Teacher's Guide to Environmental Management

A Core Text for O Level and IGCSE

INTRODUCTION

Background to the syllabus and its study

The focus of the Environmental Management syllabus (CIE, O level, 5014; IGCSE 0680) is sustainable development in a world where the Earth's natural resources and life-sustaining systems are being threatened by increased human populations and their growing impact.

The field of study embraced by the syllabus is broad. It draws upon content from more specialized disciplines notably biology, earth science, geography and economics. It begins from the educationally sound premise that it is necessary for students to have some knowledge and understanding of the Earth's natural systems, how they are interdependent and how people use natural resources. These make up the content in the first two columns of the syllabus i.e. Resources and Development. Out of necessity the depth of study needed for each natural system is less than it is in specialist disciplines. Breadth of study is definitely more important in this syllabus than depth.

In the last two columns of the syllabus, Impact and Management, the emphasis switches towards the impact of human development on the environment, and how this can be managed in ways that will allow sustainable development for the future. Important issues, such as resource depletion, and environmental damage and pollution, are covered in the third column. In line with the desire to keep the approach forward-looking, management methods and strategies to change the nature of human development towards future sustainability are given prominence in the fourth column.

Therefore, Environmental Management is concerned not only with the impact of people on the Earth's resources, but also with the patterns of human behaviour necessary to preserve and manage the environment in a self-sustaining way – so that natural resources will be preserved for the benefit of future generations. At the same time it is recognized that humans live with aspirations of an improved quality of life. A major aim is to demonstrate to students that this does not inevitably have to be to the detriment of the environment. For this reason, syllabus content includes results of new thinking in methods to improve output and to manage the environment, as well as to discover alternative technologies.

The syllabus is written in a manner which presents students with a global perspective. Of course, most decisions that affect the environment are taken by individuals at local, regional or national levels. This is why the use of local case studies is encouraged as it is often easier for students to appreciate the nature and seriousness of environmental problems if they have had personal experience of them. It should also make the exploration of the merits and problems of implementing strategies for their alleviation more meaningful, since students are in a better position to understand the varied views of local people and conflicting pressures that arise.

Whenever possible, therefore, local examples should be given priority over examples from more distant places when delivering the syllabus. Activities which rely upon local investigation are included regularly in the main book. Other potential opportunities are suggested in the Further Study sections in this guide. Given the enormous variations in local conditions and differences between places, these cannot be exhaustive. By giving students greater insight into natural systems and environmental issues, it becomes more likely that they can formulate opinions of their own, perhaps ahead of policymaking decisions that affect the environment.

At all times students should be encouraged to think for themselves about environmental and other management issues, and to express their opinions. It is hoped that a study of the Environmental Management syllabus will allow them to do so in a more informed manner. Questions are included among the Activities which invite students to recognize advantages and disadvantages or costs and benefits, before they are asked to choose and justify the viewpoint they agree with most. These mirror the style used in some examination questions. When it comes to marking student answers, what matters most is the strength of the comment and justification and not the viewpoint itself, although some viewpoints are easier to support than others.

The theme of sustainable use and development of the Earth's natural resources runs all the way through the syllabus. Students are encouraged to explore the view that we have not so much 'inherited the world from our parents' but 'borrowed it from our children'. The needs of the present generation should be met without compromising the ability of future generations to meet their own needs.

The amount of information in this book is more than sufficient for students to obtain the top examination grade. When examples which are more recent, local or regional are studied, they should be used in preference to those in the book and not in addition. In answering examination questions students are always allowed the freedom of choosing their own examples to illustrate the theme under study.

Practical skills

Through a study of the syllabus it is hoped that students will develop important personal skills needed for life. Some of these, such as environmental awareness, awareness of different opinions held by others and a willingness to express their own views supported by knowledge and understanding of the issues, have already been emphasized in the section above. The ideal is that students keep an open mind and show a willingness to review and re-appraise their own attitudes in the light of new experiences and future technological change.

Skills of a more practical nature, notably enquiry, presentation and analysis, also feature prominently in this syllabus. For example, students should be encouraged to undertake first hand local investigations, using basic techniques to observe, record and classify primary data. This is similar to what specialist students in biology, geography or earth science are expected to do. Secondary sources, such as newspapers, booklets and internet web sites, are also useful as sources of information and data.

In some examination questions source materials are provided in with the questions. These sources include;

- written information (e.g. a newspaper report);
- tables of data, graphs (e.g. bar, line, pie and pictographs);
- diagrams, maps and photographs.

The first stage in answering usually requires students to identify and extracting relevant information, or to recognize trends and patterns. It is expected that relevant values will be quoted and used to support good answers. Later students can be asked to deduce relationships between the data, and to draw reasoned conclusions. Many of these source materials will contain information about parts of the world unfamiliar to students; they are expected to use their skills and understanding, gained from general study of the topic or from familiarity with similar local examples, rather than knowledge.

Although maps have been appropriately provided with the text, it must be emphasized that teachers and students should have access to a comprehensive, updated atlas, to understand the geographical aspects of this syllabus.

Without a formal check list of techniques of presentation in the syllabus, any technique appropriate for showing relevant data or information can be provided for interpretation in examination questions or used by students in examination answers. Among the Activities are regular opportunities for students to try out their practical skills, by drawing graphs of different types, labelled diagrams, sketch maps and labelled sketches from photographic observation. Students should be reminded about the importance of completing graphs, maps and diagrams accurately and neatly. A title, as well as a key to shading (or colours)

used that matches exactly, are important parts of the finished product. Not all students recognize the importance of this without instruction.

Examples of techniques used in the book are given below; references are for the first appearance only.

A Used in support of the written text:

1. Bar graph:
   - vertical Figure 1.5 page 5
   - horizontal Figure 1.23 page 22
   - divided Figure 2.30 page 79
2. Line graph – Figure 1.15 page 16
3. Pie graph – Figure 1.27 page 25
4. Spider diagram – Figure 1.33 page 30
5. Dispersion diagram – Figure 2.9 page 63
6. Pictograph – Figure 2.15 page 68
7. Star diagram – Figure 2.24 page 75
8. Time line – Figure 2.37 page 84
9. Proportional flow lines – Figure 2.29 page 77
10. Shading (choropleth) map – Figure 4.97 page 255

B Drawn by students in an Activity:

1. Bar graph – Activity 1(b) page 5
2. Spider diagram – Activity 2 page 13
3. Labelled sketch from a photograph Activity 3(a) page 14
4. Line graph – Activity 2(a) page 16
5. Pie graph – Activity 3(a) page 18
6. Dispersion diagram – Activity 1(a) page 67
7. Divided bar graph – Activity 4(a) page 79
8. Scatter graph – Activity 3(a) page 122

Chapter 1 The Lithosphere

This chapter starts from a study of how the natural system works, beginning with the structure of the Earth and the natural processes that operate upon it, followed by a shorter study of elements of soil. The order of approach for the study of separate topics within the Lithosphere mirrors the layout in the syllabus. The separate topics are organized within the units 1.1 to 1.7. In the study of each one, the text works from left to right across and through the syllabus content. It is recommended that a copy of the syllabus should be available for ready reference.

1.1 Basic information about the structure of the Earth and its rocks and minerals is placed in column 1 of the syllabus. Methods of search and extraction for rocks and minerals, and their uses, are part of the content in column 2.

1.2 The focus of impacts of mining on environments and people moves the study of content into column 3. The theme of mineral supply and demand makes its first appearance in column 2; it is then followed through into later columns for the economic implications (in column 3) and environmental conservation schemes (in column 4).

1.3 Fossil fuels are given a separate section to themselves, a reflection of their great significance. Study content in this section goes across the first three columns, beginning with their formation (column 1), search, extraction and production (column 2), and environmental problems that result (column 3).

1.4 Alternative energy sources and strategies for conservation and management of existing fossil fuel resources are from the content in column 4 in the syllabus.

1.5 Plate tectonics is another topic which goes across all four columns, from the cycle of new crust formation and destruction in column 1 to strategies for managing the impacts of earthquakes and volcanic activity in column 4.

1.6 An introduction to the study of soils is focused on formation, composition and usefulness; this is why it makes an appearance only in column 1 in this unit. It is not until the biosphere unit that soil study is extended to cover soil erosion and strategies for soil conservation.

1.7 Causes and consequences of land pollution appears only in column 3 in this unit.

1.8 Renewable and non-renewable resources are the vehicles chosen for summary questions relevant to the lithosphere unit.

UNIT 1.1 – THE EARTH, ITS ROCKS AND MINERALS

Structure of the Earth (pages 2-4)

Syllabus coverage 1.1 and 1.2

Only a brief outline of the Earth's structure is needed as background information. The coverage of the three groups of rock types is more thorough. Emphasis is placed upon different methods of formation. Students are encouraged by the use of photographs so that they can recognize differences between rock types in the landscape by observation. The Information Box is important and can be used to place the Lithosphere in context both for the Earth's natural systems and the study of the syllabus content that follows.

Activities

Activity 1 is a summary exercise for which students are expected to select key pieces of information from the text; the use of the table format is suggested to give a clear visual summary. Activity 2 is broader in its scope and requires students to explain and think about the importance of the Earth's crust and the resources it provides for human activities.

Further study

Students should be encouraged to discover and name the types of rock found in the local area. Which are the main types of rocks? How and when were they formed? Are they the same as those found in other parts of the country? Practical work could involve drawing a field sketch of a local rock outcrop and adding labels to show its main characteristics. Rock samples can be collected, labelled and displayed.

Distribution, types and reserves of major minerals (pages 4-5)

Syllabus coverage 1.3 (except fossil fuels)

Basic background information is given about types of minerals and the areas of the world in which major concentrations of minerals are found. The point to emphasize from the study of Figure 1.4 is that commercial concentrations of minerals are very unevenly distributed throughout the world, with significant concentrations in old shields (for example, the Canadian Shield), old plateau blocks (for example, much of Africa) and in certain young fold mountain ranges (for example, Andes and Rockies). Students should be asked to comment on the relative importance of their home region for mineral production.

Activities

Activity 1 is focused on Africa, a mineral rich and commercially important continent. As an alternative in part (a), another world region could be substituted

or a national map showing minerals could be used instead. Part (b) is a skills exercise; when assessing student graphs, look for labelling of axes, accuracy of completion of bars and good appearance, plus the inclusion of a title. Activity 2 encourages study at the national level. Since opportunities for answering are greater in mineral-rich countries, it may be desirable to broaden out the area of study to a regional or continental scale.

Further study

Activity 2 provides the main opportunity here.

Methods of search and extraction of rocks and minerals (pages 6-8)

Syllabus coverage 3.1 (except fossil fuels)

The text, supported by sketches, focuses upon the differences between opencast and deep mining as methods of mineral extraction. The point worthy of most emphasis is that opencast mining has many economic advantages over deep mining, notably ease of discovery and cheapness of extraction.

Activities

Activities 1 and 2 develop the main focus as stated above. Activity 3 requires more detailed observation of the sketch which shows a modern mine. There is also the invitation for students to think about, and in some cases use knowledge of, working mines much older than this one, which are far more common. Activity 4 again allows the inclusion of a local element, likely to be closer to the student's direct experience.

Further study

Activity 4 provides the opportunity. If resident in a mineral-poor country, a wider view may need to be taken of what is meant by the 'region'; if resident in a mineral-rich country, information booklets may be available from the mining company which can be used as source materials, or there may be the possibility of arranging a visit to the mine.

Uses of rocks and minerals in industrial processes (pages 8-10)

Syllabus coverage 3.2 and 3.8

References to the general uses of common rocks are supplemented by the use of limestone as a specific example. The latter was chosen because of its widespread distribution and varied uses. Should limestone not be present in your country, it may be useful to ask students build up a diagram of uses, as in Figure 1.9, for another type of rock. A similar approach is followed for a varied range of minerals in the next part. In the final section students are introduced to the importance

of minerals for the growth of manufacturing industry and associated economic growth and development. Check that students understand the key terms in the Information Box, which will be used again later in the book.

Activities

In Activity 1, information is supplied for student answers for limestone and iron, but some individual research will be useful for supplementing the answer for the mineral of the student's choice. Activity 2 gives another opportunity to apply the general information to the student's local area and country.

Further study

Opportunities for local investigations are explored in Activity 2.

UNIT 1.2 IMPACTS OF EXPLOITING MINERALS AND ENVIRONMENTAL CONSERVATION

Impacts of mining on environments (pages 10-12)

Syllabus coverage 4.1

The waste heaps created by mining were mentioned in passing on pages 6-8. The text covers the three types of pollutio

n from mining – land, water and air. Students should be encouraged to think about, as well as explain, why mining is allowed in National Parks and why mining companies often do little to reduce the environmental impacts of their operations. The Exam Watch box should be used to advise students about the careless use of a 'buzz word' like pollution, which should always be qualified as to type, especially in examination answers.

Activities

The purpose of Activity 1 is simply so that students can identify and be aware of land, air and water pollution in connection with the comment made above. Development of the answer follows in Activity 2. Students need to convert information from the written form into labelled sketches; this allows practice of another type of skill. Activity 3 can have a more discursive element to it. Although some information that is directly relevant is given in the text, there is more of an opportunity for students to vary the emphasis according to their own views about this.

Further study

If resident in a mining area, there may be fieldwork opportunities for students to observe and / or measure one or more of the types of pollution caused by mining. Alternatively, if there is national issue about obtaining mining rights in a National Park or elsewhere, this would offer opportunities for fuller investigation. It may

be possible to construct a short questionnaire to residents about the impacts (good and bad) of mining in anticipation of the next section of study.

Impacts of mining on people – negative and positive (pages 12-14)

Syllabus coverage 4.1

While environmental impacts from mining are almost invariably negative, an attempt is made to give more balanced coverage between negative and positive impacts on people in line with the comment made in the Exam Watch box. There is also an opportunity here to emphasize differences between environmental, economic and social impacts and check student understanding of these three key words used in examination questions.

Activities

The main purpose of Activity 1(a) is to make students look more carefully at a map and describe locations as part of a pattern or distribution. Part (b) requires selection from the text of economic benefits alone. The spider diagrams used in Activity 2 encourage the labelling of positive and negative impacts of mining in a summary form so that they are easy to see. Activity 3 invites students to consider the varied reactions from local people which inevitably exist when proposals to begin or extend mining or quarrying are put forward. Parts (a) and (b) are included to give a context, as well as allowing practice of student's observational skills.

Further study

If no local, regional or national mining issue exists that can be investigated by students, an issue of greater international concern could be a focus for investigation, such as proposals by the US government to allow new explorations for oil and gas in environmentally sensitive Alaska.

How supply and demand affects mining (pages 14-16)

Syllabus coverage 3.5

The role of the different factors named in the syllabus is summarized in Table 1.3. A check should be made that students understand the geological terms of folding and faulting (shown and used later in Figure 1.16). In the text which follows an attempt is made to highlight and explain the factors important in the syllabus, such as fluctuations in world prices.

Activities

For Activity 1 students are required to study Figure 1.16 and interpret where mineral exploitation would be most and least likely to occur depending upon geological structure. Example C is the only one where opencast mining is possible

(refer back to pages 7-9). Faulting in A and folding in B create geological problems for mining. Students could discuss whether it is the faulting or the folding which will cause the greater problems for mining. Part (a) of Activity 2 is a practical skills exercise. A line graph is an appropriate technique for showing this data because the gold price is an example of 'continuous data' – there is always a current selling price for gold which the line can show. Changes in price over time can be followed by the line going up and down on the graph. A line shows frequent variations with greater accuracy and in more detail than a bar graph. (Temperature, page 48 is another example of continuous data). Part (b) expects students to think about the advantages and disadvantages of changing oil prices, before the study of fossil fuels begins.

Economic consequences of overexploitation of mineral resources (page 17)

Conservation of environments damaged by mining (pages 17-18)

Syllabus coverage 4.2 and 5.1

Fossil fuels are introduced here; there are links back to reserves of minerals (pages 4-6) and to methods of mining (pages 6-8). For the first time the content moves to coverage of what is included in the fourth column of the syllabus, human action on the lithosphere, as the focus is switched to conservation schemes for environments damaged by mining. Some of the key terms named in the syllabus are highlighted or given special mention such as landscaping, restoration, reclamation and waste. It is essential that these terms are known and understood by students, because they may be used in examination questions.

Activities

In Figure 1.17 years for the life expectancies of coal, oil and gas are given, which means these can be used as the basis for drawing a graph. The type of graph most likely to be chosen by students in answers to Activity 1(a) is bar graph, but there are other possibilities (such as a pictograph). One of the reasons for setting this question is to demonstrate to students that there are alternative ways of showing the same data, which should be used for variety and according to visual effectiveness for the data shown. Activity 2 is included because of the importance attached to student understanding of key syllabus terms (mentioned above). In Activity 3 a practical skills exercise is followed up with the need for students to give some thought to the possible environmental consequences of different methods of waste removal.

Further study

It would be ideal if data similar to that given for the UK could be obtained for your country, or even for a city or region within it. Direct comparisons would then be possible, opening up the way for comment about similarities and

differences between methods of waste disposal used in different places. Even if mining in the local area or region is small scale or finished some time ago, there are still likely to be opportunities for observation and study of land uses on areas previously affected by mining – and a chance to discover whether any schemes of conservation are used.

UNIT 1.3 FOSSIL FUELS AS SOURCES OF ENERGY

Fossil fuels; formation, search and extraction (pages 19-21)

Syllabus sections 1.4 and 3.1

A definition of fossil fuels is followed by explanation of their formation; emphasis is placed upon similarities between the three fuels. Detail about search and extraction represents no more than an extension from the same section for minerals on pages16. What is new are the different methods of extraction for liquid oil and natural gas compared with those already described for obtaining solid minerals such as coal and iron ore.

Activities

The main theme which runs through the activities is similarities and differences between the three fossil fuels in terms of formation, search and extraction; as the student progresses through the five activities, increased levels of thought and interpretation are required.

Types of energy production (pages 21-24)

Syllabus sections 3.3 and 3.4

Published data is almost invariably only for the commercial types of primary energy shown in Figure 1.22; this is why some information about biomass, which is of great importance in some developing countries, is added. In order to aid student use of Figure 1.22, it may be helpful to explain the meaning of the units used in the graph – 'million tonnes of oil equivalent' (i.e. the amount of energy obtained from using other fuels equivalent to that produced from burning a tonne of oil). This unit is used so that direct comparisons in production and consumption can be made between different energy sources. Nuclear power is mentioned for the first time. A world map is used as the basis for naming and showing the locations of the world's top ten coal producing countries. The great importance of coal in earlier periods of industrial growth and for electricity production today needs emphasis.

Activities

The purpose of the two questions which form Activity 1 is to focus students upon the two key points shown in Figure 1.22 – that world consumption of energy

is increasing (it increased by just under 3 000 million tonnes of oil equivalent from 1982 to 2002) and that the world overwhelmingly depends upon fossil fuels for its energy (amounts or percentages can be stated from the graph by students). Activity 2 introduces students to biomass, to which more references will be made later in the book because of the environmental effects from the collection of firewood. Under Activity 3, only two countries, Japan and South Korea, are shown to be great consumers and unimportant producers. To find the best answers in parts (c) and (d) students need to compare the values given for coal production and consumption. The greatest excess of production is in Australia, which makes this country the best answer to part (c). India, Japan, Germany and South Korea are the coal importing countries in part (d).

Energy production and patterns of global trade (pages 24-26)

Syllabus sections 3.4 and 3.7

The main focus in this section is on production and trade in oil, easily the most widely traded energy source. In this context the Middle East is the most important world region in terms of both current output and reserves. Students can be asked to identify countries located in the Middle East from the table below Figure 1.26. The Middle East is the world region with the greatest excess of production over consumption (Figure 1.27). In the study of Figure 1.28, students should be advised to look first at the Middle East, the main supplier to countries in the developed world, and follow the lines outwards from here.

Activities

These provide statistical support for the key theme outlined above by using the pie graph data in Figure 1.27, and the world map information in Figure 1.28. In Activity 3 additional data is provided for world reserves of oil. The practical skills exercise is followed by the opportunity for students to write about, and demonstrate understanding of, the great importance of the Middle East for world supplies of oil both now and in the future.

Further study

Undertake an investigation of home country oil production and use. Is any oil produced in your country? If it is, where is it produced? Is any oil imported? If yes, from which countries is it imported? Overall, how important is Middle East oil to your country? The investigation could be extended to neighbouring countries. Are their circumstances similar or different with regard to oil production and import?

Environmental problems from energy production (pages 27-29)

Syllabus sections 3.3 and 4.3

Table 1.5 is a summary of environmental problems for all stages in energy production and use. This is only an outline, but students can be asked to recap elements related to mining already covered earlier in the chapter. More details about environmental problems from transportation and use will follow later in the book in the hydrosphere and atmosphere units. The text here focuses on nuclear power and develops the key syllabus theme of how the environmental effects of nuclear power are different from those of fossil fuels.

Activities

Activity 1 is about the production of nuclear power and the key point that most is generated in the developed world. In (a) most students are likely to choose to use a pie graph; an alternative method is the divided bar graph. Showing the percentages in separate bars is valid as well, but it is less effective for showing percentages when the total adds up to 100%. It is good practice to make students aware that alternative methods of presentation can be chosen and used. In Activity 2 good students can be expected to comment on, and express views about, both types of power station; some might use the index to discover additional information about environmental problems referred to in part C of Table 1.5.

Further study

Make an investigation into types of electricity production in the home country, to include relative importance of different types and reasons, as well as the environmental problems caused.

UNIT 1.4 ALTERNATIVE ENERGY SOURCES AND OTHER CONSERVATION STRATEGIES

Alternative energy sources (pages 29-31)

Syllabus section 5.2

Brief reference is made to the six examples of alternative energy sources named in the syllabus; outline details of new technologies, which have allowed some alternatives to be used more than others, are included. The general advantages of alternatives over fossil fuels are presented in Figure 1.33. The disadvantages listed in the same Figure should help student understanding of why development and use of alternatives has been slower than many environmentalists would have wished for.

Activities

Activity 1 is in part a recap to ensure that students do understand the meaning of these key terms in the study of energy supplies. For Activity 2 students can be advised to use a table lay out, with assessment factors listed on the left and columns for their own assessments on the right. (This will make it possible to add the assessments for the other alternative sources named in Activity 1(a) page 42.)

Further study

Activity 3 allows the national situation with regard to alternative energy sources to be explored by students.

Examples of alternative energy sources (pages 31-33)

Syllabus section 5.2

Further detail is given about HEP, wind and geothermal power, chosen because they are the most widely used of the alternative energy sources. (Also they have links to other syllabus sections (HEP – Hydrosphere; wind – Atmosphere; geothermal – Plate tectonics.)

Activities

In Activity 1, information in the text will allow students to make more meaningful and accurate assessments of these alternative energy sources, and these can be compared with earlier assessments. Students can be asked to compare their assessments with those of other class members; differences in student assessments could form the basis for a class discussion about the merits of different energy sources. The main message from Figure 1.36 in Activity 2 is that alternatives are still more expensive than fossil fuels; it also helps to explain why hydro and wind are in more widespread use than the others. Activity 3 gives the opportunity for students to take more of an overview with respect to energy sources in their own country, drawing partially upon answers already given to previous activities.

Further study

Activity 3 completes the study of energy sources in the home country. It could also be useful to keep a record (say once a month) of the world price of crude oil. In 2004 it moved up into a higher price range and shows signs of staying at these new levels in 2005. What will be the effects on the development of alternatives if the oil price remains high? Will it just lead to a rash of new oil explorations in more difficult environments, some of which are environmentally sensitive?

Strategies for conservation and management of fossil fuel reserves (pages 34-35)

Syllabus section 5.3

General comment, which rounds off the section on alternative energy sources, is followed by references to the energy saving strategies named in the syllabus. Of these, increased efficiency in use, plus recycling and re-use, are given the most prominence. Many students believe that 'increased efficiency in energy use' and 'reduced energy consumption' are exactly the same. One example commonly used by students for increased efficiency in energy use is people giving up travel by car in favour of public transport. However, increased efficiency is a more specialized term. The student example above will lead to reduced energy consumption, but cars need to be developed which travel more kilometres per litre of fuel used for energy efficiency to be achieved.

Activities

Much of the content needed by students to answer Activity 1 is provided, but the wording of the question invites students to make use of their own knowledge and family experiences as well. In Activity 2, although Japan is the only developed country, there are plentiful differences between the three developing countries to allow meaningful answers to be given to parts (b) and (c).

Further study

Research the same statistics for either your home country (if not already given) or for another developed country (for example, USA or one of the EU countries). Investigate whether there are similarities between developed and developing countries as well as differences.

UNIT 1.5 PLATE TECTONICS

Tectonic activity (pages 36-38)

Syllabus section 1.5

This provides the essential introduction to plate tectonics by showing the Earth's main tectonic plates on a world map, and by naming, illustrating and describing what happens at the three types of plate boundary. Figure 1.40 is placed below the world map of plate boundaries to show the almost perfect coincidence between these and the occurrence of earthquakes.

Activities

The purpose of Activity 1 is to reduce the world scale to that part of the world in which the student lives and has greater familiarity – to make it more manageable. Note that the syllabus does not require student knowledge of the world pattern of plate boundaries. The emphasis is upon student understanding of what can

happen along different plate boundaries, which is highlighted by Activity 2. Activity 1(b) draws attention to the main example of a conservative boundary in the world, the one between the North American and Pacific plates. By asking students to undertake a practical activity in the first two parts of Activity 3 it is hoped that students will realize the closeness of the relationship between plate boundaries and earthquakes. The final part of this activity brings the student's attention back to their own world region.

Further study

Activities 1 and 3 require study of the likelihood of tectonic activity affecting the student's local area / world region. A sufficiently large area should be studied so that areas with different levels of risk are covered.

Earthquakes and their impacts on people (pages 38-40)

Syllabus sections 1.5 and 4.4

Further information about earthquakes and how their strength is recorded is followed by their impact on people. Students are introduced for the first time to the headings primary and secondary effects, which are often used when examining the effects of natural disasters on people. Students were previously advised to look for both positive and negative effects to satisfy the full need of questions asking for 'impacts on people'; this is why an explanation is given at the end of the section as to why this 'good advice' has not been done in this case.

Activities

Activity 1 is a skills exercise for students to show understanding of the graph (Figure 1.42). The information which forms the basis for answering Activity 2(a) is supplied in Table 1.8; answers should begin with little damage for magnitude 4.5 and progress to much damage for 6.5 and widespread serious damage for 8.5. Good students can be expected to use the text to suggest types of damage likely to occur. In part (b) students are required to apply general statements to the particular example of the Turkish earthquake; there does appear to be the expected widespread damage, although some of the buildings can be seen to have withstood the impact of what was a major earthquake.

Further study

Use another example of an earthquake, either local or more recent. It is likely that the major earthquake in Indonesia, which caused the Asian tsunami at the end of 2004, will be remembered for several years and will form an obvious choice for further study. It is often helpful to provide students with headings, so that when they undertake their own investigations, more of them are likely to home in on the key details useful for a case study question in an examination. It should help to stop students writing down a mass of detail which they will never be able to reuse. One example, with headings in bold, is shown below.

Earthquake in Indonesia – December 2004

- Location

  Epicentre off the west coast of the island of Sumatra in NW Indonesia.

- Strength

  Magnitude 8.9 on the Richter Scale.

- Area affected

  Direct effects in neighbouring Sumatra.

  Tsunami (giant sea wave) created by the earthquake shocks greatly affected all coastlines around the sides of the Indian Ocean; its effects reached the coast of East Africa about 4 200km away.

- Impacts

  Loss of life – up to 300 000, with most in Indonesia and many in Sri Lanka, India and Thailand.

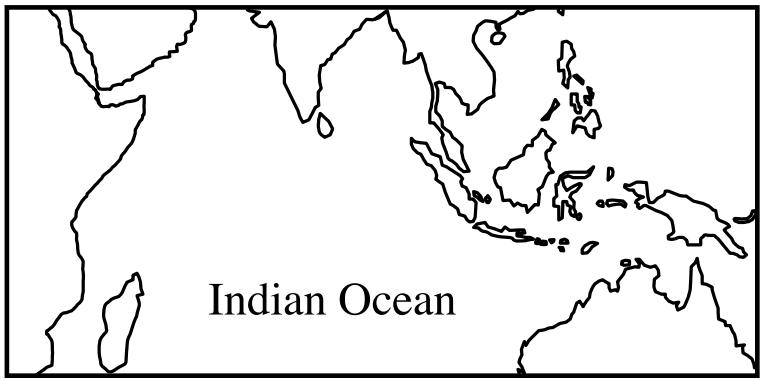
  Numbers made homeless – over 2 million people.

  Damage – great destruction of properties in coastal areas (homes, hotels, fishing villages and boats).

  Primary effects on people – shortages of fresh water, shelter and food; great danger of the spread of diseases such as cholera.

  Secondary effects on people – economic livelihoods taken away; farmland ruined by salt and flooding; collapse of fishing industry due to damage to harbours, boats and equipment; coastal tourist resorts destroyed and many jobs lost.

Additionally an outline map of the region could be provided similar to the one below.



Students can be asked to show number of deaths by country, either simply by numbers or in a more graphic manner by drawing separate bars proportional in length to the number dead. The latest estimated figures for numbers dead and missing (presumed dead) as of February 2005 are (approximately);

Indonesia 150 000; Sri Lanka 50 000; India 30 000; Thailand 7 000; Maldives 100; Malaysia 80; Burma 100; Bangladesh 2; Somalia 200; Tanzania 10

Students can then be asked to describe and explain the pattern shown on the map.

It should be noted that the specialist term 'tsunami' is not included in the syllabus so that there can be no requirement to explain its formation in examination answers. However, it may be useful as good educational practice and as an aid to student understanding of this earthquake's enormous impacts. The relevant parts of the syllabus are about why the earthquake happened and its impacts on people.

For all recent large earthquakes an internet search engine will help students to find web sites containing useful information. For example, BBC News kept updating its website on the impacts of the Indonesian earthquake. The February 2005 update was at http://news.bbc.co.uk/2/hi/in_depth/4126019.stm.

Volcanoes – economic uses and impacts on people (pages 40-42)

Syllabus sections 1.5 and 4.4

It is possible to give a more balanced coverage between positive and negative impacts for volcanoes compared with earthquakes, because volcanoes are often useful to people living in the surrounding area. The point to emphasize is that volcanic soils are some of the world's most fertile, which is the principal reason why some 500 million people continue to live in areas at risk from volcanic activity. However, sometimes volcanic activity is so strong and prolonged that residents are forced to move, as the example of Montserrat demonstrates.

Activities

Within Activities 1 and 2 are opportunities for students to refer to both positive and negative impacts. Montserrat is used as a case study in Activity 3, while Activity 4 requires students to comment on different reactions of people living in the island to the damaging eruption.

Further study

A more local or recent volcanic eruption can be studied using newspapers and the internet as sources, in a similar manner to that suggested for earthquakes.

Strategies for managing the impact of volcanoes and earthquakes (pages 42-44)

Syllabus section 5.4

These are given separate coverage because it is possible to monitor volcanoes in populated areas and often (but not always) there are warning signs of increased activity. Earthquakes are impossible to predict, and therefore for people living in areas close to plate boundaries preventive measures against damage to property and loss of life are the only options. Information contained in Figure 1.51 and Table 1.9 show that there is not necessarily a relationship between earthquake magnitude and loss of life.

Activities

Activity 1 develops further the previously used case study for Montserrat. Activity 2 emphasises to students how tall buildings can potentially be 'made safe', although in earthquake zones where building techniques are not advanced the local custom is usually to build low. Activity 3 derives from the presence of notices for guests in modern hotels in earthquake-prone locations, 'What to do in an earthquake', which give instructions such as

- Use the emergency stairways
- Do not use lifts
- Do not smoke
- Leave the building as quickly as possible
- Assemble in an open space
- If you cannot leave your room, stand under the door frame or lie under the table

Further activities

If you live in an area with an earthquake risk, students can investigate the preparations made and emergency procedures in place, as well as their adequacy. Questionnaires can be distributed to a sample of local people to discover their levels of awareness about the earthquake risk.

Example – Earthquake in Bam in December 2003 (pages 45-46)

Syllabus sections 1.5, 4.4 and 5.4

Different types of content are included such as maps showing location and position in relation to plate boundaries, text about damage and loss of life and a newspaper report in which the reasons for the high death roll are analyzed. Of course, the total amount of detail provided is greater than can ever be used in an examination answer at this level. Therefore students need guidance to select the key points (see 'Earthquake in Indonesia' example above).

Activities

Activity 1 invites students to apply their general knowledge of tectonic activity to this particular event (as they may be required to do in an examination). Activity 2 is about impacts of this and future earthquakes in Iran, where the level of earthquake management and readiness is low (and similar to that in many other developing countries). Activity 3 gives an introduction to the need for aid after a natural disaster, a topic which will be covered more fully in later units. Activity 4 represents a summary for the whole section on earthquakes; students should be advised to look through the previous pages for ideas for answering and supporting information.

Further study

After a major earthquake or volcanic eruption students can investigate from media reports in newspapers and on websites whether the loss of life could have been less than it was.

UNIT 1.6 SOILS: FORMATION, COMPOSITION AND USES

Elements of soil (pages 47-49)

Syllabus section 2.1

This is an outline introduction to the study of soils. Students are introduced to the soil profile and its constituent horizons. No soil type is specified in the syllabus for study which is why only brief details are given of one type, latosol, as an illustration. Leaching is an important soil process, of relevance in later units notably the biosphere; therefore it has been given its own Information Box and diagram (Figure 1.57) to show how the process works. The final section is devoted to the composition of soils.

Activities

Activity 1 introduces students to the soil profile, with a particular emphasis on the top soil, which is the most significant part for human activities. The theme of soil fertility, what helps and what does not, is stressed in Activity 2. Activity 3 suggests a local fieldwork investigation which may be possible even within some urban locations, such as a road cutting.

Further study

Activity 3 gives the opportunity for further study.

Mineral particles, soil texture and farming opportunities (pages 49-51)

Syllabus section 2.2

The first section covers other soil characteristics; the emphasis is upon ways in which they are helpful to plant growth. Farming opportunities in the second part follows on naturally from coverage of basic soil characteristics. The great importance of soil for life on Earth forms the conclusion.

Activities

The purpose of Activity 1 is to give students an opportunity to show that they understand the meaning of key terms used in the study of soils (and for teachers to check that they do know). Part (c) of this activity and part (b) of Activity 2 incorporate the farming element, which becomes more significant in later units; it forms part of both the atmosphere and biosphere units. The pie graph is the obvious choice of method in 2(a), although a divided bar can also be used. Separate bar graphs should be regarded as a less good choice because the percentages here add up to 100. Activity 3 suggests a local investigation to anticipate work to follow in later units.

Further study

In the syllabus, the 'Elements of Soil' unit is unusual in that it does not extend through into the second column (about how people use natural resources). Instead farming activities, which are more dependent than any other activity on soil as a natural resource, are listed under 15.4 in Atmosphere and 22.1 and 22.2 in Biosphere. However, sometimes it is good practice for students to work ahead, which is why Activity 3 was included – a study of the importance of soil at the national scale. The same could also be done at a wider regional scale.

UNIT 1.7 CAUSES AND CONSEQUENCES OF LAND POLLUTION

Land pollution from farming (pages 51-53)

Syllabus section 4.6

This section concentrates on pollution caused by farming, with a particular emphasis on salinization, an increasingly widespread problem in arid and semi-arid areas which have been reclaimed for farming by irrigation.

Activities

Activities 1 and 2 require use of the written text for answers to part (a); a demonstration of greater student understanding is needed in (b). Activity 3 suggests another opportunity for local investigation should suitable rural areas lie within easy reach.

Further study

Activity 3 gives one suggestion for further study.

Land pollution from industries and urban areas (pages 53-55)

Syllabus section 4.6

This section focuses on those types of land pollution more widespread in urban and industrial areas. The concentration is upon the three types of waste named in the syllabus at this point, namely domestic, toxic and nuclear. To round off this section, Pakistan is used as the basis for a short case study, a suitable choice because of the range and severity of land pollution problems in the country

Activities

In Activity 1 students are mainly required to select appropriate content from the text. In part (c) there is a switch towards how the impact of these problems can be reduced. (Please note that strategies for reduction will be covered more fully in later units where these problems reappear in the syllabus). Activity 2 is another suggestion for local investigation, this time at a national scale.

Further study

Activity 2 can be the starting point. The focus could be the local urban area instead of the country as a whole.

UNIT 1.8 RENEWABLE AND NON-RENEWABLE RESOURCES (PAGE 55-56)

Questions and issues

This acts as a summary for the unit as a whole. Renewable and non-renewable are key terms. Without a clear understanding of the difference between them, students cannot appreciate how sustainability, the key syllabus theme, can be achieved. Separated out in Figure 1.70 in the centre circle is a list of natural resources that are renewable, provided that they are not over-exploited and abused by humans. From the coverage in Unit 1, students have fossil fuels and minerals to provide the content in their answers. It will be possible to keep referring back to Figure 1.70 during the study of subsequent units, as other resources listed here are studied – for example, over-exploitation of fresh water supplies on land, and fish stocks in seas and oceans in Unit 2.

Chapter 2 The Hydrosphere

The same approach to syllabus coverage is followed as was used for Chapter 1. Although water on the land and water in the oceans receive separate study, the order of approach is similar in both.

2.1 The water cycle in column 1 in the UCIE O level syllabus is followed through into column 2 for variations in water availability and competition for fresh water supplies.

2.2 This concentrates on content from column 2, focusing upon collection and control of water for a variety of uses. There is an extension into the third column for contrasts in water availability between places.

2.3 The content is again taken mainly from column 2; reference to the causes and effects of flooding and drought is supported by the case study of flooding in Bangladesh.

2.4 The theme is water pollution; causes and consequences are taken from column 3, while strategies for pollution control come from the fourth column.

2.5 The topic of water-related diseases is introduced in column 3 and carried forward into column 4. Greater depth of study is provided by the case study of malaria.

2.6 Basic information about life, resources and currents in the world's oceans is taken from column 1. A brief section on factors which limit full exploitation of ocean resources is drawn from column 2.

2.7 The theme of world ocean fisheries is picked up first in column 2, then it is carried through into column 3 for overfishing and its consequences; finally it reaches column 4 and strategies for sustainable harvesting.

2.8 As with water pollution on the continents, marine pollution is flagged up first in column 3 and continued into column 4 for pollution controls and remedial action.

2.9 The case study of the Southern Ocean cuts across syllabus columns, since it includes references to natural resources, resource exploitation, implications and management.

UNIT 2.1 THE WATER CYCLE AND WATER AVAILABILITY ON EARTH

Water on Earth (pages 58-60)

Syllabus section 6.1

The first point that is emphasized is that fresh water makes up only a tiny percentage of the water on the Earth's surface – and that much of this fresh

water is not readily available for human use. Water is, therefore, a more scarce resource than the majority of students are likely to have realized. In the section on the water cycle which follows the focus is upon processes to give students knowledge and understanding of terms which will be used many times in this and subsequent units.

Activities

The pie graphs required in Activity 1 will give a visual summary of the percentages in Figure 2.2 and the Information Box. It should help to highlight the main message that fresh water supplies potentially available for human use are limited. Activity 2 furthers knowledge and understanding of water cycle processes.

Further study

Undertake an investigation of the different water stores in the student's home country – their locations, sizes and relative importance.

The role of water within ecosystems (pages 60-62)

Syllabus section 6.3

After a brief introduction to the concept of ecosystems, (which is used much more widely later in the Biosphere unit), students are introduced to the great importance of water in enabling life on Earth and its diversity. In the study of ecosystems a key theme to emphasize is interdependence between different elements within the system. The last section illustrates this by showing how changes in the vegetation cover affect the operation of several water cycle processes.

Activities

Activity 1 stresses the importance of water for plant growth. In Activity 2 some simple data is provided to exemplify how runoff, a physical process in the water cycle, is affected by human changes in land use. Students are most likely to draw a bar graph in (a); this should provide a visual emphasis of the size of the differences. When explaining in (b), students are required to apply general comment to a particular example. This should give a good indication of individual levels of understanding.

How natural availability of water varies from place to place (pages 62-64)

Syllabus section 6.2

The amount of precipitation is the main physical control on water resources potentially available for use in a country or region. A summary map of world annual precipitation is provided in Figure 2.8. Countries with the world's highest and lowest renewable annual fresh water resources are shown in Figure 2.9; their locations are commented upon in the accompanying text. This may be the first

time that the majority of students have seen a dispersion diagram; they might need to be introduced to this technique of presentation. A second world map, Figure 2.10, showing world water scarcity was drawn up by the UN taking factors other than just annual renewable water sources into account; a composite index was used based upon current use, reliability of water supply and national income as well. It is useful as an indication of the likelihood of a country suffering from water worries or 'water stress'.

Activities

Examination students usually face difficulty interpreting the main features of the pattern on a world map such as Figure 2.8; often it appears that they do not know where to start. For the first stage it can be best to identify highest and lowest. By asking students in Activity 1 to show the locations of countries named in Figure 2.9 on a world map, they should be in a better position to describe and explain differences between the national extremes for freshwater resources. Activity 2 enables the national and regional situation to be examined within the global perspective.

Further study

Activity 2 gives the lead. Opportunities for extension investigations, such as exploiting new sources as well as any economic, social or environmental issues arising from this, are likely to exist more for students living in countries / world regions that are water-poor.

Competition for water supplies (pages 64-71)

Syllabus sections 8.2 and 8.3

The text moves away from physical availability towards human need for water resources and resulting mismatches between supply and demand. Students could be asked to study Figure 2.9 and Table 2.2 and comment upon the extent to which the water-rich and water-poor countries are shown to be the same for the two types of data. Most of the text relates to how water-poor countries obtain their much-needed water supplies – from aquifers, surface rivers with sources in other countries and desalination plants. Towards the end there are references to water supply as a growing international issue as competition for a scarce resource increases, especially in the world's arid regions.

Activities

Figure 2.9 gives the lead for students to follow in drawing their own dispersion diagrams in Activity 1(a). After identifying Africa with one other continent such as South America (for water-rich) and Asia (for water-poor) in (b), students will be better placed to explain in (c) why water resources are unevenly distributed in the world. This is one of the themes running through this part of the unit. Saudi Arabia features in Figures 2.9, 2.11 and 2.12, as well as in Tables 2.2 and 2.3.

Content is adequate for answering the questions set, although more able students can still be encouraged to extend their answers by investigating other sources. Bear in mind, however, that the amount of content needed for a case study examination answer is restricted. Figure 2.11 is the most obvious (but not the only) source, from which students can obtain data to draw graphs and diagrams as illustrations for their answers. Examples of suitable graphs include bar graphs for precipitation and water demand, and any one from pie graph, divided bar graph and pictograph for percentage use of water by sector.

Further study

The same or similar headings as in Activity 2, (a, b, c, d) can be used for a case study based on the home country, or for another country instead of Saudi Arabia. Providing students with headings in advance of undertaking investigative work usually increases the quality of the final report.

UNIT 2.2 USES OF FRESH WATER AND WATER SUPPLY

Uses of fresh water (pages 67-69)

Syllabus section 8.1 (water use)

After a brief reference to the global picture, which is one of persistently rising water consumption, water uses are classified under three headings – domestic, industrial and agricultural. There are striking variations in the relative importance of these three between countries, as well as in amount of water consumed per head. As with most of the Earth's resources, consumption rates tend to be higher in countries of the developed world.

Activities

Activities 1 and 2 develop the themes of increased water use and differences in water uses between countries; both follow a similar pattern of presenting data first, followed by some description and use of the data. Activity 3 could be amended to focus upon a comparison of the home continent with others. Activity 4 brings down the scale to a personal level and encourages students to consider their own family's water consumption levels.

Further study

Undertake an investigation of water supply in the student's home town or village. Each member of the class could be required to complete a spreadsheet or questionnaire about water uses in their family; class data could be collated and similarities and differences commented upon.

Water supply from natural stores (pages 69-72)

Syllabus section 8.1 (water supply)

Rivers fed by heavy precipitation and snow melt in high mountains and aquifers are the two stores for most of the world's water supplies. How aquifers are formed is explained first. Then examples from Australia and India are used to illustrate how rivers can be used for water supply in dry zones of countries.

Activities

Activity 1 is an exercise to check student understanding of where and why water can be obtained from underground. Activity 2 asks students to focus upon water supply in the home region. If students live in an area without significant water supply problems, an alternative suggestion would be for students to use the India Rivers Interlinking Plan as a case study, for which the following guidance might be useful for organizing the work.

a) Labelled sketch map showing outline details of the plan
b) Explanation – why it is needed
c) Spider diagram showing disadvantages
d) Alternative suggestions – are they more environmentally friendly?

Further study

Ideas can be developed from those suggested for Activity 2.

Human stores for water supply (pages 72-75)

Syllabus section 8.1 (water supply)

The focus here, upon building dams for water supply, is narrower. A special study is made of the Three Gorges Dam in China; after this the advantages and disadvantages of building large dams are examined in a more general manner.

Activities

Activity 1 at first draws directly upon given information before students are required to think about advantages of small dams. Activity 2 requires student observation in relation to site requirements for building a large dam. Activity 3 focuses on policies to alleviate the negative effects of large dams. Activity 4 suggests useful headings to be used for a case study of a different dam, perhaps one in the home country or world region, with which students are more familiar.

Further study

The opportunity is to further investigate given in Activity 4.

Contrasts in availability of water between places (pages 75-76)

Syllabus section 10.2

The earlier study of differences in fresh water availability between countries is extended to examine the wide variations in access to clean water and sanitation within and between countries. The focus is upon developing countries and rural regions, where lack of access is a major issue. Note that the example of the Punjab is followed up later on page 85.

Activities

In Activity 1 bar graphs will highlight the size of the differences between developed and developing countries. Labels around the spider diagram in Activity 2 will provide the summary reasons to explain the poor provision in some areas of the world. The example of the Punjab can be used as an illustration of poor provision in Activity 3. Students should reach the conclusion in Activity 4 that Figure 2.28 shows that sanitation in developing countries is getting worse; in each five-year period the numbers 'without sanitation' were increasing faster than those 'with sanitation', so that for the first time by 2000 there were more than double the number 'without sanitation' compared to those 'with sanitation'.

UNIT 2.3 FLOODING AND DROUGHT: CAUSES AND EFFECTS

Flooding and drought: causes and effects (pages 77-79)

Syllabus section 8.4

It should be stressed to students that river floods are regular natural events. However, many of the changes in land use made by humans inadvertently increase runoff, which is having consequences for the increased frequency and severity of river floods. In turn these lead to increased effects on people. Drought is also a natural event. Its effects on people are greatest in rural areas of the developing world where local people depend directly for their survival upon what the land provides every year.

Activities

In Activities 1 and 2 there are links back to the previous section on the water cycle. The main message from Figure 2.29 is the 35% increase in runoff. In Activity 3 students are required to adapt the contents of the table from flooding to drought. After drawing the second divided bar graph in Activity 4, students should be in a better position to recognize the differences. The change likely to have the most serious consequence for the environment is increased use of firewood. Activity 5 is an attempt to get students to think about what may be the similarities and differences between the effects of floods and droughts on local people according

to where they live. Worthwhile explanatory answers are possible for every level of agreement/disagreement with this statement.

Further study

Investigate the occurrence of floods and droughts in the home country / world region. How regular are they? When and why are they most likely to happen? What kinds of damage do they cause?

Case study – Flooding in Bangladesh (pages 79-81)

Syllabus section 8.4

Bangladesh was chosen because of its high flood risk. Serious flooding is sufficiently frequent to attract the attention of the international news media. Although causes of flooding are overwhelmingly physical, there is a human contribution. As the country's population continues to grow, the effects of flooding become more serious and affect more people. In the final section students are introduced to the concept of 'hard engineering', by which people use major construction works in an attempt to control natural disasters.

Activities

The purpose of Activity 1 is to make students summarize the causes of flooding by using a table and sketch map as alternatives to written explanation. Activity 2 highlights hard engineering and its possible disadvantages (which relates back to earlier references about the disadvantages from building large dams). Activity 3 gives the opportunity to use a more local example of a flood.

Further study

Activity 3 offers this and suggests headings for how the work can be organized.

UNIT 2.4 WATER POLLUTION: CAUSES, CONSEQUENCES AND IMPROVEMENTS

Main causes and consequences of water pollution (pages 81-83)

Syllabus section 10.1

This is directed at content in the third column in the syllabus, thereby placing the emphasis firmly upon the role of humans within the natural world. Water pollution is so widespread because of the importance of rivers for human settlement. Due to a mixture of intent and accident, most agricultural, domestic and industrial wastes end up in rivers, lakes and seas. The consequences for ecosystems can be devastating. The process of eutrophication receives special mention.

Activities

Activities 1 and 2 concentrate on the two main themes covered i.e. causes and effects of water pollution. Both activities begin with questions about natural processes before becoming more focused on the role of people. Activity 3 encourages investigation of a local river or stream.

Further study

It is likely that most students will live no great distance from a water course or a water source that is polluted, which can be investigated using fieldwork techniques. Sometimes a sudden increase in water pollution downstream can be noticed, in which case separate surveys can be made above and below this point to investigate differences and causes.

Ways of improving water quality and supply (pages 84-85)

Syllabus section 12.1

The River Clyde in Glasgow, used in Figure 2.37, is an example of what can be done to improve a river that had been badly polluted by industrial and domestic wastes. Although most examples of river improvement schemes are found in the developed world, they provide a model for what could be done to rivers in developing countries should both the desire and the economic resources exist. In developing countries it is more likely that resources and aid are being channelled into providing clean water, especially in rural areas, where (as we have already seen) provision lags behind as compared to urban areas. A second reference to the Punjab shows that in some places there are hopeful signs of change and improvement.

Activities

Activity 1 is based around the example of the River Clyde; the emphasis is upon checking that students are aware that similar improvements will be possible in rivers in other parts of the world. Information about the Punjab is used in a case study in Activity 2. Headings are suggested so that students can structure their answers; hopefully it will help them to identify key points for an examination answer.

Further study

For students living in developing countries, a local case study of water improvement can be investigated.

UNIT 2.5 WATER-RELATED DISEASES

Water-related diseases (pages 88-87)

Syllabus section 10.3

Particularly in hot countries, many common diseases are water-related. It is important that students understand the differences between 'water-based', 'water-borne' and 'water-bred' diseases, which are separated out (with examples) in the syllabus. Examples of each of the three types are used, but with a slightly higher level of detail for malaria. This is a reflection of its global significance for people's health.

Activities

The first three activities address the need for students to understand differences between the different types of water-related diseases, as well as what they have in common. Activity 4 poses a more open ended question, which invites the student to offer an opinion and support it with reasons. Again the reasons should be regarded as more important that the opinion itself.

Further study

Which water-related diseases are present in the student's home country? Where and when do they occur? Are they major health problems? Search for data on the main causes of death in the country – what is the relative importance of water-related diseases within the death statistics?

Impact on human activities and development

Strategies of control and eradication (pages 87-89)

Syllabus sections 10.3 and 12.2

The impact of water-related diseases varies according to age (infants most at risk) and where people live (greater prevalence in rural areas). Ill health is one of the contributory factors to the lower level of economic development in many rural areas compared with urban areas. For strategies of control and eradication, prevention is usually better than cure; several ways of doing this are discussed with reference to a variety of diseases, including malaria.

Activities

Activities 1 and 2 focus upon disease prevention. In Activity 3 students are introduced to the poverty cycle (referred to later in the syllabus in section 26.3) into which disease related information has been inserted. In part (a) they are required to demonstrate their understanding of the effects of disease on farmers (covered in the text); in part (b), higher levels of understanding and application are needed. Students can add 'Vaccinated against malaria' at any point in the cycle or by extending the size of the cycle; after its inclusion, many of the negative

statements should be reversed to make positive statements such as 'Good level of energy', 'Able to work hard (in the wet season)', 'Good crops grown', 'Increased food output' and 'People well fed'. New statements like 'Surplus food for sale' leading to 'Poverty is reduced' might be added, causing a break-up of the cycle of poverty as shown here.

Case study of a water-related disease – malaria (pages 90-91)

Syllabus section 10.3 and 12.2

Malaria is used as the case study; it is given more prominence than the other diseases named in the syllabus because of the number of people and wide areas of the world affected by it. Studying it illustrates the kind of problems faced by health workers trying to discover and implement successful strategies for its control and eradication.

Activities

The questions in Activity 1 are set to guide to students into finding information that is going to be most useful to them in examination answers, either for general questions about water-related diseases, or for a more specific case study question based on an example of one type of disease. Activity 2 is for a local investigation.

Further study

This is suggested in Activity 2. It may be redundant if the previous further study suggestion was taken up.

UNIT 2.6 THE OCEANS

The Oceans (pages 92-94)

Syllabus sections 7.1, 7.2 and 9.2

This is a general introduction to the oceans, marine ecosystems and their resource potential, as well as to threats from over-exploitation. The importance of the continental shelf is stressed, because it is the most important part of the oceans for human use. On the shelves or around their edges, the world's most important commercial fishing grounds are found.

Activities

The purpose of Activity 1 is to convey knowledge of names and locations of the world's major oceans and seas, many of which will be referred to again later in the unit. It is important that students understand the great extent of the Pacific and Southern Oceans in part (b) and the difference between ocean in the Arctic and a continental land mass in the Antarctic in part (c). For life in the oceans,

phytoplankton is massively important which is why it is given exclusively in Activity 2. Methods of discovering and extracting oil and gas were covered in Unit 1; therefore students should have a knowledge base from which to think about the ease and cost of discovering and obtaining them from continental shelves compared with on land in Activity 3.

Distribution of ocean currents and their effects (pages 94-97)

Syllabus section 7.3

A general introduction to the nomenclature, characteristics and position of the main ocean currents fills the first part. There is much to be said for restricting study of the pattern of ocean currents to just one world region, preferably the home region. In the second section information is given about their effects on climate and fishing grounds. Peru is used as the example because this prepares the way for a study of the El Niño event in the next part of this unit.

Activities

In Activity 1 areas of suitable size for students to choose would be the Indian Ocean extending into the Southern Ocean, Atlantic Ocean, or Pacific Ocean; in any one of these it is possible to identify a pattern of currents so that explanation can include references to a combination of wind directions and shape and positions of land masses. The reason for Activity 2 is to try to ensure student knowledge and understanding of the 'normal' situation off the coast of Peru before the 'exceptional' is studied in the next part.

Further study

Which coastal resources are exploited in the home region? How important is their exploitation compared with other economic activities along the coast?

El Niño and its effects (pages 97-99)

Syllabus section 7.4

Direct comparisons between El Niño and normal years can be made using the maps and information in the text. Although no one seems to understand fully why it occurs, it is a natural phenomenon that keeps on repeating every few years. In some years, notably in 1982-3 and 1997-8, the effects were much worse than in others. It should be stressed to students that the first and greatest effects in an El Niño year are felt in Peru itself, where it causes major changes in climate and size of fish stocks. Effects on other countries are more variable, but some of the exceptional weather around the world that appeared to result from the 1997-8 El Niño event had considerable knock-on effects for people (Figure 2.51).

Activities

Headings are suggested in Activity 1 to aid recognition of the differences between 'normal' and 'exceptional' years shown in Figures 2.47 and 2.48. In Activity 2 the focus is upon El Niño's economic effects in Peru. Activity 3 asks for the student's opinion. The explanation should be considered as being more important than the view itself. Activity 4 encourages awareness of just how widespread the worldwide effects of El Niño can be.

Further study

During the next El Niño year students can be encouraged to note its effects using sources such as newspaper reports, TV news programmes and internet sites.

UNIT 2.7 WORLD OCEAN FISHERIES

World ocean fisheries (pages 99-101)

Syllabus section 9.1

The text is focused upon locating and giving environmental and human reasons for the distribution of ocean fisheries. It is supported by a world map of major fishing grounds (Figure 2.51), which shows a domination in temperate waters, close to large centres of population where a wide extent of continental shelf exists. Additionally the top 14 fishing nations are listed; their total population is included so that differences in relative importance of home consumption and export between countries can be gauged.

Activities

The purpose of Activity 1 is to draw the attention of students to the locations of the main fishing grounds and fishing countries. Activity 2 gives students the freedom to choose two fishing grounds for more detailed study. In Activity 3, students need to relate amounts of fish landed to population sizes in Table 2.6 in order to discover that countries such as Peru, Chile, Norway and Iceland are likely to be exporters, whereas the likes of China and India with their big populations are likely to consume all they catch. Activity 4 suggests an investigation of fishing in the home country or region and to assess its importance both in absolute and relative terms.

Further study

See Activity 4.

Overfishing and its consequences (pages 101-103)

Syllabus section 11.1

Overfishing is a growing problem and a major international issue. It may be relevant to only a limited number of countries, but it can have great economic and social importance for them. One of the main causes of overfishing, improvements in technology, is covered in detail. The consequences for future fish stocks and for present day coastal fishing communities are enormous.

Activities

Drawing a line graph for world marine fish catches in Activity 1 highlights the downturn since 1989. Activity 2 focuses upon the way in which new technology has caused this decrease. Activity 3 begins with a statement; it is used as a trigger for getting students to explain why what was once considered to be a plentiful, renewable resource is now a scarce resource in some locations. The investigation in Activity 4 is not as central to the syllabus, but stopping whaling has been an important environmental issue for the last 20 years and more, and raises issues of broader significance to the study of human use of ocean resources.

Strategies for the harvesting of sustainable fisheries (pages 103-106)

Syllabus section 13.1

Using fishing quotas is the most widespread strategy; however, it is useful to emphasise to students how a package of measures might produce better results, more sustainable over time. Iceland is one of the few countries that has preserved its fish stocks at reasonable levels by careful management, although not without opposition from fishermen. In general, strategies have had only limited success, even in developed countries like those in the EU, which has many regulatory controls at its disposal; fish stocks in the North Sea are still decreasing.

Activities

Activity 1 requires students to assemble content to support this section's main theme. Students can use examples quoted in the text, although other examples drawn from their own world region or from other parts of the world are equally valid. Activity 2 can form the basis of a case study of the North Sea – a useful region to use because strategies are in place, but without leading so far to total success.

Further study

If ocean fishing is a significant economic activity in your home country or world region, it may be possible to investigate the existence or otherwise of strategies for its long term preservation. If strategies do not exist or are not enforced, what are the reasons? Are environmental groups campaigning for controls?

UNIT 2.8 MARINE POLLUTION

Marine pollution: causes and impacts (pages 106-109)

Syllabus section 11.2

Marine pollution is overwhelmingly concentrated in those zones where the ocean meets the land. The source for most marine pollutants is land-based human activities. The list of these is long (Table 2.9), and almost inexhaustible. Oil spills from ships at sea are a contributory source. Some of the sea areas of the world at particular risk are identified.

Activities

Before writing about the effects of pollution on marine life in the second part of Activity 1, students are asked to take the different types of marine pollution from Table 2.9 and show them on a sketch similar to the one used in Figure 2.57. In Activity 2 the focus is on oil spills, with students expected to assess the relative importance of different factors to the amount of environmental damage caused. Activity 3 gives students the opportunity to go local and make a study of an event that received more publicity in their home region.

Further study

After the next major oil spill that reaches the international news media, students can be asked to keep a log of key details from sources, such as radio and TV reports and internet, as the basis for a short case study. Students should be reminded that it is good policy to devise headings relating to syllabus needs first, such as location, size of spill, causes, impact on (a) wildlife and (b) people, and attempts made to reduce pollution effects.

Marine pollution controls and remedies (pages 109-111)

Syllabus section 13.2

The first point to be stressed is that pollution control is never easy when the problem goes across national borders; differing and sometimes competing national interests make it more difficult for international agreement about measures for reducing and stopping pollution to be reached. Methods for tackling an oil spill are used as an example of what can be done to counter pollution; they are supported by case study information about the Prestige tanker wreck off Spain in 2002.

Activities

The theme of Activity 1 is the need for international cooperation if pollution problems are to be addressed in a serious way; the Black Sea is used as the example through which to examine this. Activity 2 is a case study answer using

the information provided, with an extension in part (d) in which students are invited to think about the likelihood of future tanker disasters occurring.

Further study

Students can apply the ideas here to a study of a land-based cause of marine pollution in their own country or region, such as from a heavy industrial works next to the coast, or from a river entering the sea after passing through urban / industrial areas.

For students living in countries with coastal wetlands, such as mangroves, there may be an additional opportunity for local study. The advantages of protecting wetlands, (such as natural flood control and purifying agents for removing toxic wastes) can be assessed in relation to the advantages predicted from clearance and reclamation of the land.

UNIT 2.9 THE SOUTHERN OCEAN: A CASE STUDY (PAGES 111-114)

Syllabus sections touched on by this case study include 7.1, 7.2, 9.1, 11.1 and 13.1

The cold waters of the Southern Ocean are rich in marine life. Despite the apparent appearance of plenty, replacement rates are slow in such cold waters. Human activity in the ocean has been one of overexploitation, first whales and now fish. Recently signs of hope for a more secure and sustainable future have started to appear.

Activities

Activity 1 is about the Southern Hemisphere food chain. The remaining three activities are intended to bring out contrasts between the non-sustainable activities undertaken in the past and the hoped for sustainable actions of people now and in the future.

Further study

Students can be asked to choose another 'Wilderness Area', defined as an area in which the forces of nature dominate over human activities, in order to examine human actions there under two headings 'Unsustainable' and 'Sustainable'. If no suitable regional example exists, Alaska would be a possible choice, especially given the increasing likelihood of further oil exploration. It would enable students to seek out comparisons and contrasts between it and the Southern Ocean and Antarctica.

Unit 2.10 WATER PROBLEMS – A SUMMARY

Questions and issues (pages 114-115)

The two flow charts for fresh water and ocean resources summarize environmental issues arising from the increasing effects of human activities on land and in seas. Negative impacts from human actions are likely to continue to increase, which makes the implementation of strategies to reduce and stop further damage to wildlife and the environment even more urgent. Rivers and seas do not respect national borders so that different countries are responsible for causing pollution, thereby making it less easy to achieve successful solutions. These are the types of themes and issues that students are being asked to explore when answering the questions. It represents a summary of work for this unit.

Chapter 3 The Atmosphere

The content in the first column of the syllabus for the atmospheric system is taken together with related content in the other three columns about human activities, their environmental impact and strategies for sustainable development in the future. A summary of the layout of this chapter is given below.

3.1 Structure and composition of the atmosphere in column 1 is followed through to include the use of water, wind and solar as power sources in column 2.

3.2 Atmospheric pollution makes its first appearance in column 2, but then develops into major areas of study in columns 3 and 4.

3.3 Measuring the weather is essentially a stand-alone topic in column 1, although it has some relevance to weather forecasting in column 4.

3.4 Major climatic types in column 1 are linked to human activities, mainly agriculture in column 2. Agriculture has links to other topics in column 2, notably increased yields and world trade. The farming link continues into columns 3 and 4, in which environmental impacts of farming practices and strategies for sustainable agriculture are substantial issues.

3.6 Climatic hazards in column 1 are taken up again in column 3 in the section about impact on human communities. They are followed through into column 4 with strategies for their reduction.

3.7 These student activities are used to summarize issues. Most of the issues were raised in this chapter, but students need to refer back at times to related work in the first two chapters.

UNIT 3.1 THE ATMOSPHERE: STRUCTURE, COMPOSITION AND ENERGY SOURCE

Structure and composition of the atmosphere (pages 118-120)

Syllabus sections 14.3 and 14.4

The atmosphere is a system of energy transfers. Its structure is described, with the support of Figure 3.3, and its important characteristics identified. The main gases of which the atmosphere is composed are listed in Table 3.1; their roles for life on Earth are examined. More space is given to some gases, notably carbon dioxide, and to ozone and water vapour, than their small percentage volumes would warrant to reflect their importance to life on Earth.

Activities

In Activity 1 the pie graph will provide students with a simple visual image of the dominance of nitrogen and oxygen in the atmosphere, while in Activity 3 students are asked to focus on those gases present in small percentages and explain their importance. In between, Activity 2 is about the characteristics of the lower atmosphere; what happens in this part of the atmosphere has most relevance to surface systems.

The Sun as an energy source (pages 120-122)

Syllabus sections 14.1 and 14.2

Students are introduced to key factors affecting energy transfers between the atmosphere and the Earth. Differences between short wave and long wave radiation, and between absorption and reflection, are dealt with first. Next the focus switches to insolation, the main factor responsible for variations in surface heating between tropical and polar latitudes. Some attempt is made to overcome two common student misconceptions, often repeated in examination answers – that insolation and insulation are the same, and that the greenhouse effect is due solely to global warming.

Activities

Activity 1 is definitions for key words, given their importance as stated above. Activity 2(a) makes students take note of the percentages merely quoted in passing in the text; clouds have a big influence on radiation levels to and from the surface and these form the theme in part (b). Students may be less familiar with a scatter graph than with most other types of graph; this explains why instructions about axes are included in Activity 3(a). It may be worth explaining two things to students about scatter graphs before they start.

1. Convention dictates that the independent variable be placed on the x axis; the y axis is used to show what depends upon it (the dependent variable).
2. Often a straight line is superimposed on the graph after the values have been plotted. This line is used to summarize the general trend of all the values. It should be stressed to students that the line is not drawn to link all the values, as happens in line graphs.

The graph drawn by students should show an almost perfect negative relationship. In part 3(b) the explanation could be supported or replaced by a labelled diagram.

Further study

Draw a second scatter graph to show the relationship between latitude and temperature for the warmest month also using values in Table 3.2.

Water, solar and wind as power sources (pages 122-124)

Syllabus section 15.1

General information about alternative energy resources was given in unit 1.4; it may be useful to revise the main points from there. Also, for the first section on water power, much of the earlier content about large dams as water stores in Unit 2.2 is relevant and useful here. In this section the focus is upon how these three weather elements can be harnessed as power sources. Examples are given of main producing countries and areas with greatest potential.

Activities

To answer Activity 1 students are required to interpret from the graph and map why physical features (climate, relief and drainage) in this part of Norway are favourable for the generation of HEP. In part (a) relevant points would include precipitation all year, no month with less than 100mm precipitation, high annual total (over 2000mm), winter temperatures above freezing point (meaning no interruption to water availability) and summer temperatures less than 15°C (so that rates of evaporation are low). Past experience suggests that students will find it easier to make scoring points about precipitation than temperature. In Activity 2 key points are steepness of the slopes, and the drop in height of over 600 metres between the HEP station and the store of lake water behind the dam. Together these give the force of water required. Activity 3 directs students towards the increasing use, and further possibilities, of harnessing solar power in the tropics. Remote rural areas are always the last places to be connected to national grids; producing electricity for their own needs is an attractive alternative and could lead to significant improvements in quality of life.

Further study

Students can be asked to investigate the use of alternatives in their home country (provided that a similar suggestion made in an earlier chapter was not taken up).

UNIT 3.2 ATMOSPHERIC POLLUTION: CAUSES, EFFECTS AND STRATEGIES

How people are changing the atmosphere (pages 125-126)

Syllabus sections 15.2, 16.1 and 16.2

Human induced changes in the composition of the atmosphere are summarized in Table 3.4 under four headings – increasing solid particles and carbon dioxide, and decreasing ozone and water vapour. Three sub-headings for study are used throughout – causes, direct effects and other effects. The comment which follows

gives more background information, a better idea of overall importance and examples of areas more badly affected.

Activities

Activity 1 requires students to organize the effects of air pollution under four headings. This involves them searching through Table 3.4 to identify effects relevant to each heading. Having studied and described what the photograph taken in Brazil shows in Activity 2(a), students have to think about consequences for the atmosphere and demonstrate that they understand.

Pollution in urban areas (pages 127-129)

Syllabus sections 15.2, 16.1, 16.2, 16.4 (inversion of temperature) and 18.1

The density of traffic and intensity of human activities in urban areas means that air pollution is a more serious problem here then elsewhere. Some big cities are almost 'famous' for their high levels of pollution, because physical features of their locations, notably relief and climate, favour the accumulation of waste gases and pollutants in the lower atmosphere. One of these, inversion of temperature, may require a special mention, since experience of examining suggests that many students do not understand it. In the second part, several strategies for improving urban air quality are examined.

Activities

Activity 1 is about students naming pollutants from vehicles and showing knowledge of their effects. For Activity 2(a) it is most likely that students will draw a bar graph; although not quite such an appropriate technique, a line graph would also give a visual image of the changes in this example. The main trend is downwards, but with two periods of sharp decrease from 1977 to 1982 and from 1992 to 1997. Answers needed for the explanation in 2(b) can be found in the text – use of catalytic converters from 1975 and cleaner burning gasoline in 1996. In part (c) students can refer to the high car ownership, numerous freeways (motorways) and physical conditions which favour lower atmosphere accumulation as reasons why the number of days without high ozone levels are unlikely to drop to zero. Activity 3 gives students an opportunity to examine a more local and familiar example.

Further study

Students living in urban areas have plenty to investigate. Secondary data may be available if the city authorities monitor and collect data about levels of air pollution and types of pollutants. Results can be compared with those from other big cities. Traffic surveys can be undertaken along different roads (for example, a main road in the centre or side streets) and/or at different times of the day (for

example, rush hours and off-peak) to identify 'pollution hot-spots' or 'pollution pockets'.

Acid rain (pages 129-132)

Syllabus sections 15.2, 16.4 and 18.1

Before beginning it may be useful to look back at pH values in the soil section towards the end of chapter 1. Coal-fired power stations are the main source of acid gases in many countries, although road transport and other industries make significant contributions as well. Acid rain is still essentially a developed world problem, but as countries develop economically, it is now spreading, particularly to growing industrial countries in Asia. Its effects on ecosystems, and more locally on buildings, can be great. Strategies to reduce this type of atmospheric pollution generally involve an increase in the costs of producing energy, which are passed on to the consumers. Therefore it is unlikely that a significant reduction in its effects will occur until fossil fuels are more widely replaced by alternatives. It is a topic area which raises the possibility of interesting discussions between students about how the problem of acid rain can be tackled.

Activities

Activities 1 and 2 give students the opportunity to demonstrate that they know and understand the causes, effects and spread of acid rain.

Further study

Is acid rain a problem/issue in the student's own country? Why or why not? Should it be an issue? Write two reports on the issue of acid rain, one from the point of the view of the company which owns a coal-fired power station and the second from the viewpoint of an environmental group. Make a judgement about which report makes the more convincing case.

Damage to the ozone layer (pages 132-134)

Syllabus sections 16.1, 16.2, 16.3, 18.1 and 18.2

There is a reference back to coverage of the ozone layer in the atmosphere earlier in this chapter. An isoline map is used to illustrate the winter and spring thinning of the ozone layer over Antarctica. (Isolines are lines linking places with the same value; perhaps the best known example of an isoline map is a contour map.) The causes are well understood and shown in Figure 3.17. The Montreal Protocol is the international agreement which has encouraged many industrial countries to adopt strategies to phase out use of CFCs. There appears to be a higher level of international agreement over this issue than for many others, probably because alternatives are more readily available at a cost which is not prohibitive. Nevertheless the Protocol is not without its critics.

Activities

Activity 1 follows the approach used in many examination answers – first interpret from a map or diagram, secondly explain how it was caused using knowledge and third make comment in relation to a syllabus theme like 'the need for international action'. In Activity 2 students are required to show an understanding of some of the different viewpoints that are always likely to exist over any international issue. It is quite acceptable for a student to concentrate on one view, perhaps the one closest to the student's own, provided that others still receive mention in a positive way.

Global warming and the greenhouse effect (pages 134-136)

Syllabus sections 15.2, 16.1, 16.2 and 16.4

Figure 3.19 gives the statistical support that shows we are living through a time when the Earth's surface is warming up. The majority of people now believe that human activities are at least partly responsible for the high releases of greenhouse gases, mainly from the burning of fossil fuels (Table 3.5). If the greenhouse effect is referred to as the 'enhanced' effect, more students might recognize that this is a natural process which is (most likely) being speeded up by human activities. The Exam watch note is worthy of special attention; great numbers of past examination students have misunderstood of the effects of the so called 'hole' in the ozone layer. The belief that it allows higher rates of surface heating and causes global warming is widespread among students of this age group.

Activities

The main purpose of Activity 1 is to increase student understanding of the greenhouse effect. Although required to draw the same diagrams used in Figure 3.20, students are expected to add more labels. The labelling will indicate the level of student understanding. Activity 2 requires description from Figure 3.19; good answers should be supported by the use of values from the graph for size of differences between dates and for variations in the overall trend. In Activity 3 students need to identify human causes of increased greenhouse gas emissions and organize them under the three headings given in the question. A good answer to Activity 4 will make use not only of the data in Table 3.5 (homing in on the number of years CFCs stay in the atmosphere which makes their contribution relatively greater than percentage alone would suggest), but also the previous section on the thinning of the ozone layer.

Further study

How great is your home country's contribution to the emission of the greenhouse gases in Table 3.5? What are the main sources? Where in the country are emissions concentrated?

Effects of global warming (pages 136-138)

Syllabus section mainly 16.5

A short section about variations between countries in terms of amount of carbon emitted per head is followed by detailed study of the effects of global warming. They include some effects that can already be observed and those that are predicted to occur within the next 50-100 years.

Activities

Information needed for answering the three separate questions within Activity 1 is included in this section. There is evidence in Figure 3.22 that developed countries are most responsible for carbon emissions, yet the majority of countries referred to in Figure 3.26, which suffered from extreme weather events, are developing countries. In Activity 2 some additional information about the possible consequences from global warming is given in Figure 3.27; this tops up the content available to students for drawing up their lists in part (a). There is the opportunity in part (b) to identify the most likely effects for the student's own country or world region. Students can be advised to look ahead into the next section in order to develop more fully their explanations in part (c).

Further study

Most likely avenues for further investigation should be suggested from answering Activity 3(b).

Strategies to deal with the causes and effects of global warming (pages 139-141)

Syllabus sections 16.5, 18.1 and 18.2

The problems encountered in persuading governments to follow the Kyoto conference guidelines for carbon emissions illustrate the difficulties of implementing international agreements when cheap alternatives are not readily available. At least the search for alternatives is being pursued more vigorously than previously. However, suggestions that nuclear power, which is a known technology for generating electric power, should be increased are bringing howls of protest from environmentalists.

Activities

World climate change is an issue which generates lively debate; a wide spectrum of views is given in Figure 3.29. Students are asked to explain in Activity 1 why views coming from different countries are so diverse. Strategies for reducing carbon dioxide emissions form the focus in Activity 2. Activity 3 is an invitation for students to express their own views and support them with explanation. Hopefully the quality of their supporting explanations will be improved by greater knowledge of the topic.

Further study

As an extension activity students can be asked to prepare reports to support the stated views of one or more of the conference delegates from Figure 3.29. Also, they can investigate the views and policy of the government (plus other interested parties) in their own country.

UNIT 3.3 MEASURING THE WEATHER

Measuring air pressure and temperature (pages 141-143)

Syllabus section 14.5

The lay out of a typical school weather station is shown by way of introduction; some students might have already noticed similar weather stations in urban areas or at tourist resorts or airports in the home country. The rest of this section is devoted to study of the instruments used to measure atmospheric pressure and temperature. Although different types of barometers and thermometers are used, the aim is the same everywhere – to take weather measurements that are as accurate as resources and time will allow. Additional references to the meteorological importance of air pressure, and how temperature readings are used to generate daily statistics, are included as well.

Activities

The purpose of Activities 1 and 2 is to stress the importance of taking accurate measurements. In Activity 3 students need to use temperatures recorded in Figure 3.33 to calculate daily temperature values.

Further study

If the students have access to one or more of the weather instruments, first hand weather investigations are possible by taking regular readings over a period of time, perhaps on a rotation basis. If not, there may be opportunities for secondary investigation using data collected at the nearest official weather station; this will be of particular relevance to the syllabus if the climate in the home location is one of the five types named.

Measuring precipitation, wind and sunshine (pages 143-145)

Syllabus sections 14.5 (mainly) and 18.3

Among these instruments, the rain gauge is the only one for which significant variations exist in size and position between weather stations. In areas of solid rock the ideal of partly burying the outer container cannot be achieved; in areas of very heavy rainfall, such as wet monsoon lands, gauges with much larger dimensions are needed. It is best to study the type most widely used in the home region. Margin comments, about statistical use of daily rainfall totals and

how a wind direction is designated, are included to aid student understanding. Information about how weather forecasts are made rounds off this section; the aim is to increase student awareness about the many groups directly affected by weather, for which improved weather forecasts are important.

Activities

The purpose of Activity 1 is to make students aware not only of how rainfall is measured, but also of precautions needed to make measurements accurate even under difficult circumstances. Activity 2 is an attempt to reduce the chances of student confusion between wind vane and anemometer. Recognition of the importance of the weather, and therefore weather forecasts, to certain companies and people is the theme running through Activity 3. Activity 4 requires the student to observe present weather and think about the possible effects (beneficial or otherwise) on local people.

Further study

First make a summary of month by month variations in climate (temperature, precipitation etc.) for the home region using data collected at the nearest weather station. Next make a list of main economic activities in the home region. Finally explain how climate affects them.

A field trip to a meteorological station, if possible, would be worthwhile.

UNIT 3.4 WORLD CLIMATES AND THEIR EFFECTS ON HUMAN ACTIVITY

World climates – wet tropical climates (pages 146-148)

Syllabus section 14.6

The syllabus attaches some importance to the study of the characteristics of different types of world climate through an interpretation of climatic graphs. Therefore a guide about how to interpret temperature and precipitation graphs is provided at the start of this section. Otherwise attention is centred on the two wet tropical climates named in the syllabus, equatorial and savanna. Locations are shown in Figure 3.40; average values for temperature and precipitation in the equatorial regions are displayed in the climate graph in Figure 3.39. Those for savanna are quoted in Table 3.7. Brief explanations for the most distinctive characteristics of each climate follow.

Activities

Activity 1 gives students a chance to practise using the guidelines for climatic graph interpretation. Activity 2 is a practical exercise. Although types of graph are not specified, students have no choice. A line graph is always used for plotting temperature. It is correct to use a line because there is always a temperature to

record. Temperature is another example of 'continuous data' (see page 10). On the other hand, rainfall data is described as 'discrete'. For much of the time there is no rainfall. Individual rainfall amounts are added up to give totals for the month. A bar graph is more effective for showing zero totals of rainfall. The temperature line should form a smooth curve passing through all the plots; it is a convention that solid shading is used for infilling rainfall bars. A comparative summary of the two types of climate is asked for in Activity 3.

Further study

As an alternative practical exercise to Activity 2, average monthly values for the climate in the home region or country could be drawn up in the graph. Choice of weather station data matters little, because this is a practical exercise. Students are still able to answer Activity 3 by using values alone from Figure 3.39 and Table 3.7.

World climates – desert, temperate and cold climates (pages 148-151)

Syllabus section 14.6

As in the previous section, the concentration is upon location, climatic characteristics and brief explanation for each of the other three types of climate specified in the syllabus. All three impose limitations on agriculture and other human activities.

Activities

Low rainfall totals should make drawing the climate graph for Cairo in Activity 1 relatively quick and easy; empty spaces on the graph will give the room needed for labels. In Activity 2 there is a distinctive pattern to the world distribution of deserts that students can be expected to recognize, such as around (or just outside) the tropics and on the western sides of continents. Size and shape are related to continental width in the latitudes where hot deserts are located. Activity 3 allows students to identify some of the features which make tundra lands a distinctive world region. In Activity 4 students are expected to explain how climate and lack of opportunities for human settlement are inter-related.

Further study

A short case study of one of the empty (almost wilderness) areas of the world could be undertaken, (if the similar idea suggested earlier was not taken up). Students should be advised to begin with a study of 'Climate'. Possible follow-up headings could be 'Natural Resources', 'Human Activities' and 'Problems for Human Settlement'.

Climate and human activity including types of farming (pages 151-153)

Syllabus sections 15.3 and 15.4

The direct and indirect affects of climate on people are explored first before effects on types of farming are examined. Students are introduced to key farming terms used in the description of farming types and farming systems. Tropical West Africa is used as an example to illustrate the close relationship that frequently exists between climate and farming. It highlights the role of variations in rainfall within the tropics, where temperatures are always high enough for crop growing.

Activities

Key farming terms are arranged as opposites in the syllabus; the same approach is asked for in part (a) of Activity 1. Key terms named in a syllabus can always appear in examination questions; student knowledge and understanding of these is encouraged by the question in part (b). Students are asked in Activity 2 to identify the changes in climate and natural vegetation before attempting to relate these to variations in types of farming.

Further study

Make a (short) investigation of types of farming in the home region or country. The following headings might be used.

- Main types of farming and locations (could be shown on a sketch map)
- Advantages of climate
- Problems caused by climate
- Ways of solving the problems (or why solving the problems is difficult)

UNIT 3.5 FARMING SYSTEMS, AGRICULTURAL TECHNIQUES AND MANAGEMENT

Farm as a system; examples of shifting cultivation and wet rice (padi) cultivation (pages 153-155)

Syllabus section 15.4

A farm is a human system with inputs, processes and outputs. These two examples were chosen because of the great contrasts in intensity of farming and commercial possibilities between them, despite both being practised in the hot wet tropics. Both physical and human factors are used to explain individual characteristics and differences. The study of shifting cultivation is relevant to the later study of tropical rain forest in the biosphere chapter; wet rice cultivation is referred to again a few pages later under the heading 'The Green Revolution'.

Activities

In Activity 1, using a diagram like the one in Figure 3.51 is a technique which allows factors can be displayed in summary form. Activity 2 requires students to practise their powers of observation and interpret a farming scene. Some of the labels may be useful supplements for information taken from the text when students answer the second part of Activity 3. Activity 4 brings in a new element, the environment, which receives more attention later in this chapter.

Increased food output and higher yields (pages 156-158)

Syllabus 15.6

Without increased food output, the large and persistent growth in world population to more than 6 billions (see Chapter 4) would not have been possible. Where natural conditions were suitable for farming, the natural vegetation was cleared; in other places, such as dry regions, where physical conditions were less suitable, land was reclaimed through the use of irrigation. New agricultural techniques and improvements in technology have allowed great increases in yields from crops and animals. In many parts of the wet tropics the varied cropping associated with subsistence shifting cultivation has been replaced by monoculture on enormous commercial plantations.

Activities

The main purpose of part (a) in Activities 1 and 2 is to get students to observe and describe what is shown, so that they have a stronger platform from which to explain their answers to the more discursive and analytical questions in part (b). Good answers to Activity 3 can be based on the fact that large farms are more likely to be commercial than subsistence, with the possibility of much greater capital investment and specialization.

Further study

The investigation of types of farming in the home country or region can be continued by a study of the use of agricultural techniques to increase yields – how many of the five techniques listed A-E are used? For what types of farming, and in which locations, are they used? With an eye on the next section, the study can be extended to include advantages and disadvantages of their use; possible headings could be economic, social and environmental. Sometimes undertaking a local study ahead of general coverage can be useful.

The Green Revolution – advantages and disadvantages (pages 158-160)

Syllabus section 17.2

World patterns of trade (pages 198-200)

Syllabus section 15.7

Details about the development of high yielding varieties of seeds and their use are followed by a summary of successes and failures. The three comments lettered A-C cover the range of opinions in response to the use of these seeds. The topic under study changes in the final third of this section to cover a separate factor, world trade in agricultural commodities, which influences patterns of agriculture. Two points are emphasized – the tiny percentage of the final selling price which finds its way back to growers and the volatility of world market prices.

Activities

By answering Activities 1 and 2 students will have covered the content in section 17.2 in the syllabus. Activity 3 focuses upon the two key points of world trade stated above. In part (c) students can use either a pie or a divided bar graph to show the percentages, or draw an outline of a jar of coffee and divide up its area according in proportion to the percentages given. Activity 4 focuses on the issue of North-South disparities in trade, which favour developed countries. Activity 5 suggests a study at the local / regional level, should suitable opportunities exist.

Further study

Activity 5 suggests one line of local study. Another would be to investigate the percentage contribution of primary products (from agriculture, mining etc.) to national exports and to comment on the advantages and disadvantages for the economy.

The adverse effects of modern agricultural practices (pages 160-162)

Syllabus section 17.1

After giving the farming context, the adverse impacts of modern agricultural practices upon the environment are summarized in Figure 3.58. There are also impacts on farmers themselves as benefits from the uptake of new practices and technologies go predominantly to large-scale farming enterprises; small-scale farmers in developing countries are often by-passed. The Indus valley is used as a case study for salinization, a growing environmental threat to farmland in arid and semi-arid lands.

Activities

In Activity 1 students are required to make a summary table using information, for which they will need to seek out details from various parts of unit 3.5. To answer Activity 2, which focuses on four environmental impacts from farming and settlement, students will need to make an even wider search for information, sometimes into other chapters. Hopefully this will increase awareness that different parts of the syllabus are interrelated. Students are asked to draw their own flow diagram in Activity 3 to show a poverty cycle for poor farmers. Activity 4 encourages the skill of selection of the key points from a case study, with three headings given under which to organize them.

Strategies for sustainable agriculture (pages 162-165)

Syllabus section 19.1

Students are introduced to the idea of using appropriate technology as a strategy for sustainable development. Illustrations are given about how to reduce the economic and environmental costs of irrigation, about how organic fertilizers and natural predators can replace the use of chemicals on farms, and about the benefits of mixed cropping instead of monoculture. Finally, it is argued that research workers in biotechnology could make more use of nature's rich gene bank of local varieties of seeds for local needs.

Activities

Activity 1 concentrates on methods by which the use of irrigation water becomes more sustainable environmentally and more useful to local communities in the developing world. The theme is similar in Activity 2; this time the focus is upon methods of farming. Activity 3 asks students to think about how more people could be given access to the benefits of using high yielding varieties of seeds.

Power from living resources (pages 165-166)

Syllabus section 19.2

Biomass is an important energy source in rural areas of developing countries. In some places it can no longer be considered to be a renewable resource due to overuse from population pressure. As the search for alternatives to fossil fuels becomes more urgent in countries of the developed world, the possibilities for using bio-fuels are being examined more seriously. However, so far developing world countries, such as Brazil and India, are the ones taking the lead in researching and using bio-fuels and biogas to offset shortages of domestic supplies of crude oil.

Activities

The three activities are closely linked. Students are asked to make comparisons between biomass, bio-fuels and biogas, and to complete assessment sheets as was

done earlier for both fossil fuels and newer alternative energy sources. In the third activity they are required to consider the potential usefulness of one, two or all three of them to their own country or world region.

Further study

Activity 3 provides the opportunity.

UNIT 3.6 CLIMATIC HAZARDS: CAUSES AND OCCURRENCE

Climatic hazards (pages 167-169)

Syllabus section 14.7

First these climatic hazards are placed within the broader context of natural hazards; Figure 3.65 shows climatic hazards to be responsible for about three quarters of deaths from all natural hazards. Other measures to indicate relative importance that students could suggest include economic (cost of the damage) or social (numbers made homeless, number affected) – see Activity 1. After this, outline information is given for the three climatic hazards named in the syllabus. Less information is provided about floods, because this hazard was covered in some detail and exemplified in Chapter 2.

Activities

In Activity 1(a) the differences are 1632, 1260 millions and US$498. The answer for greatest percentage increase in (b) is economic losses; this probably reflects increases in development and wealth during the 20 year period, at the same time as more strategies were put in place to prevent loss of life, at least in some countries. In Activity 2(a) the cyclone percentage is 21, which makes it the second largest, but still well behind drought. For part (b), Figure 3.67 shows that there are more places at risk from cyclones in the northern hemisphere, with some places outside the tropics also at risk. Coasts on the eastern side of continents, especially North America and Asia, are most at risk. Many islands in the Pacific and Indian oceans, as well as those in the Caribbean, are located in the path of major cyclone tracks. Figure 3.66 and the text are needed for answering part (c). Many different types of graph are appropriate for showing values from Table 3.14 in Activity 3(a), such as pie, bar, divided bar or pictograph. Students should be encouraged to ask themselves, 'Which technique will give the best visual display of the values?' For example, if a simple bar graph is chosen, horizontal instead of vertical bars may give a better visual result, because of having the number of years along the bottom. Percentages showing area affected will be easier to read when written across the page (rather than up and down). Students living in the South Asia region, with personal experience of the monsoon, may be able to give fuller answers to part (b) than book content will allow. The main theme of answers to (c) is likely to be that it is difficult to prepare for an unpredictable

natural event that affects large areas (say more than 10% of India) for only about 30% of the time.

Further study

Undertake an investigation of climatic hazards which affect your country or world region – 'causes', 'time of year', 'areas most at risk' and 'relative importance' are possible headings for organizing the work.

Climatic hazards – impacts and strategies for their reduction (pages 169-171)

Syllabus section 18.3

Tropical cyclones cause flooding, but flooding is not otherwise mentioned because it was dealt with in detail in chapter 2. The text is devoted to cyclones and drought. An important theme when discussing the impact of hazards is that the poor suffer more than the rich; (a previous reference to this was made during the study of earthquakesl). To illustrate this, the effects of two hurricanes are compared in Table 3.15. They are not too different in terms of storm intensity and number of people living in the areas affected. Economic losses were greater in the USA, but the death toll and human suffering was of a different magnitude in Honduras and Nicaragua. Although droughts do occur from time to time in developed countries, such as Australia, the wealth of these countries means that most human suffering can be eliminated. Drought, therefore, is a much more serious climatic hazard when it occurs in developing countries.

Activities

Figure 3.68 in Activity 1 confirms the upward trend in economic losses that was recorded earlier in Table 3.13, despite some years with low losses in the late 1990s. In Activity 2(a) students are asked to select evidence from Table 3.15, which supports the assertion that the poor suffer more than the rich from natural disasters. Reasons for this, needed again in part (b), revolve around more and better strategies for prevention of loss of life. In Activity 3 the theme switches from cyclones to drought.

Case study – Cyclone in Orissa, India 1999 (pages 171-172)

Syllabus sections 16.6 and 18.3

This very strong cyclone brought widespread damage and destruction to coastal Orissa. The losses it caused provoked quite a lot of comment in Indian newspapers about the lack of preparedness against cyclones, in an area where they are a known hazard.

Activities

Headings for extracting the key facts about this cyclone, which are likely to be useful in an examination answer that asks for the use or support of an example, are given in Activity 1. Short term effects are the ones mainly described in the text at this point. In Activity 2 students are asked to think about long term effects as well; the last sentence contains related information. Activity 3 requires students to think about, and comment on, the state of preparedness, which was at levels not atypical of rural regions in countries of the developing world.

Further study

The same headings given in Activity 1 can be used to investigate either a more recent event or one closer to home.

UNIT 3.7 GLOOM, DOOM AND HOPE (PAGES 173-174)

Activities

When answering the questions in Activity 1, good students will begin by making the point that some areas and countries are more at risk from natural hazards than others, preferably supported by examples. Figure 3.71 is dominated by poor African countries. However, human actions that contribute to their severity, such as deforestation, can be reversed; also measures can be implemented to reduce loss of life and damage when natural disasters inevitably occur again.

For Activity 2, the problem highlighted in Figure 3.72 is global warming; a graph earlier in the chapter provided the evidence that this was happening. The newspaper headlines suggest that problems caused by it can only get worse, and that human actions are to blame. Some environmentalists fear that, without the worldwide implementation of strong and immediate measures to stop pollution, the Earth is doomed!

There is some good news around as Figure 3.73 shows. In Activity 3 students can explore the use of small scale schemes and appropriate technology in Tigray, international action through the Montreal Protocol for making the ozone layer thicker, and the development of new strains of staple crops for people living in rural areas of Africa.

Chapter 4 The Biosphere

The book layout for this chapter follows the same arrangement used in previous chapters.

4.1 This section, based on natural ecosystems and relationships between living organisms, is almost entirely drawn from column 1 in the syllabus.

4.2 Human activities, with the main concentration on agriculture, are taken from column 2. When the focus switches to 'how humans are putting ecosystems at risk', the content source moves into the third column in the syllabus.

4.3 Strategies for conservation of natural ecosystems are extended to take in managing tourism, all derived from column 4.

4.4 The focus reverts to a study of natural systems from column 1. References are made to the distribution and characteristics of six major biomes.

4.5 The study of biomes is followed up by an examination of the clearance of natural vegetation and the factors responsible for this, taken from column 2. After this, the study switches to examples of sustainable forest management techniques, which are listed in column 4 of the syllabus.

4.6 In this section the study of soils from unit 1.6 (entirely in column 1) is extended to include the causes and consequences of soil erosion from column 3 and strategies for soil conservation from column 4.

4.7 The study of population begins in column 2 with basic details to explain population growth, structure and migration. Implications of these extend the study into content from column 3; migration, for example, feeds into the topic of urbanization. Strategies for managing population and urban growth are taken from the fourth column.

4.8 International issues such as world development, poverty, the widening gap between rich and poor, and an unfair pattern of world trade are drawn from columns 3 and 4.

4.9 These student activities, based upon 'Unsustainability on Earth', are intended to act as a summary of many of the issues raised throughout the book in other units as well as this one.

UNIT 4.1 ECOSYSTEMS: THEIR FUNCTION, OPERATION AND RESOURCE POTENTIAL

Ecosystems and their organization (pages 176-178)

Syllabus sections 20.1 and 20.2

Ecosystems were briefly introduced in chapter 2. The concept is covered more formally here. All ecosystems contain both living and non-living components and are maintained by energy flows between these. Between plants, there is great competition for available resources of light, water, soil nutrients and space. Plants affect the numbers and variety of animals living in an area, because plants are the base of the food chain.

Activities

Students need to know and understand the key terms used in the study of ecosystems; this is the main purpose of Activity 1. Activity 2 tests whether students are able to apply the general to actual observation of an ecosystem. Observation is from a photograph, but the same exercise can be repeated undertaking the type of fieldwork suggested in Activity 3.

Further study

Activity 3 gives the lead. Students can be asked to draw a field sketch while observing an ecosystem and add labels, as asked for in Activity 2(b). Written explanation can be added later.

Adaptations to physical factors (pages 178-181)

Syllabus section 20.3

Physical factors vary greatly from place to place; over time species of plants and animals have developed special characteristics which allow survival, even in extreme environments like hot deserts. A contrast is made between hot deserts and tropical rainforests; in the latter, physical conditions (plentiful heat and water) are ideal for plant growth, which makes for fierce competition between living organisms.

Activities

In tropical rainforests different physical conditions within the forest and competition are significant; these are covered in Activity 1. In hot deserts survival under difficult physical conditions is all important; this is the focus of Activity 2. In Activity 3 students are required to add labels, obtained from the text, to a sketch, in order to illustrate how camels are adapted to desert conditions. Another animal, equally as well-adapted to a difficult environment as the camel, is the polar bear. It could be the subject of the separate investigation suggested in Activity 4.

Further study

The polar bear extension activity can be used. Tundra climate and vegetation are in the syllabus. Polar bears are also under the spotlight because of environmentalists' fears that their numbers will reduce due to global warming as more of the ice melts every year in the Arctic Ocean.

Relationships of living organisms (pages 181-183)

Syllabus section 20.4

How living organisms depend upon each other for survival is the theme of this section. In this first part, the text is concentrated on pollination, dispersal of fruits and seeds, and vegetation succession.

Activities

The main theme of this section is the focus for Activity 1. The questions in Activity 2 follow the usual pattern for exam questions that are based on diagram, namely description followed by explanation. In Activity 3 students are required to apply their knowledge and understanding to a different example of an ecosystem. In part (a) the task resembles what a student would be required to do when observing an ecosystem in the field.

Producers, consumers, food chains and webs (pages 183-185)

Syllabus section 20.4

In this second part on relationships of living organisms, the focus is upon food chains and food webs. Consumers are distinguished from producers and then the different types of consumers are identified. Nutrients and energy, originally absorbed by plants, are passed along a food chain of living organisms. This produces a pyramid of numbers from large to small. Organisms at the bottom of the food chain or web must be more numerous than those higher up and at the top.

Activities

Activity 1 is a check upon student understanding of key terms. In Activity 2 students can use Figures 4.15 and 4.16 to guide them towards the type of diagram required. Organisms should be shown in the same order as in the text – plankton, phytoplankton, zooplankton, for example, water fleas and shrimps, small fish, large fish and birds of prey. For Activity 3, the Arctic makes for easier study of its food web due to the limited variety of organisms living on land in such a cold environment. Students should note that details of the tundra climate were given in chapter 2.

Further study

Students could undertake an individual investigation of a food chain and/or food web in the home region. Alternatively, the full class of students could be asked to name as many living organisms found in the home region as they can, both plant and animal. Individuals or small groups could re-arrange these into food chains and a food web.

Energy flows (pages 185-187)

Syllabus section 20.5

Photosynthesis in green plants is the most important process for life on land. During daylight hours is the process of respiration produces oxygen. Green plants are able to store the Sun's energy, which is released when they are consumed. Although this release allows energy flows higher up the food chain, great losses occur as energy is transferred from one trophic level to the next.

Activities

Activity 1 is focused upon photosynthesis and its great importance. In Activity 2 the theme switches to loss of energy between trophic levels. Activity 3 encourages local investigation. Some of the research needed for part (a) might have already been done during an earlier extension activity.

Nutrient recycling (pages 187-189)

Syllabus section 20.6

Recycling of nutrients is crucial for continued life on Earth; nature gives only a constant flow of solar energy, not new materials. Out of all the land-based ecosystems, recycling is fastest, and on the largest scale, in tropical rainforests. Two of the individual cycles, for carbon and nitrogen, are used as examples of recycling because they are named in the syllabus.

Activities

Figure 4.21 is useful as a source for student answers to Activity 1. Activity 2 requires basic answers that demonstrate an understanding of the importance of carbon to living communities within ecosystems. References to carbon stores, the theme of Activity 3, are heard more and more frequently in discussions about anti-pollution measures for reducing carbon dioxide emissions. Activity 4 focuses on nitrogen and its importance to the growth of living organisms both in the natural world and in farming.

Further study

Ask students to relate the nitrogen and carbon cycles to the types of pollution covered in earlier chapters, notably water pollution from nitrates in chapter 2 and global warming from carbon emissions in chapter 3.

Resource potential of biomes and biodiversity (pages 189-192)

Syllabus sections 20.7 and 25.1

This section begins with references to biomass. The size of the biomass is related to the productivity of the ecosystem. At each trophic level there is a change in biomass size as well, which produces a pyramid like the one already mentioned for food chains. High productivity and great biodiversity are best illustrated by reference to tropical rainforest. Seeds of wild plants were the genetic resource from which today's farm-grown food crops have been selectively bred over many centuries. There are fears that the natural pool of genetic materials, useful as a source for new crops and medicines, will diminish due to the continual reductions in biodiversity caused by humans.

Activities

In part (a) of Activity 1 a pie or bar graph, or proportional flow graph, can be used. This example illustrates the '90% loss rule' in energy transfers, which students can refer to in answers to part (b). One stage in the food chain is bypassed when people eat crops instead of meat. Biodiversity is the theme of Activity 2. Use of the values quoted for net primary productivity for types of farming on land cleared of tropical rainforest will lend statistical support to students' answers in part (c). Activity 3 focuses upon the syllabus theme of 'biodiversity as a genetic resource'. In Activity 4 a student investigation is suggested into biodiversity in a different continent to South America, the one used in the book example.

Further study

Activity 4 provides an example of one area for further investigation. Students could work ahead of book content, (as is sometimes educationally desirable for them to do), by extending Activity 3 to include GM (genetically modified) crops.

UNIT 4.2 HUMAN ACTIVITIES AND THEIR IMPACTS ON THE EARTH'S ENVIRONMENT

Human activities on Earth (pages 192-194)

Syllabus section 22.1

The main aim of this section is to provide students with background information about the range of human activities. This is before the environmental impacts, which are more central to the syllabus, are studied. The human activities named in the syllabus are integrated within the more widely used headings for the three sectors of primary, secondary and tertiary. The significant differences in the relative importance of these three sectors between developed and developing countries are noted at the end of this section.

Activities

Activity 1 is focused upon differences in employment between developed and developing countries, with the largest difference (46%) between primary sectors. Activity 2 is a check upon student understanding of which types of work fall into which employment sectors. Figure 4.32, placed within Activity 3, shows changes over time in the UK, an example of a well-developed country. The UK has undergone a long period of development; note that even in 1841 the manufacturing industry was already more important than farming. The recent change in orientation of the economy from industry to services is very marked, as more and more manufacturing takes place in developing countries, particularly in Asia. In Activity 4 Pakistan provides the contrasting example of a developing country, which has yet to industrialize to the same extent as other Asian countries.

Further study

The option given in Activity 4 can be taken up by asking students to plot the employment structure for the home country. Search government websites in order to discover the main activities. Rank them according to economic importance.

Changes in farming and the natural environment (pages 194-196)

Syllabus sections 22.1 and 22.2

The underlying theme is one of increasing human control over food supplies. Hunter gatherers and pastoral nomads continue to practise traditional forms of farming, but they are now a tiny minority. A long history of major technological developments, itemized in Figure 4.33, has resulted in progressively higher farm yields, with more food produced by fewer farmers. At the same time, human impacts on the natural environment have increased. The recent emergence of

GM plants is confirmation (if any were needed) that technological development has not finished.

Activities

In Activity 1 students are asked to show understanding of the differences between three primary activities – hunting, gathering and farming. If students are in any doubt about how to draw a time line in Activity 2, they can be advised to refer back to the example in Figure 2.37. Appropriate choices in Activity 3 would be named types of machinery for part (i), one from forests cleared, wetlands drained, irrigation systems and seeds for special physical conditions in part (ii), and either large scale irrigation systems or any one of those named in box 6 in part (iii). Wise students will choose those developments in (a) about which they can write most for their advantages and disadvantages in part (b).

Genetic engineering and GM crops (pages 196-198)

Syllabus section 22.2

This has developed into a major world issue. Ten years ago it would have rated only a paragraph in a book like this; today it has a section to itself. In order to develop new seeds with the potential to increase the world's food output through greater resistance to disease, drought and salinity, scientists have done something that nature does not do – they have transferred genes from one organism to an unrelated species. Having been planted for years in North America and Argentina with little opposition, attempts to extend their cultivation to countries in the 'Old World' have met with an increasingly hostile response from environmental groups.

Activities

Activities 1 and 2 cover the basic points about genetic engineering and growth of GM crops. Activity 3 involves students in the GM debate and asks them to express their own views, after having listed arguments for and against growing GM crops in part (a). Activity 4 encourages an investigation of the national picture. Activity 5 requires student thought about conducting a scientific experiment. To make it valid, everything possible must be done to obtain tomatoes picked at the same time, and then kept under identical conditions, so that it is GM and non-GM characteristics that are being directly compared.

Further study

The debate about G M crops is going to run for many years. Students can be advised to keep their eyes on the media for new developments, especially those affecting their home country or world region.

Habitat destruction and their effects on species (pages 198-200)

Syllabus sections 25.1 but mainly 25.2

Species loss is another example of a natural process that has been speeded up by humans. The human component has increased its influence within natural ecosystems resulting in widespread habitat destruction from deforestation, loss of wetlands and impounding water in association with dam building. Included among the details of habitat destruction are lists of reasons why forests and wetlands are worth preserving.

Activities

Activities 1 and 2 are focused upon preservation and conservation of natural habitats. Activity 3 gives students the opportunity to change the scale of the debate from world-wide to one that is more local, either national or regional, depending upon the range of habitats available for study.

Further study

Activity 3 gives the lead. Some issues are on-going, such as declining numbers of tigers in India. Investigations could be extended to include comment upon the effectiveness of the attempts to prevent extinction.

Tourism and its impacts (pages 200-203)

Syllabus section 25.3

Although the vast majority of tourists live in and visit other places within the developed world, they are visiting developing world countries in increasing numbers. For some developing countries tourism is a major route to economic development. It can be one of few options open to developing countries for increasing earnings of foreign exchange. Like everything else, tourism brings disadvantages as well as advantages. Impacts on the environment in places where growth is rapid and inadequately managed can be disastrous.

Activities

Good description from the graph in Activity 1(a) will be supported by the use of numbers which illustrate the general trend and variations in the rates of growth. In part (b) the similarity is the constant increases. One difference is that revenues have grown faster than numbers of visitors, especially since the late 1980s. Figure 4.39 shows infrastructure improvement mainly for tourism; the vegetation looks like tropical rainforest and students can be expected to refer to environmental impacts such as habitat loss and soil erosion in their answers to Activity 2(b). A more optimistic picture of tourism emerges in Figure 4.40 showing the 'tourist tree' in Activity 3; it shows examples of the 'spin-off' advantages of tourism for

both the local communities and national economy. In Activity 4 students are invited to draw a similar type of diagram to show disadvantages.

Further study

Students can investigate tourism in their home country or world region. Headings which may be useful include:

a) visitor attractions and their locations;
b) facilities / services provided for tourism;
c) benefits to the local economy and people;
d) environmental impact of tourism – good or bad?

UNIT 4.3 STRATEGIES FOR CONSERVATION

Conservation of species: strategies (pages 203-206)

Syllabus section 28.1

This covers part of what is included under strategies for conservation of biodiversity and the genetic resource. Brief references are made to the sustainable harvesting of wild plants and animal species and gene banks, before concentrating upon world biosphere reserves. Recognized and supported by UNESCO, biosphere reserves are worldwide, having been set up in almost a hundred countries. The reasons for setting them up are explained and an example from the Caribbean is used. The majority of students are likely to be less familiar with these than with other areas of protection such as Nature Reserves and National Parks.

Activities

Activity 1 covers all the general information that students are likely to need to know about biosphere reserves for answering examination questions. Activity 2 enables students to use a real example so that they can become more familiar with the essential features of a biosphere reserve. Activity 3 encourages individual investigation of another biosphere reserve, with which they will possibly be more familiar. Visiting the UNESCO web site at www.unesco.org/mab will help.

Further study

Develop further the study initiated in Activity 3. MAB in the UNESCO address refers to the 'Man and Biosphere' programme.

Nature Reserves and National Parks (pages 206-208)

Syllabus sections 28.1 and 29.4

This covers the remaining strategies named in the syllabus for this section; it overlaps in the syllabus with another section, managing tourism, which is also included here. Although most of the information given is of a general nature,

examples are named in passing with slightly more detail about the Galapagos Islands and Mauritius. It is likely that many teachers and students will wish to use examples from their home country or world region, since nature reserves and national parks are strategies for conservation that are widely used irrespective of whether a country is developed or developing.

Activities

Activity 1 covers the basic, general content for examination needs. Activity 2 encourages the use of local examples for case studies.

Further study

The local investigation in Activity 2 can be taken a stage further to include comment about the adequacy and effectiveness of the country's Nature Reserve / National Park programmes.

Case study – National Parks and National Wildlife Reserves in Kenya (pages 203-211)

Syllabus sections 28.1 and 29.4

Kenya is a useful choice because it has many parks and a long history of wildlife protection. Tourism is a big business. It can also be used to illustrate some of the pressures, conflicts and problems that conservation measures bring within the country, especially during a period of rapid population increase. Encouraging the growth of eco-tourism is seen as a way forward for the future, because of its potential to deliver social and economic benefits to local tribes-people, at the same time as it increases protection to wildlife.

Activities

Activity 1 asks students to elaborate upon the natural attractions of Kenya and the urgent need for protection of animal habitats. For Activity 2 students are expected to make a table to summarize advantages and disadvantages of tourism in Kenya. The headings are the same as those used in Table 4.2 on page 251. The skill required is to apply the general points to a particular country by deciding which apply to Kenya and choosing content that is specific to the example of Kenya.

Further study

The same activities can be used for a similar case study undertaken for any other country.

World conservation strategies (pages 211-213)

Syllabus section 28.2

There are many organizations working to conserve species, which operate in many countries. Four of these are named in the syllabus as examples; however, students are free to study others that may be more active in their own country or region. A little information about all four is included in this section. However, if students decide to study another organization in more detail because of its greater relevance to them or their country, the most they will need for examination purposes are outline details of the type of work each one undertakes, as in Activity 2(a). It is unlikely that one of the organizations will be named in an examination question and students asked to describe its work in detail, because 'such as' is used in the syllabus. Instead it is more likely that students will be given the freedom to choose the organization for writing about its conservation work.

Activities

Activity 1 is a general question. Students can relate back to earlier issues requiring an international approach for their solutions, such as overfishing, ozone depletion and carbon dioxide emissions. Activity 2(a) gives the notes needed for students to show familiarity with the work of the four organizations named in the syllabus in examination answers; part (b) suggests how a little more information about the work of one of them may be gathered. Activity 3 increases local relevance by opening up the choice of organization.

Further study

No more detail will be needed for examination purposes if Activities 2(b) and 3 are both used. Too much information may be the greater danger for interested students, beyond the amount that they can ever use in an examination answer at this level. Internet web sites are the most accessible sources of information for all international organizations.

UNIT 4.4 BIOMES AND THEIR DISTRIBUTION

Biomes – Tundra and Taiga (pages 213-215)

Syllabus section 21.1

The general introduction to the study of biomes includes a world map showing distributions for the six syllabus biomes. A relationship between the extent of each biome and width of the land masses in its latitudes is shown in Figure 4.49. Also students can be directed to look back at earlier maps showing distributions of climatic types (Figures 3.40, 3.42 and 3.43) and to note the similarities. A close causal relationship exists between climate and vegetation characteristics; for this reason climatic conditions are summarized in Information Boxes.

Activities

In Activity 1(a) students can be expected to describe using names of continents (for example, Asia, Europe and North America), latitude (for example, closer to the poles than the tropics, mainly north of 60°N), width and extent (for example, all the way across the land masses, greatest width of taiga in eastern Asia, greatest extent of tundra in eastern North America). From among these are many similarities from which to choose one for in the answer to part (b). The most significant difference is that taiga is always on the southern side of tundra. Completeness of the description from the photograph will be the main determinant of answer quality in Activity 2(a); description from a photograph can also be done by use of a labelled sketch, although students rarely use this option unless directed to do so. For the remaining questions in Activities 2 and 3 students are required to select and use relevant information from the text.

Biomes – Tropical rainforest (pages 215-217)

Syllabus sections 21.1 and 20.6

This is the biome with the greatest biodiversity, primary productivity, stratification and competition between living organisms. The hot, wet tropical climate, which provides ideal conditions for plant growth all year round, is responsible for all of these. It also has the world's largest and fastest nutrient recycling system. Students could be asked to assemble points to support the argument that this is the world's most important biome. Earlier references to tropical rainforests appeared under biomass, biodiversity and productivity (pages 237-9); later references are included under deforestation (pages 274-9) and management (pages 279-282).

Activities

In Activity 1 students are asked to use labelled diagrams to support their explanation for important characteristics of rainforests, namely stratification in (a), biodiversity in (b) and rapid nutrient recycling in (c). Activity 2 is about soils under tropical rainforests and what happens to them when the rich nutrient cycle is reduced or destroyed. In rainforests the soil store is quite small in relation to other stores, but it is constantly re-supplied with nutrients along the wide decay pathway, which in turn supports the equally large uptake pathway to plants. The other inflows and outflows are insignificant in comparison. A reduction in the decay pathway will increase outflows by runoff, erosion and leaching.

Other tropical biomes – Monsoon forests, Savanna grassland and Hot desert (pages 217-219)

Syllabus section 21.1

Moving away from the Equator the length and severity of the dry season increases until it is all year in hot deserts around the tropics. The amount of woodland is reduced until trees are replaced by grasses. In turn, grasses are replaced by

plants adapted to withstand long periods of drought. Essential climatic details are quoted again, because of their dominant influence on natural vegetation. For the extent of these three biomes it is necessary for students to refer back to Figure 4.49.

Activities

In Activity 1 students are referred back to Figure 4.49 so that they can state where the largest areas of each biome are located. There is a zone of merging (rather than clear cut dividing lines) between biomes, which is the reason for asking the question in Activity 2(a). Activity 3 is focused upon the adaptations of plants to extreme environmental conditions; additional information about this was given in Unit 4.1 on pages 224-5. In Activity 4 the focus is upon seasonal change, a major feature of the savanna biome.

Further study

Investigate the natural vegetation in your country / world region.

a) From Figure 4.49 name the biome(s) present.
b) Name the common varieties of plants (trees, shrubs and grasses).
c) Where are the largest areas of natural vegetation cover found?
d) Describe the human uses of the natural vegetation.

UNIT 4.5 DEFORESTATION AND SUSTAINABLE MANAGEMENT OF FORESTS

Clearance of natural vegetation and rainforest destruction (pages 219-222)

Syllabus section 24.1

Great areas of natural forests have already been cleared; some of the largest areas of natural forest remaining in the world are tropical rainforests, but many of these are under increasing threat of destruction. The main reasons of this are examined. The consequences of clearance are placed in boxes for easy observation. All except C have already been covered in the book; soil erosion is the theme of unit 4.6.

Activities

Activity 1 requires students to explain why the world focus is upon threats to the rainforest. The best answers to Activity 2 will come from students who attempt to give balanced answers; clearance of the forest means increased runoff and a greater risk of soil erosion, but as long as a good surface covering of grass remains and the area is not over-grazed, serious soil erosion should be avoided.

For effective answers in Activity 3 students need to seek out relevant sections in the book; the index will help.

Case study of deforestation – Indonesia (pages 222-224)

Syllabus section 24.1

Indonesia is a highly populated country, the fourth largest in the world; deforestation of its rainforests speeded up during the 1990s. The human causes of deforestation are the same as those in most other developing countries; as an extreme example, this makes it a good example to use. The scale of deforestation was brought to the world's attention during the great forest fires of 1997, which affected air quality in neighbouring countries.

Activities

Several techniques are appropriate in Activity 1, but the bar graph is as good as any; this is the one that the majority of students are likely to use. Air pollution from the Indonesian forest fires in 1997 spread to neighbouring countries; this is the basis for the answer to Activity 2 about why deforestation in Indonesia became an international issue. Before sensible judgements can be made, all options need to be examined. This is why in part (a) of Activity 3 students are asked to explain the part played by each one before choosing the one they consider to be most to blame in part (b). The quality of the justification is more important than the choice.

Further study

Case study of deforestation in your home country – follow a similar approach to the one used in this case study.

A Research data for amount of deforestation and population numbers.
B What is the attitude of the government to deforestation? Does it have a policy?
C In what ways can deforestation aid economic development?
D How great are the pressures from a growing population?

Sustainable forest management techniques (pages 224-226)

Syllabus section 30.2

The commercial timber resources in some coniferous forests have been managed for decades, whereas management of tropical forests is more recent and not as widespread. Conservation groups have shown that preservation of the forests can bring long-term benefits greater than the more obvious short-term economic benefits from clearance (Figure 4.64). Sustainable management usually involves local community involvement, but even overtly commercial activities like logging can be practised in a way that doesn't require complete forest destruction. There is increasing international pressure upon governments to properly manage their

remaining areas of rainforest; the economic incentives for preservation are increasing, albeit only slowly.

Activities

In Activity 1, a study of Figure 4.64 reveals long-term (sustainable) benefits over short-term (but finite) economic gain. To achieve the long-term benefits research, education, training and management are needed. Activity 2 allows some of the options for forest preservation to be described in more detail. Increasing public awareness is important; designing a poster in Activity 3 is intended to make students think about messages that will persuade people to value their rainforests more. Activity 4 encourages local investigation.

Further study

Activity 4 can be extended to include management methods that could be used should the country become more conservation-minded.

UNIT 4.6 SOIL EROSION, DESERTIFICATION AND CONSERVATION

Soil erosion: causes and consequences (pages 226-228)

Syllabus section 27.2

This is another example of a natural process speeded up by human actions. Natural soil erosion is most likely to occur in dry environments and where the land is mountainous and slopes are steep. Humans clearing the land in these areas risk causing the highest rates of erosion. Bad farming practises and increasing population pressure are also responsible for making soil erosion a growing environmental problem. Both the environmental and economic consequences of soil erosion are serious.

Activities

Information useful for answering the question in Activity 1 can be found earlier in the book in Unit 1.6, where students were introduced to the topic of soils. In Activity 2, population pressure is the basic answer to part (a), steepness of slopes to part (b), bad farming methods to part (c), increased water and soil flow as well as silting up the river in part (d). The local dimension is introduced in Activity 4.

Further study

Activity 4 offers the opportunity for this.

Desertification: causes, effects and example of the Sahel (pages 228-230)

Syllabus sections 27.2 and 30.1

This happens when human activities result in the creation of land surfaces unable to support vegetation, mainly in semi-arid regions, resulting in environmental, economic and social consequences that are usually more serious than those caused by soil erosion. The Sahel is the largest world area which is repeatedly affected. In a few areas strategies to reverse desertification have been introduced, with enough success to suggest that desertification need not always be permanent.

Activities

The aim is to get students to identify the key points under the four headings suggested, so that information about desertification is organized in a manner which should make it easier to remember for, and use in, an examination.

Further study

Is your home country (or world region) at risk from desertification?

- If yes, why and what measures are being taken to stop its spread?
- If not, why not? Are natural or human factors more important for explaining this?

Soil conservation (pages 231-233)

Syllabus section 30.1

The syllabus list of strategies is organized under three headings. Mechanical methods involve a change in the land and farming landscape; examples are terraces and small embankments, which alter the shape of the land surface, and contour ploughing and windbreaks which affect the appearance of the fields and surrounding areas. Changes in farming practices usually involve ways of keeping as much of the surface covered for as long as possible, of which mixed cropping, crop rotation and improved dry land farming techniques are examples. Community solutions often involve use of a package of measures; the issue of land reform and redistribution of land, however, is often an issue too far for governments to accept.

Activities

Activity 1 requires students to observe that terracing is being used, and then draw a sketch labelled to show how it aids soil conservation. For Activity 2(a) the two methods are terracing and planting trees. The area marked 3 in Figure 4.73 appears to be the main farming area where slopes are less steep, so that reference to good farming practices is the best way to answer Activity 2(b). The main aim in Activity 3 is to get students to name and explain methods of conservation, which

are useful in the area that was used previously to show the effects of soil erosion. On the final sketch in the answer to part (c) we can expect to see woodland planted on the upper slopes above the farming areas, windbreaks between some of the fields, terraces on the steeper slopes within the farmed area and greater crop variety inside the fields.

UNIT 4.7 WORLD POPULATION GROWTH

World population growth: birth and death rates (pages 233-235)

Syllabus section 23.1

Total world population growth is displayed in Figure 4.74 and students are introduced to four key population terms. References to the variations in birth and death rates between countries, and the reasons for them, are followed by a short introduction to natural increase. Important differences between developed and developing countries are explored more vigorously in the Activities.

Activities

One message from Figure 4.75 in Activity 1 is that total population growth speeded up; the increase in numbers was greater from 1975 to 2000 than it had been from 1950 to 1975. An even stronger message is that most of the growth took place in developing countries. Good students will use values to support their answers. The difference in population in part 1(b) is 3.7 million. Any one method from line, bar or pictograph can be used in Activity 2(a) for showing values in A; a pie graph or divided bar graph makes a more appropriate choice for showing B. In A the number of years for the population to grow by 1 billion is expected for increase from 13 to 27 (i.e. almost double) – this is the basic evidence needed to answer part (b). In Activity 3, natural increases are 27 per 1000 for Pakistan, 10 for China and 1 for the UK. A range of answers to part (b) are likely, but the most obvious point of comment is that the developed country (the UK) has the highest death rate. The reason for this, which many students find difficult to understand, is that the death rate is a ratio per 1000 people. Developed countries have relatively few young people and high percentages of old people; even though old people are living longer due to improved medical knowledge, many more are reaching the age when they will die. The reverse applies in developing countries; life expectancy may be lower, but a much higher proportion of the population is well below the age of life expectancy.

Further study

What are the birth, death and natural increase rates in your country? How do they compare with surrounding countries? If there are big differences, why have they come about?

The Demographic Transition Model (pages 236-237)

Syllabus section 23.4

The four stages of the model are shown in a diagram (Figure 4.76), summarized in a table (Table 4.8) and explained in the text. Since the original model was created, some developed countries have moved into a time of natural decrease in population, which has led to the suggestion that a stage 5 needs to be added to the basic model in order to accommodate these.

Activities

Demographic transition model diagrams need to be drawn carefully in relation to the values for birth and death rates. Carelessly drawn diagrams in Activity 1(a) will not take due note of the values for birth and death rates. In part (b) the natural increase is shown by the size of the gap between the lines for birth and death rates; this should emphasize to students the enormous size of the increase in stages 2 and 3. The answer to Activity 2(a) is fall in death rate, due to improvements in healthcare and clean water supply which increase life expectancy. Fall in birth rate is the answer to part (b), for which the reasons are a mixture of political, economic and social factors. Activity 3 is about natural decrease, mainly restricted to Europe where birth rates are the lowest in the world. The factors used for explaining decrease in birth rates in Stage 3 apply in an extreme form in Europe; the point about women becoming more career-minded is particularly significant. Activity 4 encourages consideration of the home country and how it fits the DTM.

Further study

Activity 4 could be extended to include population data for surrounding countries, especially if there are significant differences.

Population structure (pages 237-239)

Syllabus section 23.2

A population pyramid is the presentation technique used for showing population structure by age and sex. By using pyramids for Pakistan and Germany the typical contrasts in population make-up between developing and developed countries are shown. A student guide to pyramid interpretation is given; of great importance is the appearance of the bottom of the pyramid, because this part displays the most recent population data. Coping with a young population has been an issue in developing countries for many years; in contrast, how to manage an ageing population is a relatively new issue that developed countries are only just beginning to address. Of course, with time it will become a broader issue as populations age in the better developed among the developing countries, such as Argentina and some in eastern Asia including China.

Activities

Activity 1(a) gives students the opportunity to put the pyramid guide into practice. Population structure is often summarized by line or bar sketches of pyramids, so that the significant features of shape can be highlighted, which is the requirement in part (b). The purpose of Activity 2 is to draw student's attention to the key words and phrases, some of which are included in the syllabus. In Activity 3 Figure 4.79 shows summary (rather than complete) pyramids for the UK, a country which began to pass through the stages of the DTM earlier than most. 1880 has the appearance of stage 2 whereas 1980 shows stage 4 (or possibly late stage 3).

Further study

From a government website seek population data for age groups 0-4, 5-9 etc. for your own or another country of your choice. Draw the population pyramid (with or without the help of a computer). Analyze its main demographic characteristics.

Migration (pages 239-241)

Syllabus section 23.3

Reasons for migration are usually examined in terms of push and pull factors. These vary in strength according to the type of migration. In forced migrations push can be 100%; for voluntary migration, pull must be more than 50% of the reason for moving. In terms of numbers, rural to urban migration represents the world's largest movement of people. The gap in service provision between rural and urban areas in developing countries, such as for clean water supplies and sanitation, was referred to earlier in Chapter 2. Despite appearances, and many problems, large cities in developing countries are dynamic places, which are centres of economic growth and change. Rural to urban migration is a selective process because the more able and go-ahead migrate first.

Activities

The main reason for asking the question in Activity 1 is to check whether students understand the difference between a push and a pull factor. The most effective answers will be given by students who do more than use simple negatives and positives such as 'no work' and 'more work'. 'More variety of work' and 'better paid work' or similar are preferable to 'more work'. In Activity 2 students are asked to draw diagrams based upon a real example (forced migration from a volcanic eruption) and upon observation (from photographs of a rural and an urban area; in other words, the requirement is to apply the specific to the general, which can be quite a demanding skill). Activity 3 is essentially a case study of rural to urban migration in the home country (if relevant), or in any other named country chosen by the student.

Further study

Activity 3 suggests investigation of a more individual nature.

Urbanization (pages 241-243)

Syllabus section 26.4

The section begins with a precise definition of urbanization, a term which is often used loosely for urban growth. This process is fuelling the growth and sprawl of big cities, which are increasingly concentrated in developing world countries. A study of causes of urbanization is followed by references to urban problems that result, which are arranged under the headings economic, social and environmental.

Activities

The answers in part (a) of Activity 1 are (i) Asia 13 cities, (ii) Africa 1, (iii) Europe 0, (iv) North America 2 and (v) Latin America 4. Plotting on the world map in part (b) should highlight the concentration in South and East Asia. Reasons in part (c) can be given in terms of developed countries compared with developing countries and variations in population numbers and wealth between continents in the developing world, such as low levels of economic development in Africa compared with Asia. The task in Activity 2 is to identify the individual problems from the text. Activity 3 requires photographic observation; the amount of detail given based on what can be seen in the photograph is likely to be the main determinant of answer quality. Speed of population increase and sheer size are likely to provide the bases for explanation in Activity 4. Activity 5 gives the chance for students to relate the urban picture in the home country to the general world pattern.

Further study

Investigate sizes of the largest cities (say top 5 or top 10) in the home country; show locations on a (sketch / printed outline) map. Choose one on which to concentrate, such as the closest, and name and explain its main urban problems.

Implications of population growth and structure (pages 244-245)

Syllabus section 26.1

Because many of the environmental problems that population growth causes and makes worse have already been covered, they are merely summarised at this point in Table 4.10. Growth in urban areas from rural to urban migration causes differences in population structure between big cities and rural areas. Figure 4.84 shows that a second population peak has developed in 20-35 age range in this city, due to in-migration of people of working age. Previous references to

young and ageing populations are taken a stage further by references to their implications for the country, which are mainly economic.

Activities

The second bulge in population, which interrupts the usual pyramid shape for a developing country, narrowing from a wide base, should be labelled prominently on the sketch diagram in Activity 1(a). In part (b) the sketch drawn by students should show a pyramid thinner than expected in the 20-40 age groups, which makes young and late middle age appear over-represented. The answer in Activity 2(a) is that the ratio has gone down by more than 3 per old person (it is about 3.4). There will be only half the number of workers per pensioner to pay taxes by 2050. In other words, more people have to be supported by fewer workers, which is why the government of Japan is facing a major problem (part b). An increase in the birth rate in Japan would reduce the problem – can students think of incentives or measures which would encourage Japanese couples to have larger families (part c)?

Strategies for managing population growth (pages 246-248)

Syllabus section 29.1

Students are introduced to the range of ways for reducing population growth and to variations in the strength with which they are implemented. The extreme example of China's famous 'one child' policy is compared with that of some of the other Asian countries.

Activities

Part (a) of Activity 1 merely requires selection from information provided in the text. Part (b) is a more open question and requires explanation, judgement and an ability to incorporate relevant examples. Activity 2 brings the issue down to a national level. Population policy in the student's home country can be studied and compared with what is happening in others.

Further study

Activity 2 suggests what might be done in a national survey of population policy.

Strategies for managing urban problems (pages 248-250)

Syllabus section 29.2

Cairo is used as a case study. It has all the usual problems of one of the world's big cities. Since attempts have been made to solve many of these, Cairo is a good city to study what has been done and assess how successful the strategies have been.

Activities

The background to the urban problems in Cairo is large and includes continuous population growth, which is dealt with in Activity 1. Choices for the two types of graph requested in Activity 2 include bar, pie, divided bar and pictograph. The key to the answer to part (ii) is rural to urban migration based on the difference shown between rural and urban – Egyptian £1108 for per capita income per year and 18 per 1000 for infant mortality. Activity 3(a) is about the strategies used in Cairo (which have been, or could be, used in other big cities); in part (b) students have the chance to comment upon their relative success. Perhaps the overall message is that urban problems are not easy to solve, even where the will to do so exists among the authorities. Activity 4 invites students to undertake a similar study for a city more familiar to them.

Further study

Activity 4 gives the framework for undertaking an investigation of the student's choice of city.

Improving housing in developing countries (pages 250-253)

Syllabus section 29.2

Housing is a particularly severe urban problem in developing countries; it keeps getting worse as people flood in from rural areas. The emphasis in this section is on self-help schemes, which for their success usually require cooperation between the community and city authorities, and the active participation of both. Two case studies in Chennai and Karachi are used as examples.

Activities

In Activity 1 students are asked first to explain the two comments about shanty towns, which are directed at the more optimistic theme of this section. They may help to offset the stereotypical image of all shanty towns as slums. Part (b) gives the opportunity to outline strategies for improvement. Activity 2 is the local study of the nearest large city. In part (a) showing locations will give some idea of the extent and scale of the problem of poor housing. For part (b), in some cities it might be easier to restrict study to just one area where improvements have been made.

Further study

This is suggested in Activity 2, which can replace the examples used in the book as student's preferred case study for use in examination answers.

UNIT 4.8 WORLD INEQUALITIES, TRADE AND AID

Contrasts in development between rich and poor (pages 253-256)

Syllabus section 26.2

It may seem rather late in the day, but in this section is the formal introduction to developed and developing worlds. Figure 4.95 shows the summary line to divide the world into a rich 'North' and a poor 'South'. The measure most widely used for comparing the wealth of countries is GDP. It is not ideal, but it is the best measure available. Reasons why it is likely to under-value the wealth of developing countries are given in the text.

Activities

What is needed for answering Activity 1 can be taken from the text. In Activity 2(a) students are required to observe the map closely and describe the course of the line from Figure 4.95; in part (b) they switch their attention to Figure 4.97 to concentrate on what it shows for the student's own world region. Questions asked in association with Figure 4.97, to try to focus student attention on the most significant aspects, might have been discussed in class. Activity 3 gives students the chance to show their understanding of these issues.

Other measures of development and their consequences (pages 256-258)

Syllabus sections 26.2 and 26.3

Social measures can also be used to highlight variations in levels of development between countries. Many of these have economic causes. They are all inter-connected; together they contribute to cycles of poverty, from which it is difficult for the world's poor to find an escape route. (Students can be asked to refer back to Figure 2.42 page 113, which examined the same theme in the context of disease.) There are environmental implications as well: for very poor people survival today is more of a concern than conservation of the environment for the future.

Activities

In Activity 1 students are required to show that they understand how the factors causing poverty act together to create inter-connected cycles of poverty. One cycle that would be an answer to Activity 2, based on what is in the text at this point, is poverty – more intensive use of farmland – soil damaged by over-cultivation and overgrazing – soil erosion occurs – farm output falls – less food to eat and sell – poverty. Others can be done for desertification and salinization. Possible labels from earlier work to attach to the spider diagram in Activity 3(a) include clean water supplies, increased water supply for irrigation, new (high yielding) varieties of seeds, more clinics and doctors, and education about birth control.

In part (b) the explanation is the important part of the answer. In Activity 4(a), Figure 4.101 shows that the highest infant mortality rates are in Africa and Asia. The basic point in part (b) is that infants are the most vulnerable to malnutrition and disease, meaning that they are the first to be affected by family poverty.

Further study

Ask students to undertake research to discover data for 5 measures of development for the home country; useful sources are websites of governments and international organizations like the UN. What is the country's position in the international league table of development? What measures could be taken to improve its position?

The need for fair trade (pages 258-259)

Syllabus section 29.3

Some of the problems related to world trade for developing countries were referred to in Chapter 3, (such as low and wildly fluctuating prices for crop and mineral exports). The scales of trade are tipped against developing countries since many rely on the export of primary products, which have less value added than manufactured goods. The Fair Trade movement guarantees a price to producers above their costs of production. It is one of the few signs of change, although it is only a tiny part of world trade at the moment. Pressure on larger companies to join in is increasing, but they are always slow to change when it costs them money.

Activities

Some of the content in unit 3.5 in chapter 3 can also be used by students in answers to Activity 1. Activities 2, 3 and 4 are about the Fair Trade movement and its usefulness.

Aid (pages 260-261)

Syllabus section 29.3

Aid can be distinguished according to type and to the time scale of need. The three types are itemized and commented on in Table 4.12. Aid from NGOs tends to be given the best press. The need for aid after a natural or human disaster is immediate; its nature and purpose is different from long-term aid, which aims to achieve improved quality of life and levels of economic development well into the future. An example is taken from Bangladesh.

Activities

Activities 1 and 2 are focused on the types of aid and different time scales. Activity 3 moves from the general to the specific; the work done by the named aid organization can be either in the student's home country or in other countries. Activity 4 is intended to make the student think about the value of aid to developing

countries; it allows them to express their opinions about the usefulness of aid as a 'strategy for overcoming world inequalities' (to quote syllabus terminology).

Further study

The local dimension has already been catered for in Activity 3.

Think local – the case for local food supplies (pages 262-263)

Syllabus sections 29.2 and 29.3

The text includes some ideas about ways in which people in rural areas in developing countries can improve their food supplies and security. Support is given by reference to Ethiopia, where real improvements can at last be seen in some areas, such as on the plains around Korem.

Activities

The purpose of Activity 1 is to make students think about sources for the main foods they eat, and how local are the supplies. In answers to Activity 2 students can be expected to refer to economic advantages, as well as those for the environment because less transport is needed. Activity 3 allows students to think about ideas for a more sustainable future for rural communities in developing countries.

UNIT 4.9 UNSUSTAINABILITY ON EARTH – CAN YOU HELP? (PAGES 264-265)

Activities

Figure 4.108 lists global indications of unsustainability caused by people, referred to throughout the book. Students are invited in the activities to select the ones they consider to be of greatest importance and to explain their choices. It would be possible to do a follow-up class activity. Based upon whole class choices, work out class average rank values for each of the indicators. Discuss what can be done about the top 5 from the class.

Activity 3 fits the theme running through this syllabus – how can the Earth's resources be conserved and managed in a self-sustaining way for the benefit of future generations, while maintaining and improving the quality of life of the present generation.