



SAMPLE COURSE OUTLINE

EARTH AND ENVIRONMENTAL SCIENCE
ATAR YEAR 11

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Sample course outline

Earth and Environmental Science – ATAR Year 11

Unit 1 – Earth systems

Science Inquiry Skills align with the Science Understanding and Science as a Human Endeavour content of the unit and are integrated into the learning experiences.

Science Inquiry Skills

- propose hypotheses; plan, and predict possible outcomes; and conduct investigations
- design investigations, including the procedure(s) to be followed, the information required and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics
- conduct laboratory and field investigations, including using map and field location techniques and environmental sampling and identification procedures, safely, competently and methodically for the collection of valid and reliable data
- identify the following sedimentary rocks from physical samples, diagrams and photographs – conglomerate, breccia, sandstone, limestone, siltstone, shale, mudstone
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error, and uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions
- interpret a range of scientific and media texts and evaluate processes, claims and conclusions by considering the quality of available evidence; use reasoning to construct scientific arguments
- interpret and use appropriate representations, including maps and cross-sections where the section line is perpendicular to strike, to describe and analyse spatial relationships and stratigraphy, and to communicate conceptual understanding, solve problems and make predictions
- communicate to specific audiences and for specific purposes using appropriate language and formats, including compilations of field data and research reports

Unit 1 – Earth systems

Semester 1

Week	Key teaching points
1	<p>Development of the geosphere</p> <ul style="list-style-type: none"> Earth has internally differentiated into a layered structure: a solid metallic inner core, a liquid metallic outer core and a silicate mantle and crust; the study of seismic waves and meteorites provides evidence for this theory
2–3	<ul style="list-style-type: none"> observation of present day processes can be used to infer past events and processes by applying the Principle of Uniformitarianism a relative geological timescale can be constructed using stratigraphic principles, including original horizontality, faunal succession, superposition, cross-cutting relationships, inclusions, unconformities and correlation precise dates can be assigned to points on the relative geological timescale using data derived from the decay of radioisotopes in rocks and minerals; this establishes an absolute timescale and places the age of the Earth at approximately 4.5 billion years early attempts to place Earth's past events in sequential order used a relative geological timescale based on stratigraphic principles, including superposition and cross-cutting relationships; subsequently radiometric dating techniques enabled these events to be assigned specific ages on an absolute timescale (SHE)
4–5	<ul style="list-style-type: none"> rocks are composed of one or more minerals and are formed through igneous, sedimentary and metamorphic processes as part of the rock cycle minerals can be characterised by their colour, streak, lustre, transparency, cleavage, fracture, hardness (Moh's scale), magnetism, density <p>Task 1: Investigation of soil properties</p>
6–7	<ul style="list-style-type: none"> simple sedimentary structures are used as evidence of past processes and are related to depositional environments, including the use of cross-bedding, graded bedding and mud cracks some sedimentary rocks can be identified according to their composition and texture, including conglomerate, breccia, sandstone, limestone, siltstone, shale, mudstone soil formation requires interaction between atmospheric, geological, hydrological and biotic processes; soil is composed of rock and mineral particles, organic material, water, gases and living organisms interpret and use appropriate representations, including maps and cross-sections where the section line is perpendicular to strike, to describe and analyse spatial relationships and stratigraphy (SIS) <p>Task 2: Test on the geosphere</p>
8	<ul style="list-style-type: none"> field investigation, data collection and report writing (SIS) <p>Task 3: Field investigation of an area with sedimentary rocks and processes</p>
9–10	<p>Development of the atmosphere and hydrosphere</p> <ul style="list-style-type: none"> the atmosphere was derived from volcanic outgassing during cooling and differentiation of Earth, and its composition has been significantly modified by the actions of photosynthesising organisms the modern atmosphere has a layered structure characterised by changes in temperature: the troposphere, stratosphere, mesosphere and thermosphere water is present on the surface of Earth as a result of volcanic outgassing and impact by icy bodies from space; water occurs in three phases (solid, liquid, gas) on Earth's surface the water cycle is an important component of Earth system processes

Week	Key teaching points
11–12	<p>Development of the biosphere</p> <ul style="list-style-type: none"> • fossil evidence indicates that life first appeared on Earth approximately 4 billion years ago. Index fossils enable correlation of rock strata for relative dating • current theories state that life emerged under anoxic atmospheric conditions in an aqueous mixture of inorganic compounds, either in a shallow water setting as a result of a lightning strike or in an ocean floor setting due to hydrothermal activity • in any one location, the characteristics (including temperature, surface water, substrate, organisms, available light) and interactions of the atmosphere, geosphere, hydrosphere and biosphere, give rise to unique and dynamic communities <p>Task 4: Research past environments through fossil evidence</p>
13–14	<ul style="list-style-type: none"> • the characteristics of past environments and communities (including presence of water, nature of the substrate, organism assemblages) can be inferred from the sequence and internal textures of sedimentary rocks and enclosed fossils, including banded iron formations and Ediacara fauna • the diversification and proliferation of living organisms over time (including increases in marine animals in the Cambrian period), and the catastrophic collapse of ecosystems (including the mass extinction event at the end of the Cretaceous period) can be inferred from the fossil record • in recent decades advances in science (including microbiology) have provided new ways to analyse and interpret the evidence for evolution in the fossil record and to model the conditions for the origin of life • improved understanding of complex events in Earth’s history (such as oxygenation of the atmosphere) requires integration of knowledge and concepts from multiple scientific disciplines (such as chemistry and palaeontology) <p>Task 5: Test on atmosphere, hydrosphere and biosphere</p>
15	Revision
16	Task 6: Semester 1 examination based on Unit 1 content

Sample course outline

Earth and Environmental Science – ATAR Year 11

Unit 2 – Earth processes

Science Inquiry Skills align with the Science Understanding and Science as a Human Endeavour content of the unit and are integrated into the learning experiences.

Science Inquiry Skills

- propose hypotheses; plan, and predict possible outcomes; and conduct investigations
- design investigations, including the procedure(s) to be followed, the information required and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics
- conduct laboratory and field investigations, including using map and field location techniques and environmental sampling and identification procedures, safely, competently and methodically for the collection of valid and reliable data
- identify and classify igneous rocks based on texture and mineralogy in physical samples, diagrams and photographs, including basalt, dolerite, gabbro, andesite, diorite, rhyolite, pegmatite, granite, pumice, tuff and obsidian
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error, and uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions
- interpret a range of scientific and media texts and evaluate processes, claims and conclusions by considering the quality of available evidence; use reasoning to construct scientific arguments
- interpret and use appropriate representations, including maps and cross-sections where the section line is perpendicular to strike, to describe and analyse spatial relationships, and stratigraphy, to communicate conceptual understanding, solve problems and make predictions
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Unit 2 – Earth processes

Semester 2

Week	Key teaching points
1–3	<p>Earth processes</p> <ul style="list-style-type: none"> energy is neither created nor destroyed, but can be transformed from one form to another (for example, kinetic, gravitational, heat, light) and transferred between objects processes within and between Earth systems require energy that originates either from the Sun or the interior of Earth energy source for tectonic plate movement scientific study of the origin and maintenance of the Earth’s internal heat has been important in developing many significant concepts in the Earth sciences, including the origin of igneous rocks and volcanoes, the age of the Earth and plate tectonics (SHE) igneous processes form different igneous rocks which can be identified based on texture and mineralogy, including basalt, dolerite, gabbro, andesite, diorite, rhyolite, pegmatite, granite, pumice, tuff and obsidian <p>Task 7: Practical identification of igneous rocks and their mode of formation</p>
4–6	<p>Atmospheric processes</p> <ul style="list-style-type: none"> the net transfer of solar energy to Earth’s surface is influenced by its passage through the atmosphere, including impeded transfer of ultraviolet radiation to Earth’s surface due to its interaction with atmospheric ozone, and by the physical characteristics of Earth’s surface, including albedo most of the thermal radiation emitted from Earth’s surface passes back out into space, but some is reflected or scattered by greenhouse gases toward Earth; this additional surface warming produces a phenomenon known as the naturally occurring Greenhouse Effect the movement of atmospheric air masses due to heating and cooling, and Earth’s rotation and revolution, cause systematic atmospheric circulation <p>Task 8: Test on Earth processes and atmospheric processes</p>
7–9	<p>Ocean processes</p> <ul style="list-style-type: none"> the movement of atmospheric air masses due to heating and cooling, and Earth’s rotation and revolution, cause systematic atmospheric circulation the interaction between Earth’s atmosphere and oceans changes over time and can result in phenomena, including El Niño and La Niña identification of cyclic changes in the atmosphere and hydrosphere, including El Niño and La Niña, requires systematic collection and analysis of data, such as air pressure and sea-surface temperature records, to reveal patterns that are not evident at small spatial or short temporal scales (SHE)
10–11	<p>Energy transfer</p> <ul style="list-style-type: none"> thermal and light energy from the Sun drive important Earth processes, including evaporation and photosynthesis photosynthesis is the principal mechanism for the transformation of energy from the Sun into energy forms that are useful for living things energy and matter flow through the biotic and abiotic components of an ecosystem, and human activities influence this flow satellite technologies enable the estimation, comparison and monitoring of primary production (biomass production due to photosynthesis) globally and in a range of different ecosystems <p>Task 9: Research use of satellite data to monitor or manage biomass production</p>

Week	Key teaching points
12–14	Biogeochemical processes <ul style="list-style-type: none">• biogeochemical cycling of matter, including nitrogen, involves the transfer and transformation of energy between the biosphere, geosphere, atmosphere and hydrosphere• energy is stored, transferred and transformed in the carbon cycle; biological elements, including living and dead organisms, store energy over relatively short time scales, and geological components store energy for extended periods• energy and matter flow through biotic and abiotic components of an ecosystem• Western Australian case study of an ecosystem Task 10: Case study – Effect of human activities on an ecosystem Task 11: Test on ocean processes, energy transfer and biogeochemical processes
15	Revision of Unit 1 and Unit 2 content
16	Task 12: Semester 2 examination based on Unit 1 and Unit 2 content