

Curriculum Learning Outcomes:

3rd and 4th class

Science

Living things: Plant and animal life

- Develop an increasing awareness of plants and animals from wider environments
- Sort and group living things into sets according to observable features
- Become aware of some of the basic life processes

Materials: Properties and characteristics of materials

- Describe and compare materials noting differences in colour, shape and texture
- Group materials according to their properties
- Examine the changes that take place in materials when physical forces are applied

Materials: Materials and change

- Explore some simple ways in which materials can be separated
- Investigate the characteristics of different materials when wet and dry

Energy and Forces: Light

- Learn that light is a form of energy
- Recognise that light comes from different natural and artificial sources
- Investigate that light can be broken up into many different colours
- Investigate the relationship between light and materials

Energy and Forces: Magnetism and electricity

- Learn that magnets can push or pull magnetic materials
- Examine and classify objects and materials as magnetic and non-magnetic
- Investigate that magnets attract certain materials through other materials

Environmental awareness: Science and the environment

- Identify the interrelationship of the living and non-living elements of local and other environments

Mathematics

Shape and Space: 2-D and 3-D shapes

- Use 2-D shapes and properties to solve problems
- Explore and describe the relationship of 3-D shapes with constituent 2-D shapes
- Construct 3-D shapes
- Solve and complete practical tasks and problems involving 2-D and 3-D shapes

Shape and Space: Symmetry

- Identify line symmetry in the environment
- Use understanding of line symmetry to complete missing half of a shape, picture or pattern.

Mathematics: Measures: Length

- Measure and record lengths using appropriate metric units

Data: Representing and interpreting data

- Collect, organise, and represent data using pictograms, block graphs and bar charts
- Use data sets to solve and complete practical tasks and problems

Geography

Natural environments: Rocks and soils

- Compare and contrast materials, focusing on certain criteria

- Begin to explore the influence of soils and rocks on animal and plant life

5th and 6th class

Science

Living things: Plant and animal life

- Recognise that there is a great diversity of plants and animals in different regions and environments
- Group and compare living things into sets according to their similarities and differences
- Become familiar with the characteristics of some major groups of living things
- Become aware of some of the basic life processes
- Observe and explore some ways in which plant and animal behaviour is influenced by, or adapted to, environmental conditions
- Identify the interrelationships and interdependence between plants and animals in local and other habitats plants and animals depend on, and compete

Materials: Properties and characteristics of materials

- Explore the origin of materials
- Group materials according to their properties and /or composition
- Recognise that some materials decay naturally while others survive a long time in the environment
- Investigate how a wide range of materials may be changed by mixing
- Examine the changes that take place in materials when physical forces are applied
- Understanding how the rocks tell us about the natural environment

Energy and Forces: Light

- Learn that light is a form of energy
- Know that light travels from a source
- Investigate the splitting and mixing of light

Energy and Forces: Magnetism and electricity

- Learn that magnet can push or pull magnetic materials
- Explore the use of magnets to lift and hold objects

Environmental awareness: Science and the environment

- Recognise the contribution of scientists to society

Mathematics

Shape and Space: 2-D and 3-D shapes

- Use 2-D shapes and properties to solve problems
- Identify and examine 3-D shapes and explore relationships, including tetrahedron (faces, edges and vertices)

Data: Representing and interpreting data

- Collect, organise, and represent data using pictograms, single and multiple bar charts, and simple pie charts

Geography

Natural environments: Rocks and soil

- Learn about the characteristics of some common rock types and where they may be found in Ireland and in other parts of the world

Learning Intentions:

- The students will understand that fossils are the remains of prehistoric animals and plants

- The students will be able to identify fossils
- The students will be aware that fossils can be found in Ireland
- The students will understand that there are clues left in the rock that can tell us about how these animals died
- Students will have learned some basic ways in which to work out how fossil creatures died
- The students will understand that objects can be grouped by material properties in addition to visible properties
- The students will be aware that material properties of objects can be used to solve problems
- The students will be aware that scientists can use special types of light to investigate the chemical composition of fossils
- The students will understand that there are clues left in the rock that can tell us about where these animals lived
- The students will understand that rocks can tell us about ancient environments
- The students will be aware that fossils can tell us about how life evolved over time

Skills development:

- Working scientifically
 - Questioning
 - Observing
 - Investigating and experimenting
 - Analysing – sorting and classifying
 - Recording and communicating

Assessment:

- Assessment of initial knowledge base will occur before the lesson via a questionnaire given to students by their teacher; the questionnaire will be developed by the UCC team and provided to the teacher.
- Learning of lesson content will be assessed via a Likert survey at the end of the lesson.

Evaluation of lesson

After the end of the lesson the facilitator will distribute a Likert survey to each student.

Primer

Resources:

- Laminated cards with animations of each stage of fossilisation
 - Death
 - Transport
 - Deposition
 - Burial
 - Uplift
- Laminated cards with well-known historical people/events
 - Queen Elizabeth 1600 AD
 - Normans 1100 AD
 - Vikings 800 AD

- St Patrick 500 AD
- Romans 27 BC
- Egyptians 3100 BC
- First humans in Ireland 33000 years ago
- String
- Pegs
- Measuring tape

Description of Activity:

Introduction

- This lesson will introduce the students to what fossils are, how they form, how old they are and where you can find them. The facilitator will emphasise that lots of different types of fossils can be found in Ireland.

Progression of lesson

Activity 1) Fossilisation processes

- Students will be sorted into groups of 4 or 5. Each group will be given a set of animated cards with one stage of fossilisation on each card. They group will be asked to arrange the cards in chronological order, from the first stage of fossilisation to the last.

Activity 2) Geological Timescale

- Each group will be given a long piece of string, some pegs and laminated cards with pictures of historical people and the dates they were alive.
- Each group will be asked to create a timeline by arranging the cards along the string in chronological order using a scale of 1 cm = 100 years.

Conclusion of lesson:

Facilitators will circulate a Likert survey to assess students understanding of the learning outcomes for this lesson.

Lesson 1: Fossil ID

Resources:

- Irish fossils (x1 of each)
 - Brachiopod
 - Solitary coral
 - Colonial coral
 - Conispiral gastropod
 - Planispiral gastropod
 - Crinoid
 - Trilobite
- Plastic 3D printed fossils (x7 of each)

- Brachiopod
 - Solitary coral
 - Colonial coral
 - Conispiral gastropod
 - Planispiral gastropod
 - Crinoid
 - Trilobite
- Hand puppets/soft toy representations of fossils
 - Brachiopod
 - Nautiloid
 - Trilobite
 - Tetrapod
 - Snail
 - Crinoid
- Laminated handout images of Irish fossils and schematic cross sections corresponding to those fossils (x7 of each)

Description of Activity:

Introduction

- The facilitator will introduce the concept of cross sections to students, using examples from common everyday items.

Progression of Lesson

Activity 1) Fossil cross sections:

- The facilitator will present cross sections of common everyday objects in the PowerPoint, introducing the concept of cross sections.
- Each group will then be presented with a series of handout images of fossils and a corresponding schematic cross-section of each fossil. The students will be asked to pair each fossil with each cross section.
- Each group will also be given a specimen of one fossil to investigate, the Irish origin of these fossils will be emphasized as they are distributed.
- Facilitators will circulate around the classroom to stimulate discussion.
- At the conclusion of this task each group will identify the cross section they paired with each fossil. The facilitator will encourage each group to hold up the picture of the fossil for each corresponding cross-section as the facilitator reveals the correct answers on the PowerPoint.

Activity 2) Mode of life:

- Next the whole class will be encouraged to consider the life environments of the Irish fossils they have encountered. Initially this will involve the facilitator using hand

puppets/soft toy representations of fossils to get students to think about the parts of the animal not preserved in the fossil.

- Using the PowerPoint presentation, the facilitator will show images of some interesting fossils and discuss how features of the animal's body can inform us of its mode of life/habitat. The facilitator will then distribute 3D plastic representations of the fossils to each group.
- Students will discuss the mode of life of each fossil in their groups. Facilitators will circulate around the classroom to stimulate discussion.
- At the end of this activity the students, as a class, will communicate what mode of life they think the fossil creatures had – if they swam in the sea, stuck to the seafloor, or slithered along the seabed.

Conclusion of lesson:

- Facilitators will circulate a Likert survey to assess students understanding of the learning outcomes for this lesson.

Lesson 2: Fossil Crime Scene

Resources:

- Crinoidal limestone slab
- Evidence boxes
 - Magnifying glass
 - Vial filled with dark mud
 - Vial filled with volcanic ash
 - Vial filled with broken shells
 - Fossil coprolites
 - Volcanic rocks
- A3 laminated photo of the limestone slab
- Large banner with animated reconstruction of Carboniferous tropical sea environment

Description of Activity:

Introduction to Lesson

- This lesson will cover how palaeontologists can use rocks to learn about the fossil environment and how fossil animals lived and died.
- The facilitator will explain that fossils can tell us about differences in environment of the past compared to the environment today. Specifically, the facilitator will mention that in the past Ireland used to be covered by a tropical sea and that because of this, different animals used to live here.

Progression of Lesson

Activity 1) Identify the victim:

- At the start of the activity the facilitator will tell students a story about how looking at fossils is like investigating a crime scene. They will describe how they act like the police

investigating the death of the fossil (the victim). The facilitator will explain that the first part of investigating is to identify the suspect.

- Students will be presented with a jigsaw of a silhouette of a fossil crinoid and asked to assemble it to identify the fossil victim.
- Once most groups have identified the silhouette as a crinoid the facilitator will reveal the colour illustration of the crinoid and circulate the fossil slab containing the crinoid. The facilitator will then explain what a crinoid is, what its anatomy is like and how they live and eat in the oceans. The facilitator informs the students that this crinoid was found on a beach in Ireland.

Activity 2) Who killed the crinoids:

- The facilitator will point out that now the victim has been identified we need to investigate the event (the criminal) that led to the death of the animal (the victim).
- Following this the facilitator will describe how scientists look for clues in the rock to learn things about fossils including how those fossils died. This discussion will be accompanied by a PowerPoint which the facilitator will use to demonstrate what clues they would expect to find under the following circumstances:
 - a) **The victim was eaten by a predator (fish):** The facilitator will show a picture of a fish and introduce the concept of coprolites (fossil poo) and how we can tell what an animal was eating from the contents in the coprolite. The facilitator will then explain that the contents of coprolites can be very small and may require the use of a magnifying glass to see. They will then point out that if the victim (crinoid) was killed by a fish we would expect to see parts of the crinoid (ossicles) in the gut and the coprolites of the fish.
 - b) **The victim was killed by a volcanic eruption:** Explain that when volcanoes explode, they produce volcanic ash and that this is harmful to animals. Explain that volcanic eruptions can leave clues in rocks such as ash and that these may need to be viewed using a magnifying glass. The facilitator will point out that if there is no evidence for a volcanic eruption then the crinoids were not killed by a volcano.
 - c) **The victim was killed because of a lack of oxygen:** The facilitator will remind the students that living things need oxygen – even animals living in water - and that they can die when oxygen levels are too low. They will also explain that rocks can leave clues as to whether there was or wasn't much oxygen present. The facilitator will show an image of a deep dark ocean and point out that not many creatures live here. The facilitator will also point out that in these environments only certain rocks are formed such as darkly coloured mudstone.
 - d) **The victim was killed by a storm:** The facilitator will explain that storms are very strong, have lots of energy, can cause a lot of damage and also kill animals. They will explain that like everything else we have discussed storms can also leave clues in the rock. The facilitator will then show a picture of a bioclastic limestone showing that evidence for storms such as broken up shells, and critically disarticulated crinoids, can also be found in rocks.
- Following this presentation, the facilitator will introduce "evidence boxes" to each group. The students will be encouraged to use magnifying glasses to explore the contents of the box. The box will include vials which will contain volcanic ash, dark mud, and broken shells. The evidence boxes will also contain fossil coprolites.

- During this activity each group will have a chance to view the real “fossil crime scene” – a slab of limestone containing fossil crinoids. They will also get an A3 photo of the crime scene to compare with their pieces of “evidence”.
- After assessing all the evidence students will be asked to explain their observations and identify which piece of evidence matched best with the crime scene and explain how the crinoid was killed.

Conclusion of lesson:

- Facilitators will circulate a Likert survey to assess students understanding of the learning outcomes for this lesson.

Lesson 3: Ping Pong Chemistry

Resources:

- Fossil fish with fluorescent scales
- Small tubs for water (500 ml)
- Boxes with ping pong balls
 - Ping pong balls filled with iron filings (x5)
 - Ping pong balls (regular) (x4)
 - Ping pong balls with UV coating (x2)
 - Play-doh balls (x3)
- Magnets
- Large plastic tub containing ping pong balls with elements written on the surface (x60)
- UV torches
- UV viewing box

Description of Activity:

Introduction to Lesson

- This lesson will cover how palaeontologists can study fossils using their chemical properties.
- The facilitator will explain how different parts of animals are made of different chemicals and how some parts of animals can fossilize differently. The facilitator will then explain how we can learn about fossil animals by looking at the chemicals they are made of.

Progression of Lesson

Activity 1) Material properties:

- Students will be presented with spheres of equal size but composed of different materials (ping pong ball filled with iron filings, ping pong ball with UV coating, playdoh, untreated ping pong ball) and a series of tools (magnet, a UV torch, and a small tub of water).
- The facilitator will ask the students to sort the objects by their “hidden” (material) properties (it does/doesn’t return to its original shape when compressed, it does or doesn’t fluoresce, it floats or sinks and it’s magnetic/not magnetic). Facilitators will

circulate around the classroom to stimulate discussion. At the conclusion of this activity the facilitator will summarize the different properties the students have identified.

Activity 2) Electromagnetic Spectrum:

- The facilitator will then use a PowerPoint to explain the concept of fluorescence and refer to the fluorescent ping pong ball from the previous activity. Using the terms visible and non-visible light the facilitator will introduce the concept of the electromagnetic (EM) spectrum and how UV light is one component of the EM spectrum. This will include showing examples of how (in addition to the light they may be familiar with, e.g. visible light) how other types of EM radiation are used in the everyday life of those students e.g. X-rays, ultraviolet light (UV), microwaves, radio waves etc.
- During this activity each group of students will also be encouraged to come and examine a fossil fish in a UV box that fluoresces when lit with UV.

Activity 3) Ping pong ball chemistry:

- The facilitator will then return to the PowerPoint to tell a simplified story about how they use other very powerful forms of energy such as X-rays to investigate what fossils are made of. Specifically, the order of events from (1) X-rays hitting a sample, (2) X-rays being detected and then (3) the X-ray signal being interpreted by the computer to provide chemical information. This story will be complemented by photographs of particle accelerators, fossils analysed using X-rays and X-ray maps of those fossils. The facilitator will reinforce the concept of the EM spectrum and highlight the position of X-rays on the EM spectrum in relation to other types of light such as UV and visible light.
- The facilitator will then present the whole class with a box filled with both untreated ping pong balls and ping pong balls filled with iron filings. Each ping pong ball has the name of a chemical (element) written onto its surface: light chemicals (Chlorine, Silicon) for the unaltered ping pong balls and heavy chemicals (Iron, Nickel, Copper, Zinc) for the ping pong balls filled with iron filings.
- The facilitator will explain to the students that the box represents the fossil, the ping pong balls are chemicals the fossil is made of and that they the students will be playing the roles of the X-ray, the detector, and the computer.
- The facilitator will then assign the roles among the students in each group and explain what each role is expected to do: "X-rays" have 10 seconds to collect the heavy chemicals from the box, "detectors" have to sort them, and "computers" have to count how many of each chemical the X-rays have collected.
- The facilitator will then take the results from each group and plot it Excel to determine the most common elements in the "fossil" collected by all groups. They will reinforce the concept of using X-rays to work out what chemicals fossils are made of.

Conclusion of lesson:

- Facilitators will circulate a Likert survey to assess students understanding of the learning outcomes for this lesson.