(IGCSE) (Environmental Management) (0680)
(unit 1): (Lithosphere)

Recommended Prior Knowledge
An understanding of some processes from earth sciences, physical geography and soil study. Many physical geography text books for GCSE include all three. An appreciation of the importance of energy in the modern world in relation to economic development and of the attempts being made to search for and develop alternative sources. A good general knowledge, particularly of events in the news such as earthquakes and volcanic eruptions.

Context
It makes good sense for this unit to be studied first. The unit provides basic information about the structure of the Earth and the natural processes that operate on it. Knowledge of the Earth's natural resources is useful to a full understanding of content in later units; for example, elements of soils knowledge is useful to the agricultural parts of unit 3, and managing the land sections in unit 4. Case studies, practical tasks and investigations are included where appropriate.

Outline
Separate topic areas within the Lithosphere section are followed through the four columns in the syllabus, beginning with how the natural system works from column 1 and finishing, where appropriate, with management of the resources in column 4. The separate topics identified in this unit are **rocks and minerals, energy, tectonic activity and soils**; they are covered in this order. Opportunities are provided for pupils to develop practical skills, such as drawing graphs, diagrams, labelled sketches and sketch maps. These can be used again and extended in later units. Pupils are encouraged to keep up to date with topical events and to choose examples from the home region or home country whenever possible.

AO	Learning outcomes	Suggested Teaching activities	Learning resources
	Rocks and minerals		
1.1	To gain knowledge of the structure of the Earth	To give students the opportunity draw a labelled diagram to show the structure of the Earth.	**Environmental Management** page 2
1.2	To learn about types of rock	To make students familiar with a simple classification of rocks into three types based on formation (igneous, metamorphic and sedimentary), with examples of types of rock. To encouraged students to use examples of rocks found in the home region, whenever possible.	**Environmental Management** pages 2 and 3 Environmental Management 0680/02 Oct/Nov 2004 Question 1(b) Past Paper
1.3	To understand the distribution, types and reserves of major minerals	To begin with a simple classification of minerals types, such as metallic and non-metallic, with examples of each, in order to provide a framework	**Environmental Management** pages 4 and 5

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		for study. To provide students with an outline world map to identify the world's main mineral-rich regions. Then to invite students, perhaps working in small groups, to comment on the importance of minerals (whether high or low) in the home region, and to investigate geological reasons for it. To request students to give a definition of 'reserves', followed by explanation with reference to expected length of life for some widely used minerals.	Natural Economy 0670/02 Oct/Nov.1999 Questions 2(a)-(e) Past Paper Environmental Management 0680/02 May/June 2005 Question 2(b) Past Paper
3.1	To have knowledge and understanding of the methods of search and extraction of rocks, minerals and fossil fuels	To demonstrate to students the difference between opencast and deep mining. Ask students to draw labelled diagrams to illustrate differences between the two methods.	**Environmental management** pages 6 and 7 for rocks and minerals; pages 19 and 20 for fossil fuels Natural Economy 0670/02 Oct/Nov. 2002 Questions 2(c)&(d) Past Paper
3.2	To know about the uses of rocks and minerals in industrial processes	To encourage students to discover the main industrial uses of a number of rocks and minerals. If relevant, to give students an opportunity to investigate how rocks and minerals produced in the home region are used.	**Environmental Management** pages 8 and 9
3.8	To understand how industrial development is used to achieve social and economic goals	To increase awareness among students of the importance of minerals to the growth of manufacturing industry and related economic development. To examine the home country's level of economic development in relation to its mineral wealth.	**Environmental Management** pages 9 and 10
4.1	To gain knowledge and understanding of the impact of mineral exploitation on the environment and on human activity and health	To introduce students to the negative effects of mining on the environment. To give students the opportunity to study photographic images of opencast mines and quarries in order to assess the damage done. To make students aware, despite the invariably negative impacts on human health from mining, of the economic benefits of mining, both for local people and the national economy. To organise students in small groups to draw up lists of advantages and disadvantages of mining for a particular country; then as a group to make an overall assessment and decide upon whether advantages outweigh disadvantages, or not.	**Environmental Management** pages 10 to 13 Environmental Management 0680/02 Oct/Nov. 2004 Question 1(e) Past Paper
3.5	To be aware of the main supply and demand constraints in exploiting	To lead students into the study of a variety of factors which affect the likelihood of exploiting a mineral source, including geological (ease of	**Environmental Management** pages 14 to 16 **BP Statistical Review of World Energy** –

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	mineral resources	exploitation), depletion rates (size of deposits), location in relation to climate and transport (for ease of working and access) and price fluctuations (high or low world prices). To offer guidance to students about making a table to show factors for a high the chance of mineral exploitation, so that individually they are then able to complete the table for low chance factors. To encourage students to investigate world price movements for a highly traded mineral, such as oil (petroleum).	annual publication Natural Economy 0670/02 Oct/Nov. 1999 Questions 2(h) and 2(g) Past Paper
4.2	To understand the global economic consequences of the over-exploitation and depletion of mineral and fossil fuel reserves	Following on from the earlier section on reserves of major minerals in 1.3, to switch the focus towards the economic consequences for people and countries of the depletion of finite mineral resources. To make use of the revised life expectancies for fossil fuels given annually in the BP Review.	**Environmental Management** page 17 **BP Statistical Review of World Energy** – annual publication
5.1	To learn about conservation schemes for damaged environments	To lead students into studies of landscaping, restoration and reclamation, as measures to try to return damaged environments to a state as close as possible to that before mining began. To increase student awareness of the need for careful management to avoid water pollution and land contamination in landfill sites used for waste disposal, one of the most common uses of large surface holes left by mining.	**Environmental Management** pages 17 and 18 http://www.bbc.co.uk/landfill
	Energy		
1.4	To have knowledge and understanding of the formation of fossil fuels	To ask students to draw labelled diagrams to highlight similarities and differences between the formations of coal and oil / natural gas. To ensure that students understand why all three are fossil fuels. To check that students can explain how and why their different formations affect methods and costs of extraction.	**Environmental Management** pages 19 to 21 Natural Economy 0670/02 May/June 2000 Question 2(a) Past Paper Natural Economy 0670/02 Oct/Nov. 2002 Question 2(f) Past Paper
3.3	To know about types of energy production from fossil and nuclear fuels	To provide students with data for world energy production from an up to date source like the BP Statistical Review, and demonstrate how fossil fuels remain the dominant sources of energy – in order of importance oil, coal and natural gas. To ask students to explore reasons for this, such as their dual use as fuels (direct heat) and as energy sources for	**Environmental Management** pages 21to 23 **BP Statistical Review of World Energy** – annual publication

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		generating electricity. Working in pairs, students can investigate how electrical energy is made from nuclear fuels and use an atlas or internet encyclopaedia to discover the leading producers. To check student findings and ensure that they recognise the great importance of nuclear energy in some developed countries such as France and Japan, although it makes only a comparatively small contribution globally.	Natural Economy 0670/02 Oct/Nov. 2002 Question 2(b) Past Paper Environmental Management 0680/02 May/June 2005 Question 2(a) Past Paper
3.7	To understand the implications of global trade in minerals and energy	To suggest to students that they focus on oil, a good example to use because of the amount, importance and worldwide reach of the oil trade. To recommend that they make use of data from an atlas or statistical review to identify the main world regions of oil production and consumption, and the trade routes between them, on a sequence of outline world maps. If the home country is a mineral exporter, to investigate export destinations.	**Environmental Management** pages 24 to 26 **BP Statistical Review of World Energy** – annual publication
4.3	To analyse and discuss the implications in social, economic and environmental terms of different types of energy production	To ask students to begin by reviewing the environmental problems caused by mining fossil fuels. Then to extend their study to include pollution risks associated with oil and gas transportation by tanker and pipeline, followed by those resulting from their use. To emphasise that only outline references to air pollution, acid rain, carbon dioxide releases and possible effects of global warming are needed at this point, since these are topics studied will be studied in greater depth later in the hydrosphere and atmosphere units. To advise students of the need to study the implications of using nuclear energy in more detail and to suggest to them that they use two spider diagrams for summarising advantages and disadvantages of its use. To encourage students individually to make an overall assessment comparing the effects of nuclear use with those of fossil fuels, and then in a group discuss and debate the arguments for and against an increase in nuclear power use.	**Environmental Management** pages 27 and 28 http://www.news.bbc.co.uk/nuclear http://www.wwflearning.co.uk/resource-centre/datasheets/energy Natural Economy 0670/02 Oct/Nov. 1999 Question 2(e) Past Paper
5.2	To analyse and discuss the technologies and viability of alternative sources of energy	To advise students to begin by giving a definition of alternative energy sources, stressing replacement for fossil fuels as well as being renewable and sustainable. To recommend that students concentrate their efforts on the six sources named in the syllabus (solar, wind, wave, geothermal, hydro-electric and biomass), studying how the natural	**Environmental Management** pages 29 to 33 Natural Economy 0670/02 May/June 2000 Questions 2(f)-(h) Past Paper Environmental Management 0680/02

AO	Learning outcomes	Suggested Teaching activities	Learning resources
		source is harnessed for energy, where the best conditions for its use exist, and present level of technological development. To suggest that a graph of relative costs can be drawn to show viability. To ask students to answer the question 'Why has uptake of alternatives been so slow? To encourage students to undertake case studies for two alternatives and to make them aware of any opportunities (should they exist) for study of an alternative source used in the home region might, which might allow assessment and comment about its chances for increased future use.	May/June 2007 Questions 2(b)-(e) Past Paper
5.3	To analyse the strategies for conservation and management of mineral and fossil fuel resources	To guide students towards the study of examples of energy efficiency (such as more fuel efficient engines and lights), recycling (referring to examples such as glass, paper, scrap metals and plastics), power from waste (incinerating waste to generate electricity and insulation (isolating the insides of buildings to maintain hotter or colder conditions according to climate). To request students to undertake a survey of energy efficiency in their own homes and to report back their findings. The same can also be done for the nature and extent of recycling in the home region.	**Environmental Management** pages 34 and 35 Environmental Management 0680/02 Oct/Nov. 2004 Question 1(f) Past Paper
5.5	To analyse and discuss the strategies for industrial materials, technologies and approaches which can contribute to solving environmental problems	To advise students of the need to keep abreast of changes and new technologies to solve environmental problems from energy use, from sources such as TV, radio, internet and newspapers. One example is increased future use of hydrogen for powering cars and buses.	**Environmental Management** page 34
	Tectonic Activity		
1.5	To gain knowledge and understanding of the crust/tectonic cycle	To show students a world map of plate boundaries and provide them with an outline map so that they can draw a summary map of their own to show plates, plate boundaries and direction of movement, at least for the continents and oceans nearest to their home country. To demonstrate to students that plates can move in three directions. To ask them to draw labelled sketches to illustrate what is happening along the three types of boundary – constructive/divergent, destructive/convergent and conservative. To study a sequence of world maps for them to identify the similarities between the distributions of plate boundaries, earthquakes and active volcanoes, to emphasise to them the importance of plate boundaries for tectonic activity.	**Environmental Management** pages 36 and 37 **Longman Geography for the GCSE** pages 6 and 7 http://www.zephyrus.demon.co.uk/geography/resources/earth/tect.html Natural Economy 0670/02 May/June 2003 Question 2(a) Past Paper Environmental Management 0680/02

AO	Learning outcomes	Suggested Teaching activities	Learning resources
			May/June 2007 Question 2(a) Past Paper
3.6	To understand the economic aspects and limitations of earthquake and volcanic zones	To demonstrate to students the economic advantages of volcanic zones for farming, energy, minerals and tourism, and the disadvantages of living in earthquake and volcanic zones. Ask students individually to produce two spider diagrams to summarise the advantages and disadvantages of living in volcanic zones; then in small groups to discuss and comment on the relative strengths of them.	**Environmental Management** pages 40 and 41
4.4	To analyse the impact of earthquakes and volcanic eruptions on human communities	To inform students that the immediate, primary impacts of natural hazards like these can be separated from the later, secondary impacts. Suggest to pupils that they analyse them in turn; direct impacts include loss of life and damage to property and infrastructure, later impacts include such as dangers to health and economic dislocation. To encourage student to use the internet to research recent earthquakes and active volcanoes, and to choose one of each as case studies. To provide students with a framework for presenting their case study, which might take the form of information in a fact file, including a sketch map of the affected area, size/scale of the event, its causes and effects.	**Environmental Management pages** 38 to 42 http://www.bbc.co.uk/Pakistanearthquake http://www.mvo.ms Natural Economy 0670/02 Oct/Nov.2003 Question 2 Past Paper Natural Economy 0670/02 May/June 2003 Question 2(b) Past Paper Natural Economy 0670/02 June 1999 Questions 2(f)-(g) Past Paper
5.4	To analyse and discuss strategies for managing the impacts of earthquakes and volcanic activity	Invite students to identify strategies for reducing the impact when an earthquake or volcanic eruption occurs. For earthquakes, these include building earthquake-resistant structures, planning settlements so that land uses are zoned and emergency planning for disaster relief. For volcanoes, monitoring physical changes to the volcano and disaster preparation are important. To lead students into an analysis of human and physical reasons why some earthquakes and volcanic eruptions have greater impacts than others.	**Environmental Management** pages 42 to 46 http:www.georesources.co.uk Natural Economy 0670/02 May/June 2001 Questions 2(a)-(f) Past Paper
	Soils		
2.1	To have knowledge and understanding of the formation and composition of soils	To recommend to students that they begin with a definition of soil and follow this up by drawing a simple sketch to show the three horizons into which many soils can be divided. To make them aware that soils are	**Environmental Management** pages 47 to 49

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		composed of four constituents, namely mineral matter (such as sand, clay and silt from rocks), organic matter (from plant and animal remains), air and water. Advise them to study examples of soils with different textures, such as sandy, clayey and loam soils. To suggest suitable ways, such as pie graphs or divided bar graphs, for showing the differing percentages of sand, clay and silt for soils of different textures. If possible, to lead students into an investigation of an exposed soil horizon in the home area, to include drawing a labelled sketch of its main features.	
2.2	To understand soil as a medium for growth and land use potential	To demonstrate to students the importance of soil texture for affecting agricultural potential, paying particular attention to pore spaces, aeration and drainage, as well as nutrients and pH. To examine the agricultural possibilities of loam, sandy and clayey soils. For those based in rural areas, there is possibility of undertaking a local investigation into the relationship between soil types and types of farming.	**Environmental Management** pages 49 and 50 Natural Economy 0670/02 May/June 2003 Question 2(c) Past Paper
4.6	To analyse and discuss the causes and consequences of land pollution	As a direct link to soils, to advise students to study salination first. Suggest that students begin with a definition and give the range of pH values for saline soils. Then they can be asked to construct a flow diagram to show how cropland can be affected by salination as a result of the over-use of irrigation water in areas with a hot dry climate. For other types of land pollution named in the syllabus, suggest that students use a table to summarise the causes and consequences for each pollution type. To inform them that an outline will suffice, since all will be referred to again under other unit headings.	**Environmental Management** pages 51 to 55 http://www.bbc.co.uk/salinisation/Pakistan Natural Economy 0670/02 May/June 2003 Question 2(d) Past Paper