Peer</td><td colspan="2">Activating students as learning resources for one another</td></tr>
<tr><td>Learner</td><td colspan="2">Activating students as owners of their own learning</td></tr>
</table>

From these key principles can emerge many varied strategies and techniques. The page over describes in detail how some of the key principles can be brought to life in one example used throughout CPD Day 1: Think Pair Share.

For more information and links to educational research that may inform your thinking on formative assessment, look in the 'Assessment' section of the Science pages on www.jct.ie. This section will be constantly updated with engaging and accessible resources that will support you in engaging with research-informed practice in Junior Cycle.

Think Pair Share Explained

Imagine you are a student and the teacher has just asked the class the question "What factors might affect the rate of photosynthesis?" Immediately students around the room shoot up their hands and offer answers. You are still searching your memory banks to translate the words "factors" and "photosynthesis". You've finally got the meaning, now you are thinking about the possible answers. You think you have a viable answer, but you're not sure if it's right or exactly how to say it, and if you make a mistake others might laugh at you. By the time you have settled on an answer the teacher has already moved on and asked two new questions…….

How does 'think pair share' utilise formative assessment principles?

1. It presents an opportunity to gather evidence of learning and understanding

2. It provides opportunities to give feedback to drive learning forward

THINK

3. Learners begin by taking ownership of their own ideas and knowledge

Think/wait time allows students time to reflect on a question silently, giving them time to process the question, the language of the question, or to simply think of the language needed to convey the answer. Asking students to write down this answer provides evidence of their thinking and this often encourages students to reconsider their initial thoughts.

PAIR

4. It facilitates productive classroom discussion

Allowing students the opportunity to discuss their ideas with their partner, increases their understanding as they attempt to agree a final answer.

Children, need to talk, in order to think and to learn. (Alexander, R. 2006)

SHARE

5. Learners are activated as instructional resources for each other

Many students are more comfortable verbalising a "team" answer to the class than they are expressing their own personal idea. It helps to develop students' confidence in speaking aloud in class and helps to develop communication skills

Action Verbs as Defined in the Specification

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
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, 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

Verb	Students should be able to …
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
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

(Adapted from the Specification for Junior Cycle Science, NCCA, Appendix 1)

Key Messages

In CPD Day 1 we explored…

- Science as a subject within the JC Framework
- Statements of Learning and Key Skills
- The rationale, aims and structure of the Science Specification
- The Nature of Science
- Inquiry through an Earth and Space Activity
- The different levels of inquiry
- Working with learning outcomes

Our hopes for you on return to school are that you may…

- Put the learner at the centre in the Science classroom
- Engage with the specification as a hands-on document which shapes teaching and learning in your classrooms
- Think about how you emphasise the Nature of Science in your teaching & learning
- Understand the importance of collaboration going forward for effective curriculum planning

Starting Collaborative Planning

Learning Outcome

Learning Unpacked

(Understanding, skills and values)

Possible Assessment Ideas

Links to Nature of Science