VCE Environmental Science: Sample teaching plan

Sample Course Outline – VCE Environmental Science Unit 2: What affects Earth’s capacity to sustain life?

**Note:** This is a sample guide only and indicates one way to present the content from the *VCE Environmental Science Study Design*. VCE units are designed on the basis of a minimum of 50 hours class time; this sample teaching plan is based on 3 hours per week over 19 weeks and includes activities covering the nine scientific methodologies. Teachers are advised to consider their own contexts in developing learning activities: Which local fieldwork sites would support learning in the topic area? Which local case studies and issues lend themselves to debate and investigation? Which experiments can students complete within the resource limitations of their learning environments?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Week** | **Area of study** | **Key knowledge** | **Learning activities**  | **Science skills focus** | **Assessment tasks** |
| **1** | ***Area of study 1:******How can we manage pollution to sustain Earth’s systems?***  | **Pollution effects on Earth’s systems** (chemical and physical characteristics of pollutants that influence dispersal of emissions from natural and manufactured sources; the transport mechanisms, persistence, fate and toxicity of pollutants throughout Earth’s four systems; impacts of a range of pollutants on the health and survival of living things in the biosphere and on the quality of the atmosphere, hydrosphere and lithosphere with reference to risk, exposure, dosage, tolerance limits, LD50, chronic and acute toxicity, allergies, disruption of system regulation and synergistic action) | * *Fieldwork* and *controlled experiments*: tests of water quality from natural and disturbed environments
* *Poster*: chemical and physical characteristics and impacts on Earth’s four systems of a selected pollutant
* *Jigsaw activity*: annotated map demonstrating geographic distribution of pollutants from source to sink
* *Literature review*: investigate selected pollutants and any associated remediation options
* *Flow chart*: bioaccumulation of a selected pollutant in a food web and the effects on the ecosystem
* *Infographic*: a selected pollutant and the impacts on society and Earth’s four systems
* *Media analysis*: students compare reported information with scientific data on selected pollutants
* *Case study*: analysis of a selected global pollution incident, e.g., Minamata disaster
* *Correlational study*: investigate the effects of sound pollution on ecosystems
* *Practical activities*: effects of acid rain on an ecosystem, building materials or water quality; effects of selected pollutants on seed germination; design an experiment to determine if ‘green’ detergents are less toxic to plant seedlings than conventional detergents; design an experiment to investigate the effects of pollutants on duckweed; design a water purification device
* *Modelling*: Demonstration to primary students of spread of pollutants using perfume, candle wax, bleach
 | * determine appropriate investigation methodology: case study; classification and identification; controlled experiment; correlational study; fieldwork; literature review; modelling; product, process or system development; simulation
* demonstrate safe laboratory practices when planning and conducting investigations by using risk assessments that are informed by safety data sheets (SDS), and accounting for risks
* record and summarise both qualitative and quantitative data, including use of a logbook as an authentication of generated or collated data
* repeat experiments to ensure findings are robust
* organise and present data in useful and meaningful ways, including schematic diagrams, flow charts, tables, bar charts and line graphs
 |  |
| **2** |  |
| **3** |  |
| **4** | **Laboratory report** (40 minutes):effect of ‘green’ detergents on growth of plant seedlings, including data presentation and analysis, with data authenticated by logbook entries |
| **5** | **Managing pollution** (contribution of scientific data, new technologies, regulatory frameworks and diverse stakeholder values in managing pollution; options for the control and treatment of pollution) | * *Fieldwork*: Survey people to establish pollution myths that exist in the community, for example, that surgical masks are the best defence against air pollution; compare findings with others in the class, consider sampling size and methods; work in groups to develop a pamphlet to address a selected myth or misconception
* *Product, process or system development*: design a water purification system using common materials
* *Controlled experiment*: design and perform an experiment to test the effectiveness of different methods for cleaning up oil spills
* *Literature review*: visually summarise a new technology that reduces pollution, including data
* *Debate*: pesticide and herbicide use in the food industry; compulsory car-free days; ‘dark skies’ legislation to reduce the effects of light pollution
* *Fieldwork*: visit a local recycling plant
 | * process quantitative data using appropriate mathematical relationships and units, including calculations of ratios, percentages, percentage change and mean
* explain the effects of varying sample sizes in obtaining robust data
* distinguish between opinion, anecdote and evidence (including weak and strong evidence), and scientific and non-scientific ideas
* identify independent, dependent and controlled variables in controlled experiments
* identify and explain when judgments or decisions associated with issues related to environmental science may be based on sociocultural, economic, political, legal and/or ethical factors and not solely on scientific evidence
 |  |
| **6** |  |
| **7** | **Visual presentation:** two PowerPoint slides to show an innovation or designed solution related to pollution management and (a) how it works; and (b) advantages for society and the environment |
| **8** | ***Area of Study 2******How can we manage food and water security to sustain Earth’s systems?*** | **Sustainable food systems** (challenges to supplying adequate and affordable food in regional and global locations that achieve regional and global food security; qualitative differences between food produced by conventional monoculture and organic monoculture agricultural systems)  | * *Research task* or *design an experiment*: investigate growing sustainable crops in inhospitable conditions
* *Jigsaw activity*: investigate conventional agricultural systems versus organic monoculture systems
* *PMI table*: monoculture agricultural systems compared to polyculture agricultural systems
* *Controlled experiments*: organic and inorganic fertilisers effect on plant growth used for human consumption; effects of temperature variations or water supply on grains grown in Australia
* *Concept map*: link food security to water security or to environmental issues such as climate change
* *Group activity*: Develop food security plans for a local, regional and global location
* *Debate/role play: ‘*The food miles campaign will work against Australia’s food industry’
 | * work independently and collaboratively as appropriate and within identified research constraints, adapting or extending processes as required and recording such modifications discuss relevant environmental science information, ideas, concepts, theories and models and the connections between them
* identify independent, dependent and controlled variables in controlled experiments
 |  |
| **9** |  |
| **10** |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **11** |  | **Maintaining food and water security** (options for improving food security that consider organisational, political and structural enablers and barriers to change; use and limitations of ecological footprint analysis, in terms of the sustainability principles of intragenerational equity and the efficient use of resources; the ecological footprint of either an individual, local and/or international community or business, or a local or imported raw food and/or food product; options for decreasing water demand and improving water-use efficiency) | * *Simulation*: calculate personal ecological footprint using an online site; develop ways to reduce individual footprint
* *Graphic organiser*: demonstrate the ecological footprint of an individual, local and/or international community, business, or a local or imported raw food or food product
* *Literature review*: research information about plant-based alternatives to meat as food sources
* *Classification and identification*: comparison of food labelling about how food is grown, processed and transported
* *Video*: watch ‘Future Food Menu of 2050 and discuss whether discuss whether an insect-based diet could be a viable future food option
* *Fieldwork*: conduct a school audit of food wastage and/or water use and develop an improvement plan
* *Group work*: Read the targets and indicators for Goals 2 and 6 of the United Nations Sustainable Development Goals for 2030 related to water and food security and develop a set of strategies for individuals, communities and governments to achieve the goals
 | * analyse and evaluate environmental science scenarios, case studies, issues and challenges using the sustainability principles of efficiency of resource use and intragenerational equity
* critically evaluate and interpret a range of scientific and media texts (including journal articles, mass media communications and opinions in the public domain), processes, claims and conclusions related to environmental science by considering the quality of available evidence
 |  |
| **12** |  |
| **13** | **Graphic organiser** (30 minutes): impact on Earth’s four systems oftransitioning from a meat-based diet to an insect-based, or plant-based, diet |
| **14** | ***Area of Study 3*** ***How do scientific endeavours contribute to minimising human impacts on Earth’s systems?*** | **Scientific evidence** (distinction between primary and secondary data; nature of evidence and information: distinction between opinion, anecdote and evidence, weak and strong evidence, and scientific and non-scientific ideas; quality of evidence, including validity and authority of data and sources of possible errors or bias relating to those who benefit and those whose health or livelihood is impacted; methods of organising, analysing and evaluating secondary data and use of a logbook to authenticate collated data) | * **Scientific investigation overview:** Investigation into how science can be applied to address Earth’s capacity to sustain life in the context of the management of a selected pollutant and/or the maintenance of food and/or water security
* *Select investigation topic*: students register an investigation topic related to pollution or food/water security
* *Background research*: students begin research in class, record information in logbooks, and complete a VCAA Authentication Record for work completed outside class
* *Data collation*: record and summarise both qualitative and quantitative data, including use of a logbook as an authentication of generated or collated data
* *Data evaluation*: students evaluate the quality of data and authority of resources
 | * identify, research and construct aims and questions for investigation
* record and summarise both qualitative and quantitative data, including use of a logbook as an authentication of generated or collated data
* distinguish between opinion, anecdote and evidence (including weak and strong evidence), and scientific and non-scientific ideas
* evaluate data to determine the degree to which the evidence supports the aim of the investigation, and make recommendations, as appropriate, for modifying or extending the investigation
 |  |
| **15** |  |
| **16** | **Science communication** (Scientific concepts specific to the investigation; appropriate communication of scientific information; use of data, models and theories in organising and explaining observed phenomena and environmental science concepts, and their limitations; the influence of sociocultural, economic, legal and political factors, and application of ethical understanding to science as a human endeavour and conventions for referencing and acknowledging sources of information) | * **Multimedia presentation techniques: discussion of** strategies for effective communication
* **Peer review:** students work in groups of three to critique each other’s PowerPoint slides
* **Presentation:** students present investigation findings; audience summarise main points from presentations
 | * analyse and explain how models and theories are used to organise and understand observed phenomena and concepts related to environmental science, identifying limitations of selected models/theories
* identify and explain when judgments or decisions associated with issues related to environmental science may be based on sociocultural, economic, political, legal and/or ethical factors and not solely on scientific evidence
* discuss the implications of research findings and proposals
* acknowledge sources of information and assistance, and use standard scientific referencing conventions
 |  |
| **17** | **Multimedia presentation to the class:** (not longer than 10 minutes and no more than 6 slides) related to the application of science to the management of a pollutant or in securing food and/or water  |
| **18** | **Unit revision** | **End-of-semester examination** |
| **19** |