Government of **Western Australia**
School Curriculum and Standards Authority

Sample Course Outline

Earth and Environmental Science
ATAR Year 12

Sample course outline

Earth and Environmental Science – ATAR Year 12

Unit 3 and Unit 4

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 metamorphic rocks based on texture and mineralogy (including slate, phyllite, schist, gneiss, marble, quartzite) from physical samples, diagrams and photographs
- 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
- select, construct and interpret appropriate representations, including maps and geological cross-sections where the section line is perpendicular to strike, and other spatial representations, such as block diagrams and stratigraphic columns, 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

Semester 1 – Unit 3 – Managing Earth resources

Week	Key teaching points
1–2	**Non-renewable Earth resources** • non-renewable mineral and energy resources are formed over geological timescales so are not readily replenished • the location of non-renewable mineral and energy resources, including fossil fuels, iron ore, nickel and gold, is related to their geological setting, including sedimentary, magmatic, metamorphic and hydrothermal processes • identify and classify metamorphic rocks based on texture and mineralogy from physical samples, diagrams and photographs (SIS) **Task 1:** Investigation – Identify metamorphic rocks and describe formation environments
3–4	• mineral and energy resources are discovered using a variety of techniques, including mapping, satellite images, aerial photographs, geophysical and geochemical methods, to identify the spatial extent of the deposit and quality of the resource • development of coupled geological and geophysical techniques (measuring magnetic fields and electromagnetic induction) and remote sensing technologies (including aerial photography, satellite based spectroscopes) have increased the rate of identification of mineral and energy resources and improved estimates of their size and value prior to extraction (SHE) • select, construct and interpret appropriate representations, including maps and geological cross-sections, and others such as block diagrams and stratigraphic columns to communicate conceptual understanding, solve problems and make predictions (SIS) • environmental considerations are important in the exploration, extraction and processing of non-renewable resources, and the decommissioning of resource sites **Task 2:** Test – Mapping, cross-section
5–6	• extraction of mineral and energy resources influences interactions between the abiotic and biotic components of ecosystems, including hydrologic systems • decisions about whether to and how to extract a resource depend on the value, location and volume of the resource. Consultation and negotiation with local and indigenous communities are required to further assess the impacts on and costs to the environment and community of removing the resource (SHE) **Task 3:** Extended task – Case study of a resource site
7–8	**Renewable Earth resources** • renewable resources are those that are typically replenished at timescales of years to decades and include harvestable resources (including water, biota and some energy resources) and ecosystem services • ecosystems provide a range of renewable resources, including provisioning services (including food, water, timber), regulating services (including carbon sequestration, climate control), and supporting services (including nutrient, air and water cycling) • the abundance of a renewable resource and how readily it can be replenished influence the rate at which it can be sustainably used at local, regional and global scales **Task 4:** Investigating a renewable resource
9–11	• the cost-effective use of renewable energy resources is constrained by the efficiency of available technologies to collect, store and transfer the energy resource • decisions to invest in energy technologies that harness Earth's internal geothermal heat are informed by environmental, economic and political considerations (SHE)
12–13	• human activities affect the quality and availability of fresh water, including aquifer recharge, desalination, over-extraction, land clearing and eutrophication • recognition of the relatively small amounts of fresh water available for biological processes informs community decision making about investment in infrastructure and technologies to increase access to high quality water, including dams, desalination plants (SHE)
14–15	• producing, harvesting, transporting and processing of resources for consumption, and assimilating the associated wastes, involves the use of resources; the concept of an 'ecological footprint' is used to measure the magnitude of this demand

Week	Key teaching points
	Task 5: Test – Renewable Earth resources
16	**Task 6:** Semester 1 examination based on Unit 3 content

Semester 2 – Unit 4 – Earth hazards and climate change

Week	Key teaching points
1–3	**The cause and impact of Earth hazards** • Earth hazards result from the interactions of Earth systems and can threaten life, health, property, or the environment; their occurrence may not be prevented, but their effects can be mitigated • plate tectonic processes generate earthquakes, volcanic eruptions and tsunamis; the occurrence of these events affects other Earth processes and interactions, including the influence of volcanic emissions on climate and weather **Task 7:** Investigation – Construct and test a seismograph
4	• monitoring and analysis of data, including composition of volcanic magma, ground motion monitoring, and earthquake location and frequency data, allows the mapping of potentially hazardous zones. This contributes to the future prediction of the location and probability of repeat occurrences of hazardous Earth events, including volcanic eruptions, earthquakes and tsunamis • sophisticated models of the dynamics and mechanics of plate tectonic motion and collision enable prediction of future plate tectonic movements and provide data for local evidence-based decision making, for example, development of infrastructure, location of geothermal resources (SHE) • advances in knowledge and understanding of seismic processes have led to improved design of ground shake resistant structures and identification of areas likely to be affected by earthquakes (SHE)
5–6	• the impact of natural hazards on the biosphere depends on the location, magnitude and intensity of the hazard, and the structure and composition of Earth materials influencing the hazard • some ecosystems rely on episodic earth hazard events to rejuvenate and maintain their long-term viability, including flood plain fertility, bushfire and seed germination (SHE) **Task 8:** Extended task – Research into a natural disaster and its effect on the biosphere **Task 9:** Test – The cause and impact of Earth hazards
7–8	**The cause and impact of global climate change** • natural processes (including oceanic circulation, orbitally-induced solar radiation fluctuations, the plate tectonic supercycle) contribute to global climate changes that are evident at a variety of timescales • human activities, particularly land-clearing and fossil fuel consumption, produce gases including carbon dioxide, methane, nitrous oxide and hydrofluorocarbons, and particulate materials, that can change the composition of the atmosphere and climatic conditions, including an enhanced greenhouse effect • models for long term climatic trends are subject to debate and revision, based on the availability of supporting evidence and review of the underpinning assumptions and limitations (SHE) **Task 10:** Investigation – Effect of carbon dioxide on temperature change
9–11	• climate change affects the biosphere, atmosphere, geosphere and hydrosphere; climate change has been linked to changes in species distribution, crop productivity, sea level, rainfall patterns, surface temperature and extent of ice sheets • geological, prehistorical and historical records provide evidence (including fossils, pollen grains, ice core data, isotopic ratios) that climate change has affected regions and species differently over time
12–14	• climate change models (including general circulation models, models of El Niño and La Niña) describe the behaviour and interactions of the oceans and atmosphere; these models are developed through the analysis of past and current climate data, with the aim of predicting the response of global climate to changes in the contributing components, including changes in global ice cover and atmospheric composition • studies of human impact on the atmosphere, hydrosphere and ecosystems rely on evidence from many scientific disciplines over time; these studies inform the concept of environmentally sustainable development (SHE)

Week	Key teaching points
	Task 11: Test – The cause and impact of global climate change
15	Revision
16	**Task 12:** Semester 2 examination based on Unit 3 and Unit 4 content