Scenario Title: Asteroids, impacts and craters (NCCA, Ireland)

Scenario Overview:

In this scenario, students collaborate using the context of an asteroid impacting on a planet. The main learning focus is on measurement, concepts of evidence, and the role of science and scientists on humanity.
As an introduction, students decide on a science in society issue, in the context of space, that they would like to investigate and report on. Their report must contribute to one of the following:

- appreciation of how scientists work and how scientific ideas are modified over time;
- appreciation of the role of science in society; and its personal, social and global importance;
- appreciation of how society influences scientific research.

Each group must decide the issues question that they will address and report on. They provide a brief abstract of what questions they hope to answer, they take comments and suggestions from the rest of the class and adapt their original question based on the class feedback. The collaborative must agree that the proposed presentation will enhance the appreciation of the whole group on one of the above topics.

Following the initial group session, learners are introduced to some stimulus material about impacts. They then plan an investigation relating to asteroids and impacts and are encouraged to investigate fundamental science topics through collaboration and inquiry. They develop their knowledge and understanding of nature, and of the laws of science, as well as how scientists work, and the impact of that work on humanity.

All students will produce a scientific communication as part of a group. Students present to their classmates, and undergo peer assessment.

Students apply fundamental concepts about the nature of science to the context of space to deepen their understanding of those concepts. They collaborate and use their science knowledge and understanding to solve problems in unrehearsed contexts. Students are guided to use their knowledge and understanding of: energy (conservation of energy); motion; mass; density; volume; and forces to simulate and explore the impact of an asteroid hitting a planet

All students are involved in a reflective exercise throughout the process.

Methods of assessment: self-assessment and peer-assessment

							
Learning Activities	Free thinking, sharing ideas	Looking for and finding content	Structuring thoughts	Developing or practising	Interviewing/ Feedback	Revising	Performing and presenting
Time (weeks)	1	2-3	1	4-5	1	2	1
Goal (learning outcomes, match to specification)	Appreciate how scientists work and how scientific ideas are modified over time. Appreciate the role of science in society; and its personal, social and global importance; and how society influences scientific research	Recognise questions that are appropriate for scientific investigation, pose testable hypotheses, and evaluate and compare strategies for investigating hypotheses. 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	Design, and plan investigations; explain how reliability, accuracy, precision, fairness, safety, ethics, and the selection of suitable equipment have been considered.	Carry out the plan, conduct the investigation. Investigate patterns and relationships between physical observables. Generate data (qualitatively/quantitatively). Identify anomalous observations and data; draw and justify conclusions; select and use appropriate measuring instruments.	Critically analyse data to identify patterns and relationships, evaluate media-based arguments concerning science and technology	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	organise and communicate their research and investigative findings in a variety of ways fit for purpose and audience, using relevant scientific terminology and representations.

							
Learning Activities	Free thinking, sharing ideas	Looking for and finding content	Structuring thoughts	Developing or practising	Interviewing/ Feedback	Revising	Performing and presenting
Description (of each learning activity)	Students choose to present on an issues questions in science.	Students are provided with a stimulus task relating to asteroids impacting on a planetary body. Students collaborate to research the issues surrounding the task. Emerging from their issue, they pose a problem statement that they would like to investigate experimentally	Students are provided with a range of materials. They must discuss amongst themselves what their problem statement is. They then devise a plan to complete the task, they select materials, and test to see they are fit for purpose.	Students colaborate to carry out the plan. They carry out investigations and record their data, observing any anomolies	Does the data support the initial hypothesis? Is their data reliable? What are the sources of error? How could those be minimised?	Following the execution of the initial plan, students argue the pros and cons of their methoods. They consider the materials, and review their plan. Changes are made and documented as to why they were made, and the proposed effect. They carry out their investigation based on their reviewed plan.	Students present their findings to the class. They include the including a theoretical framework, and a science in society theme.

							
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Learning Environment/s (the physical or virtual setting(s) in which learning takes place)	• Classroom • Science centers	• Classroom • Online simulation sites, libraries • Science Museum	• Classroom • Home • Online	• Classroom • Home • Virtual sharing spaces such as Skype, Lync • Mobile Phones • Video software • Data logging and video-tracking editing software;	• Science centers, Galleries • Home • Classroom • Online	• School • Home • Online	• At school as a public event, but can be online too;
Digital Technologies and Tools	• Mind Maps (for sharing brainstorming and thinking) • Virtual laboratories • Padlet and other collaborative online tools.	• Communication Tools to share ideas across the disciplines • Padlet • Graphical analysis software, video tracking software	• Mind mapping tools • Data logging, video, audio, devices • simulation software	• Skype • Audio recorders • Speakers • IMovie	• Audio Recorder • Video Recorder • Mobile Phone • Pen and paper	• Data logging software; video, audio; sensor technologies	• Presentation software, other equipment necessary for the production/presentation.

							
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Roles (teacher, students, parents, experts, etc.)	**Teacher:** Provides stimulus materials Guides the students to appropriate information. Sparks the imagination of the students Facilitates debate and discussion **Student:** Considers the contexts that could be chosen; Discuss and share with others;	**Teacher:** Provides opportunities for exploration of ideas. Monitors student interaction in groups; **Student:** Collaborate within subject specific domain; Researcher; Defends their ideas.	**Teacher:** Support students in negotiating; Offer advice. Provides a variety of everyday materials: sand flour ball bearings, etc. **Student:** Work on developing problem statements and hypotheses; develops a plan; Consider how the materials can be used to within their plan,	**Teacher:** Technical support as needed; Monitor progress of groups and keep students on agreed timeline; **Student:** Students follow their plan They collect their data Students stay in communication as they progress towards the end of the first investigation	**Teacher:** Provide information for various sources. Supports students on how to carry out research. Assists literature review **Student:** Researcher: Data Collector Managing the Information	**Teacher:** Advise Support Mentor Observe **Student:** Complete the final product; Prepare the location for the final presentation; Consider the time, place, invites and logistics for the culminating presentation	**Teacher:** Supporter Advocate Adviser Mentor **Student:** Expert on their work on display; Owner of the work

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Collaboration (team work) **Individual Work** (personalisation)	Decide the groups and the roles within the groups; students share their initial ideas; Theme for the collaborative work is chosen; Decide the format of the presentation	Share findings within their subject area in real time and virtually; Collaborate to ask questions and solve a problem;	students work together to agree concepts; collaborate to decide what tasks need to be done;	Each member of the team completes their tasks; The groups keep the overall plan in mind to ensure that they are sharing a common goal and staying on task;	Students collaborate to attend to collate feedback to support the work of the final phase; Students collate their findings and compile a report for the rest of the team.	Students collaborate to complete the design of the final product; They decide decide on the order they will be displayed in.	Collaboration on the day is needed to ensure that all the individual elements in presenting an exhibition come together; Share responsibility.
Reflection (reflecting upon one's learning and reporting activity status and progress)	Students consider their role and contribution to the brainstorm sessions; Students consider steps to take in future debate and discussion to become effective contributors;	Students reflect on their role and contribution to the group effort; Students consider the concepts of process and product generation	Students reflect on their role and contribution to the group endeavor; They consider if they are prepared to move to the next phase. Students should be keeping a record of their reflections in	Students reflect on their roles and responsibilities; Students reflect on areas of conflict and uncertainty that may have arisen at this phase; Students reflect on how best to	Students reflect on their engagement with the research and with the process of the investigation. They reflect on what scientific practices they have engaged in	Students reflect on what they would do differently if they were doing it again; what extra research would they do	Students reflect on the questions/issues that their presentation raised; have they aligned enough evidence to support their statements?

							
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			a portfolio or learning diary.	proceed to the final presentation;			
Assessment (type, instruments)	Teacher will offer feedback to group members based on observation; Students seek feedback from other peers.	Teacher will offer feedback on the problem statement, the planning and the engagement with scientific practices. Students will seek peer feedback on the same; Teacher will offer advice on what steps to take for the next phase; Students seek feedback from other sectors of the school community, such as other teachers,	Feedback will be offered through peer or teacher feedback on the ideas generated and suggestions offered for improving or amending the investigation design; students from different groups will offer each other feedback on the design based on agreed criteria.	Feedback will be provided on the initial plan this can come via teachers, peers or other experts available to the school; Feedback will allow students prepare for the next phase and will allow them consider what they may need to ask other experts in the next	Feedback is offered by peers or teachers on the process undertaken by the student; A peer review sheet is filled in.	Students will be assessed on the final presentation on all aspects of scientific practices, according to an agreed set of success criteria or features of quality; This feedback will be a combination of self, peer and teacher feedback; The feedback should incorporate the concept of process as well as the product.	Self-assessment as the reflection above and filled in through a reflection diary or blog or other mechanism; Peer assessment where other students can offer feedback to the presentation. Teacher assessment based on observation of the level of collaborative activity and the development in collaborative skills.

							
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		experts and parents.					

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Resources:

Asteroids Scenario Resource: Fact sheet
Asteroids Scenario Resource: Glossary of Terms
Asteroids Scenario Resource: Physics PowerPoint Presentation
Asteroids Scenario Resource: Peer Assessment Sheet
Padlet: https://padlet.com/
Graphical analysis software
Video tracking software
Data logging tools
Devices simulation software
Online blog