**ROCKS AND GEOLOGICAL TIME PERIODS**

**Acknowledgement**

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***Year 8 Earth & space sciences lesson sequence***

Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales [(ACSSU153)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSSU153)

Elaborations

* representing the stages in the formation of igneous, metamorphic and sedimentary rocks, including indications of timescales involved
* identifying a range of common rock types using a key based on observable physical and chemical properties
* recognising that rocks are a collection of different minerals
* considering the role of forces and energy in the formation of different types of rocks and minerals
* recognising that some rocks and minerals, such as ores, provide valuable resources

**Rationale:** We aim for students to gain a better understanding of how our knowledge of Earth sciences, particularly palaeontology is continually evolving. It is a growing field that allows us to make links between Earth in its current day, and its conception. Understanding how rocks form and their dynamic processes, gives an insight into the circumstances in which fossils are found. With this, understanding characteristics of geological time periods, can provide further understanding into the discovery of fossils and the significance of their discovery. Questions about evolution can be better understood and give rise to the opportunity to delve into contemporary science. By identifying types and processes of fossilisation in ostracods, students can understand that there is more to palaeontology than just dinosaurs. Seeing how current research is influencing scientific understanding can provide students with a deeper understanding and appreciation for scientific method and the world around us.

| **Lesson** | **Curriculum Reference points** | **Learning Intentions** | **Teaching Tasks & Methodology** | **Assessment for and of learning.** |
| --- | --- | --- | --- | --- |
| **Introduction to lesson sequence sedimentary, Igneous & Metamorphic rocks**  **Rock Cycle** | - Scientific knowledge has changed people's’ understanding of the world and is refined as new [evidence](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evidence) becomes available [(ACSHE119)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE119)  - Construct and use a range of representations, including graphs, keys and models to represent and [analyse](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=analyse) patterns or relationships in [data](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=data) using [digital technologies](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=digital+technologies) as appropriate [(ACSIS144)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS144) | * Be able to describe the formation and characteristics of metamorphic, igneous and sedimentary rocks * Identify and describe the steps in the rock cycle * Construct a model of the rock cycle. * Understand where fossils are found within rock timelines | **Introduction: (3min)** Start by outlining the topics to be covered in the next few lessons with the use of a timeline. These include  ·       Fossils  ·       Rock Types  ·       Rock Cycle  ·       Timelines  As a class create a concept map for where students think these concepts may be linked together, and what other information they can think of.  [Watch Video from Tamara Camilleri](Group%201%20Video.mp4) Research Scientist  **Activity 1A: Prior knowledge task (10 mins)** Start lesson with class quiz to provide the teacher with a guide to student’s current knowledge and preconceptions regarding the topics outlined above. Quiz will be completed with a partner to promote collaboration of ideas and reduced fear of being wrong.  True or false statements can be displayed on PowerPoint or used as a worksheet (**Appendix** **Worksheet 1**). No wrong answers because it is just to establish a base for how much they understand.  **Activity 1B: Prior knowledge task (10 mins)** Go over questions with the answers, as a class, which have been put down by students clarifying any wrong answers and creating an initial understanding to move forward in lessons. Students will keep their answers as a reference for themselves  **Activity 2: Rock formation (20 mins):** Video on rock formation. Which also begins discussion on Rock Cycles.  <https://www.youtube.com/watch?v=EGK1KkLjdQY>  Students will be asked to complete **Worksheet 2 (see Appendix)** while watching video outlining the 3 types of rocks, how they are formed and examples of each. Students will be shown examples of each rock type which they will note any physical properties (colour, texture etc.) in their table that they can recognize from the samples.  **Activity 3: The rock cycle diagram (10 mins):** Students to complete and annotate with descriptions **Worksheet 2 Activity 3** diagram of the rock cycle for personal reference while noting the connection between each form. If there are any students that will have particular difficulty with this, they may receive a completed diagram to annotate with their own explanations. Next to each part of the diagram, a short explanation of the processes occurring are to be included.  <http://dl0.creation.com/articles/p115/c11538/rock-cycle-lge.jpg>  **Activity 4: Fossils uncover life’s secrets (15 mins):** Ties in sedimentary rocks with fossils. Watch video with the intention of answering the following question. Once students have watched video they can arrange into groups and brainstorm on butchers paper their answer to this question.  ***What information can be found out about the role of fossils, and the rocks they are found in, in revealing the order and history of life on Earth?***  <http://splash.abc.net.au/home#!/media/30519/>  **End Summary (2 mins)** Go back over the information including rock cycles, rock formation, fossil location. | **Activity 1A &1B: Prior knowledge task** Initial Quiz establishes current knowledge of students and could help guide the teacher as to which topics may require less or more time for comprehensive student understanding.  **Activity 2: Fill in the worksheet using multimedia video and rock samples.**  Students being given independence to take their own notes from a video will show how much information has been understood or perceived as important.  **Activity 3: The rock cycle diagram.** All students will have completed the diagram of the rock cycle with the intention of being able to recreate it. |
| **Sand and how it is linked with the rock cycle and fossils.** | - Scientific knowledge has changed peoples’ understanding of the world and is refined as new [evidence](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evidence) becomes available [(ACSHE134)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE134)  - Communicate ideas, findings and [evidence](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evidence) based solutions to problems using [scientific language](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=scientific+language), and representations, using [digital technologies](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=digital+technologies) as appropriate [(ACSIS133)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS133) | * Students will understand that sand is what is left after weathering of other rocks. * Students will recognize that different types of sand exist. * Students will explore and identify different materials that make up individual sand grains. * Students will understand how sand is moved and transported * Students will understand how sand/fossilisation are related (sand sediment would cover remains of organisms) * Primarily students will build on knowledge of sand, rocks and rock ages and thus be equipped to progress to the next lesson of time scales\ * Understand the process and skills required for drawing an appropriate scientific diagram/sketch from a microscopic view * Be able to identify key features on small organisms such as ostracods | **Introduction and recap: Rock cycle creative writing activity (20 mins)**  Students are to write a creative writing piece resembling the transformation of a rock in the rock cycle. They are at free will to use cartoon/visual aids to accompany the writing piece.   * What happens during the rock cycle? * What did you start as? What did you become? * Why are we all different from each other? (why aren't all rocks the same) * Why do we find some types of rocks in some places and not in others?     **Activity 1: How is sand formed? (20 mins)**  Information will be delivered in a physical and multimedia presentation. In this instance visual teaching mechanisms are vital. Being able to physically show the students the different coloured sands will increase their level of engagement and interest. Many of them will never have seen sands such as black or pink sands.  Gather students around a table/bench, where the sands are on display. Allow them to see and handle the sands, feeling different textures.  <https://www.youtube.com/watch?v=CHKbLlpFNrM>  <https://youtu.be/VkrQ9QuKprE>   * Why are there different coloured sands? * Use the different coloured sands to develop student’s understandings of where sand comes from (lava rocks vs sandstone etc.) * Physical samples of sand will be provided as well as photos of different sands (black beaches, pink beaches) * How sand would play a part in fossilisation as layers of sediment develop   Prepare a few jars containing sand, pebbles, soil and water. Shake them and leave to rest so that students can see what layers are formed. Prompt students with discussion points, guiding them towards the explanation that the heavier sediments sink to the bottom.  **Activity 2: How are rocks formed? (7 mins)**  Rocks are not just the ones students see on the ground, begin with the biggest rock we stand on. The earth’s crust! Putting a different light on what rocks are will instantly engage students into how rocks are formed, given they come in so many different shapes and sizes. Given accessibility to laptops, students will access the site <https://www.sciencelearn.org.nz/embeds/11-relative-rock-layers> to link with their knowledge on layers of rocks. The lower they are, the older they are. We may be able to figure out how old they are if we find fossils from a particular era.  Alternatively, the teacher can do this through the projector and have students answer as a class.  **Activity 3: Target Point Information Task.** **(15 mins)**  Present an ostracod under the microscope (use projector) so students can understand just how small these organisms are: from the size of a poppy seed to a meat ball. Students will draw their own diagram of what they see and together as a class will label the morphological features. Discussion on significant evolutionary features.  Integration/EAL students may find the language associated with different types of rocks and rock formation difficult. At a minimum, ensure they are able to establish the key types of rocks and indicate the differences between them. Although the students may not be able to list differences ranging from appearance to formation, they should be able to visually indicate a difference. These students may also find the importance of ostracods in evolutionary features a difficult concept to understand. Bench marks should be made for a minimum understanding that may begin as low as being able to identify an ostracod from a slide/photograph.  Extension/accelerated students would be expected to not only be able to identify and differentiate between different rock types, but also highlight their use, function, location and formation. | **Introduction: Creative writing piece of rock cycle**   * Are students able to identify and explain the components of the rock cycle? * A creative writing task ensures students understand on a level that requires explanation not just repetition * Activity expected to be completed at home as a set formative assessment task   **Activity 2: How are rocks formed** Students will be able to answer the following questions upon looking at a rock column?   * What is the oldest layer of rock? * What is the youngest layer of rock? * What is the most prominent layer of rock?   **Activity 3: Target Point Information Task** Students will be expected to hand in their sketch at the end of the lesson. As the skill of scientific sketching was previously covered in another chapter of work, the teacher will be able to utilize the sketches to gauge the level of understanding students have in terms of the expectation of a scientific sketch and gauge the level of skill depicted by individuals. Comparing the sketch in this topic to the individual sketches they were permitted to do in the previous chapter. Teachers will be able to compare and contrast to distinguish consolidation of knowledge and skills of this scientific dexterity and moderate effectively across the cohort. |
| **Geological Timescales** | - Construct and use a range of representations, including graphs, keys and models to represent and [analyse](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=analyse) patterns or relationships in [data](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=data) using [digital technologies](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=digital+technologies) as appropriate [(ACSIS144)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS144)  - Summarise [data](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=data), from students’ own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on [evidence](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evidence)[(ACSIS145)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS145)  - Scientific knowledge has changed people's’ understanding of the world and is refined as new [evidence](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evidence) becomes available [(ACSHE134)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE134)  - Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures [(ACSHE223)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE223) | * Gain an understanding of each of the main periods of geological time * Develop a greater perspective on the age of and evolution on Earth * Understand and describe the characteristics and main events for each time period * Understand the evolution of life on the planet. * Specifically delve into the early Cambrian (524 mya) period and the critical role small organisms such as ostracods played. | **Introduction video (2 mins):** Introduces the topic in a very broad manner however suitable for beginner level of understanding  **Brief class discussion (3mins):**on what information stood out to them most whilst viewing the video. [**https://www.youtube.com/watch?v=r10oh1NHKv4**](https://www.youtube.com/watch?v=r10oh1NHKv4)  **Activity 1:  (90 mins): Worksheet 3**  Students can start by working through the following interactive on the main geological time scale. A worksheet has been provided in Ms. Ash’s Science Website that students can complete as they work on the interactive. Links provided below.  <http://www.ucmp.berkeley.edu/education/explorations/tours/geotime/index.html>  <http://aashscience.weebly.com/geologic-time.html>  Using **Worksheet 3 (appendix**) students to work in groups of 4 and using the knowledge gained from the interactive and links provided, will produce an animated video, or a Digiexplanation (<http://www.digiexplanations.com/video.html>)  of the Geological timeline of events that they will present to the class. Provide students with coloured pencils/Textas, plasticine etc. Students to use, computers, ipads or phones to film video. Students will have 50-70 minutes to complete activity. Then 5 minutes each to present to the class. Include a peer feedback sheet and ask each group to give feedback to one other group.  [**http://www.ucmp.berkeley.edu/help/timeform.php**](http://www.ucmp.berkeley.edu/help/timeform.php)  [**https://geology.com/time.htm**](https://geology.com/time.htm)  [**http://hyperphysics.phy-astr.gsu.edu/hbase/Geophys/geotime.html**](http://hyperphysics.phy-astr.gsu.edu/hbase/Geophys/geotime.html)  *Extension:*  Students who finish early will be asked to research an interesting fact about a small organism in either the pre-Cambrian, Palaeozoic or Mesozoic time periods. They will be required to share it in a modified listening triangle exercise. (One student that finished early (speaker) will be paired with 2 other students who did not finish early. One of these students is the ‘questioner’ asking for further clarification of the new information. Whilst the remaining 3rd student will type out this new researched information on a shared learning space platform  all students have access to at any time (MYed or New feeds for students)(Sadler 2011 p.175).  **End summary video (4 mins)** The wrap up  <https://www.youtube.com/watch?v=SY3MZ_wNFW8> | **Activity 1A : Board Game:**  The teacher will be monitoring and offering some level of assistance during the discussion time between classmates whilst also being mindful to gauge what the students initial thoughts were by auditory measures. (informal roving)  **Activity 1: Geological Time Scale Video: Student Self-Assessment:**  Students will work in pairs to complete the task and will have the opportunity to present it to their class. Peer feedback will be given via a peer feedback sheet    **Extension Activity: Listening Triangles.**  For the student undertaking the researching role this provides the opportunity to select an area of interest in the topic and apply their independent researching skills to this task. Students will be able to assess their own research ability when they view other classmates’ work online. The teacher will be able to read through the detailed information from each group posted up online by the ‘script’ to assess (and correct if need be) the level of current understanding of information by the detail provided. The teacher will furthermore be able to understand the particular interest points in the topic students are most engaging in.  By walking around the room during this mini activity by the means of informal roving. (Sadler 2011 p.9) the teacher will be able to conduct mini auditory assessment on students who are asking provoking questions to the researcher. The level of these questions posed will determine how engaged and how well information is currently understood about this area of interest. Ability for students to create meaningful links between time eras of particular organism will also be assessed. |
| **Fossilisation across geological timescales** | - Collaboratively and individually plan and conduct a range of [investigation](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=investigation) types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed [(ACSIS140)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS140)  - People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity [(ACSHE121)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE121)  [- Communicate ideas, findings and](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE121) [evidence](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evidence) [based solutions to problems using](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE121) [scientific language](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=scientific+language)[, and representations, using](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE121) [digital technologies](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=digital+technologies) [as appropriate](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE121) [(ACSIS133)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS133) | * Understand and describe the different conditions in which living organisms become fossilised * Consider the link between geological timescales and the processes of fossilisation * Apply knowledge learned throughout the topic to research a specific fossil and its characteristics. * Exercise research skills to find new information based on pre-existing knowledge | **Introduction (5 mins)** Video on how fossils are created. Upcoming worksheet is distributed to students first for them to have a quick read through before the commencement of the video so they can try and recognise any words whilst they are watching and listening.  <https://www.youtube.com/watch?v=VVadWrsHtJM>  **Activity 1: Jigsaw Fossilisation activity (20 mins)** Students to identify key words and develop a deeper understanding on the underlying processes of fossilisation. Including types of fossils 1. Mold and Cast fossils  2. Trace fossils  3. Petrified fossils  4. True form fossils  5. Carbon films and impressions  Including methods of fossilisation  1. Unaltered preservation  2. Permineralisation  3. Replacement  4. Carbonisation  5. Recrystallisation  To keep students engaged, a jigsaw strategy will be used. In the average class of 25 students they will be broken up into 5 groups of 5. Each group of 5 students will be allocated 1 type of fossil (1-4) and 1 method of fossilisation (1-5) information. Each member of a group has 5 minutes to become an expert on their allocated topic. Students researching the same area are encouraged to help each other to understand. (research can be done using the internet or information sheets provided by the teacher).  Finally, regroup students so that there are 5 students with different expert knowledge in a group and they each share their knowledge with the rest of the group members. By students having to relay the information to their peers they will work to gain a greater understanding knowing they need to come back to their groups to teach them. Answers will be checked as a class by asking a person who focused in on each area to present their information.  <https://www.slideshare.net/JuliePen/geology-part-3>  **Activity 2: Fossils research task (90 mins)**  Using the knowledge students have gained about the rock cycle, timescales and fossilisation, they will complete a research task. Students will be able to choose between ostracods, brachiopods, bivalves, trilobites, solitary rugose corals, gastropods or crinoid ossicles and will need to create a hypothetical situation in which they discover one. Students will use laptops to access the internet to complete their research. A template (**Worksheet 4**) will be provided with all subheadings. Activity can be modified for students by requiring a reduced amount of detail in the marking process.  *Extension*: students who finish early can play this game incorporating time scales and fossilisation <http://www.mylearning.org/fossils-game/interactive/2402/> | **Activity** **1:Jigsaw Activity** Having student source their own information on behalf of a group gives them a stronger sense of responsibility and can initiate stronger development of learning as they work knowing they’ll have to pass the information onto their peers. Individuals will correct their own work to ensure they have all key information available to them for the next activity.  **Activity 2: Fossils summative research task.**  Students are to choose one of ostracods, brachiopods, bivalves, trilobites, solitary rugose corals, gastropods and crinoid ossicles; which are all associated fossils. They are to become a palaeontologist and collect information on their ‘fossil’   * Image of fossil * Labelled diagram of organism and short description of any special features/adaptations it has. * Approximate area fossil was found in. * Description on the type and method of fossilisation. * Labelled diagram of fossil and its recognisable characteristics. * Justification on approximate time period the fossil is from. * Characteristics of that time period * 3 fun facts on that fossil   It is hoped that by personalising this research task, students will feel enthusiastic to fulfil the criteria and answer questions. Students will gain an appreciation on the impact such small organisms have had on our understanding of history. |

**Worksheet 1: Rocks - What do you think?**

**Activity 1:**

In your group, make judgements about the following statements as to whether you think they are true or false. Discuss your reasoning with the group and make sure you listen to each other’s opinions.

For this activity you will need to allocate the following jobs:

* Scribe
* Questioner (questions people to keep the discussion flowing and makes sure everyone is contributing)
* Timekeeper (someone to watch the time to make sure all statements are discussed in the time given)
* Devil’s advocate (someone to ask the difficult questions such as “Why do you think that?” and “What evidence do you have to back up that opinion?”

|  |  |  |
| --- | --- | --- |
| Statement | True or False? | Reasons for making your decision |
| *The rocks you see on the surface are the same as the ones deep below the ground.* |  |  |
| *There are three types of rocks* |  |  |
| *Once a rock is formed it stays the same forever.* |  |  |
| *The Earth is about 10 million years old.* |  |  |
| *Fossils are the bones of ancient animal.* |  |  |
| *The Earth’s crust is the same thickness everywhere, like the shell of an egg.* |  |  |
| *Volcanoes are made from molten rock.* |  |  |
| *There would be rocks found on other planets that are the same as on the Earth.* |  |  |

Once you have discussed the above statements, try to write three statements to give to another group for them to make a judgement as to whether they are true or not.

**WORKSHEET 2: ROCK FORMATION**

**Use the following link to explore the 3 main types of rocks and the rock cycle.**

<https://www.youtube.com/watch?v=EGK1KkLjdQY>

**Activity 2: Fill in the table below to show your understanding of the different types of rocks. Use the above link and rock samples provided.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Rock Type** | **How rock type is formed** | **Examples** | **Observed Physical Properties** |
| **Igneous** |  |  |  |
| **Sedimentary** |  |  |  |
| **Metamorphic** |  |  |  |

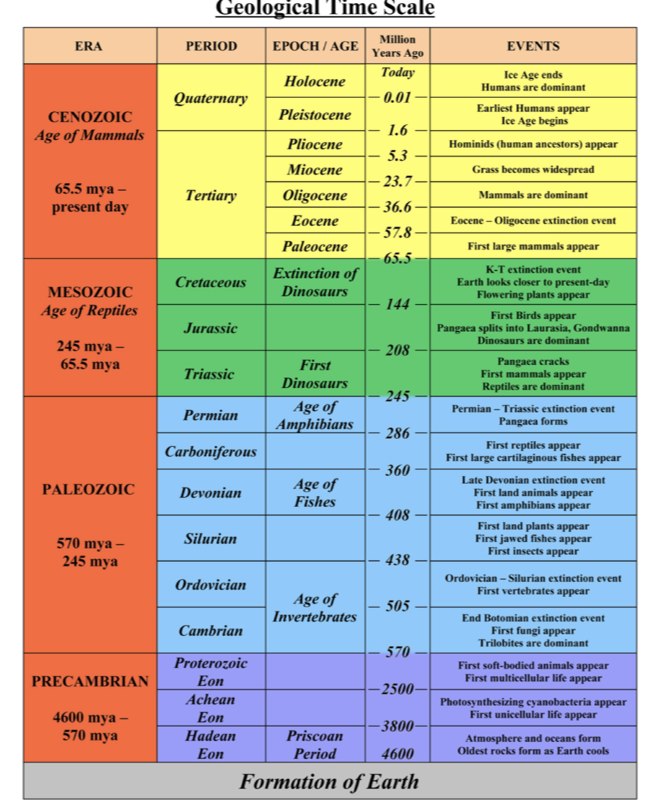
**Activity 3: Use the video from Activity 2 and the following links to fill in and annotate the diagram of the rock cycle.**

<http://www.cotf.edu/ete/modules/msese/earthsysflr/rock.html>

<https://www.ck12.org/earth-science/rock-cycle-processes/lesson/Rocks-and-Processes-of-the-Rock-Cycle-HS-ES/>

**Worksheet 3: Geological Time Scale**

**Task: Work in groups of 4 to produce a 5-minute video or** [**Digiexplanation**](http://www.digiexplanations.com/) **of the Geological Time line of events. Be as creative as you like (using models, drawings etc.) to create an informative video or Digiexplanation of the different time periods and key events.**

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1. **Begin your task by researching the key time periods and events. See suggested links below.**

[**http://www.ucmp.berkeley.edu/help/timeform.php**](http://www.ucmp.berkeley.edu/help/timeform.php)

[**https://geology.com/time.htm**](https://geology.com/time.htm)

[**http://hyperphysics.phy-astr.gsu.edu/hbase/Geophys/geotime.html**](http://hyperphysics.phy-astr.gsu.edu/hbase/Geophys/geotime.html)

1. **Work in groups of 4 to produce an informative video or Digiexplanation that is no longer than 5 minutes.**
2. **You will have 11/2 lessons to complete this activity and will present your final product to the rest of the class.**

**Worksheet 4: Fossil Summative Research Task**

1. You are to choose one of the following: ***ostracods, brachiopods, bivalves, trilobites, solitary rugose corals, gastropods and crinoid ossicles*;** which are all associated fossils.
2. You are to become a palaeontologist and collect information on your ‘fossil’.
3. This can be presented as a pamphlet or PowerPoint or small poster.
4. You have 2 lessons to complete your task.
5. Include the following information
   1. Image of fossil
   2. Labelled diagram of organism and short description of any special features/adaptations it has.
   3. Approximate area fossil was found in.
   4. Description on the type and method of fossilisation.
   5. Labelled diagram of fossil and its recognisable characteristics.
   6. Justification on approximate time period the fossil is from.
   7. Characteristics of that time period.
   8. 3 fun facts on that fossil.