 Rocks, minerals and the rock cycle

Year 11 Earth and Environmental Science 2018

Duration: 2½ - 3 weeks

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Description of unit

This section investigates the Earth’s lithosphere and its composition. Students engage with rock composition and the origins of the component materials, including minerals. They extend their knowledge of the Earth and space from Science Stage 5 by learning about soil and the Rock Cycle

Inquiry question

* What are the components of rocks and soils?

Working scientifically skills

* EES11/12-1 develops and evaluates questions and hypotheses for scientific investigation
* EES11/12-3 conducts investigations to collect valid and reliable primary and secondary data and information
* EES11/12-4 selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media
* EES11/12-5 analyses and evaluates primary and secondary data and information

Outcomes

* EES11-8 describes the key features of the Earth’s systems, including the geosphere, atmosphere, hydrosphere and biosphere and how they are interrelated

Assessment

| Outcomes/content | Teaching and learning | Evidence of learning |
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| Investigate methods of classifying rocks and minerals used by Aboriginal and Torres Strait Islander Peoples | Research Task  Using resources and secondary source data create a message stick outlining methods used by Aboriginal and Torres Strait Islander people to classify rocks and minerals. Include the uses of those minerals and rocks and their importance to the community.  Note – accessing this information to create the message stick has been difficult and a point in the right direction is required | * The message stick outlines an indigenous perspective on the classification of rocks and minerals |
| Investigate the chemical composition of a variety of minerals and explain their formation, including:   * felsic minerals * mafic minerals | Minerals  [Introduce what is a mineral](https://www.youtube.com/watch?v=8a7p1NFn64s)?  Students define the term mineral and provide an explanation of how they form and add examples.  Outline that igneous rocks form as magma cools and crystallises. The crystals represent minerals that make up the rocks. Crystallisation of an igneous rock occurs in a set pattern, different minerals crystallise at different temperatures this is Bowen’s Reaction Series.  Introduce Bowen’s reaction series using digital media some possible links are listed below;   * [Bowen’s reaction series](https://www.youtube.com/watch?v=ZggKhS4hr_Y) * [Geology: Bowen’s reaction](https://www.youtube.com/watch?v=yqjsd9ZR2Sg) series. Provide students with a copy of Bowen’s Reaction Series diagrams. The secondary source material listed below contains Bowen’s Reaction Series diagram and a corresponding worksheet for students to practice. Worksheet contains answers.   [Bowen’s reaction series](http://zengeology.weebly.com/uploads/4/1/5/3/41533293/bowen_reaction_series_activity2.pdf)  Pose scenarios of different igneous rock formation that require the use of Bowen’s reaction series to solve.  Eg. Scenario A – young, hot magma. Scenario B – magma sits around, cools.  Another resource containing information on [igneous rocks and processes](http://geologycafe.com/gems/chapter5.html) can be viewed. | * Students define the term mineral, explains how they form and provide examples * Students correctly interpret Bowen’s Reaction Series diagrams to answer the worksheet questions and the scenarios. |
| Investigate the physical properties of minerals that are used to assist in classification | Research Task  Students research and create a table that outlines how each of these properties are used to identify common minerals – providing examples of each. The properties of common rock forming minerals include:   * Hardness * Lustre * Streak * Cleavage * Colour * Fracture   [Identifying minerals](https://www.youtube.com/watch?v=32NG9aeZ7_c)  Practical Activity  Students use available samples or information to complete a Mineral Classification Investigation worksheet. | * Students create a table that defines the specific physical property of minerals * Students correctly identify the properties of common rock forming minerals and place the first-hand and secondary source data into a table. Recognise the most significant property of each mineral useful for identification. |
| Explain the formation of rocks as characteristic assemblages of mineral crystals or grains that are formed through igneous, sedimentary and metamorphic processes, as part of the Rock Cycle (ACSES019) | The Rock Cycle  Create a mind map of students’ prior knowledge of the rock cycle OR Pre-test asking students to draw a simplified rock cycle.  Outline the processes that occur between each rock type that lead to each types formation using a simplified version of the rock cycle as stimulus material.  Students research the rock cycle and create an intricate flowchart of the rock cycle which includes the processes between each rock type for them to form. The flowchart must include the following elements:   * Intrusive and extrusive Igneous rocks * Metamorphic rocks * Sedimentary rocks * Processes required to go between each rock type (melting, heat and pressure, weathering and erosion, deposition, burial, lithification, uplifting, eruption, intrusion) | * develop an intricate flow chart of the rock cycle incorporating all necessary components and processes |
| Investigate a range of rocks and minerals and classify samples using dichotomous keys | Practical Activity  Classify a selection of minerals using a dichotomous key. A smartboard sample is listed below  [Mineral dichotomous Key](http://exchange.smarttech.com/details.html?id=cdce8076-9416-4d46-b405-2bba511b1c05)  [Classify a selection of rocks](http://www.bwctc.northants.sch.uk/Learning/Science/Rocks/Images/Key.gif) (ensure there are several from each group) using a dichotomous key. A sample is listed below.  Alternative activity if no physical rock samples are available  Using rock sample images (in colour) include,   * sandstone * limestone * conglomerate * basalt * granite * schist * marble   Using a dichotomous key possible option from the site below identify the rock samples.  [What rock is it?](http://vhmsscience.weebly.com/uploads/1/2/7/6/12762866/423293_orig.jpg)  This source is a video of [mineral and rock classification](https://www.youtube.com/watch?v=7MvXv66b5h4) and their properties. | * Students correctly identify mineral and rock samples using a variety of dichotomous keys |
| Explain the formation of soil in terms of the interaction of atmospheric, geologic, hydrologic and biotic processes (ACSES020) | Soil  Students openly discuss the following questions   * What is soil? * Where does it come from? * What processes form soil?   Evolve the responses of the discussion to generate links between parent rock types and soil formation and the connection between the weathering of those rocks and minerals and the types of soils that form. Students are to investigate and generate a statement that outlines the minerals in Bowen’s reaction series and their resistance to weathering and the types of soils they will produce.  In groups students investigate what processes are occurring in each sphere (Atmosphere - weather/climate conditions, Hydrosphere - water movement above and below the ground and Biosphere - all living things) and then summarise the impact on the Lithosphere which creates soil.  [Introduce the soil profile](http://www.enchantedlearning.com/geology/soil/soillayers.GIF)  Students are to draw a generic soil profile and then relate this profile to a first-hand site (dig a hole in the school grounds) drawing the profile to scale and labelling each layer and describing its appearance any inclusions. Try and find a site that is relatively undisturbed from fill or building materials if possible. | * Students produce a statement that links parent rock/minerals and soil types that form * Students responses to questioning and summary * Drawing of a generic soil profile * First-hand scaled drawing of a local soil profile labelled and each layer has a description |
| Conduct a practical investigation to examine soil types and component materials (ACSES020) | Practical Activity  Demonstrate soil test experiments on a sample of soil. These tests can include   * pH test * squeeze test for soil type * drainage * humus content * water content   Students develop a case study and write a report on soil in their local area, looking at the specific parent rock present, weather/climatic conditions, types of macro and micro biological material available. The case study should also contain first-hand data collection of soil type (clay, sandy, loamy), water content, drainage, humus content, pH levels, etc.  Resources that could be useful  [Soil science](http://www.soils4teachers.org/lessons-and-activities)  [Soil resources](http://www.soilscienceaustralia.com.au/conference-proceedings/13-branches/179-soil-resources)  [Understanding soil](http://soilscienceaustralia.com.au/images/sampledata/publications_tab/schoolresources/factsheets/01_understanding-soil.pdf) | N/A |
| N/A | Mind Map Summary  Using the question “What are the components of rocks and soils?” as the central concept create a mind map summarising the main points of this section. | * Mind map contains all main points on rock and soil components |

Reflection and evaluation: