HL Paper 1

"Poverty reduction cannot be achieved without improved soil management." Discuss this statement.

Markscheme

Responses should show a clear understanding of the terms "poverty reduction" and "soil management" and comment on the direct links or lack of

links between the two.

Possible themes include:

- · soil erosion and overgrazing and the harm to farmers' livelihoods
- · salinization and the long-term problems it creates in some low-income countries
- · poverty reduction can also be achieved through international aid and debt relief
- · migrant remittances play an important role in some contexts
- soil management techniques including terracing, afforestation, rotation, additional fertilizers.

Good responses that score well at AO3 (synthesis/evaluation) will consider both sides of this question and may use one or more of the following approaches:

Spatial – On a local, national or regional scale where agricultural activities are the norm, soil management strategies will no doubt have a positive impact on communities and help in reducing poverty. By comparing strategies in rural/urban and/or different geographic regions responses may evaluate the success of different poverty reduction strategies.

Temporal – Soil management may reduce poverty in the long-term, but is unlikely to have any positive impact in the short-term, whereas other strategies such as micro credit, aid, family support payments and remittances may be more appropriate and have more short-term benefits.

Perspectives – Responses could comment that soil management is only part of any poverty reduction strategy as it only focuses on one limited aspect of poverty. Reducing poverty for agricultural communities is not only about yields from farmlands but is also about access to markets and a fair price for produce. Also poverty reduction

is not only about increasing wealth, but also intricately connected to education, health and gender issues, where improved soil management may not make much of a difference.

Responses do not need to consider more than one of these ways in order to access top marks. They may also tackle the question on any scale, local, regional or global.

Better answers will discuss not only soil management strategies but other ways in which poverty can be reduced, such as debt relief, remittances, aid, trade and market access.

At band D, responses will describe some aspects of soil management techniques or may focus on alternative approaches to reducing poverty.

At band E, responses will <u>either</u> explain both sides of the question <u>or</u> will synthesize well developed themes to discuss how poverty as a concept goes beyond only the quality of soil.

At band F, expect both.

Marks should be allocated according to the markbands.

Examiners report

[N/A]

Discuss why some governments find it difficult to provide access to safe drinking water for all their people.

Markscheme

Possible themes may include:

- · safe drinking water and provision/access/affordability
- · physical water scarcity and economic water scarcity

- · disparities in access
- control of supply (privatization/nationalization)
- possible government corruption
- privatization
- · lack of infrastructure in rural areas.

Good responses that score well at AO3 (synthesis/evaluation) will consider both sides of this question. An examination of both sides may involve consideration of those national or regional governments that find it difficult to provide access and those that are able. Other approaches that examine both sides may discuss variations in the

level of difficulty. Answers may use one or more of the following approaches:

Spatial – Some governments are in countries that suffer from physical water scarcity, which limits the supply and/or suffer from economic water scarcity, which limits access. This is mainly an issue in low-income countries **but** it is possible that it can be an issue in countries of all levels of wealth. Responses may also look at how the size of the country may pose challenges for water provision.

Temporal - Overcoming physical water scarcity may take a lot longer to achieve than overcoming issues associated with economic water scarcity.

Perspectives – Some governments may prioritize other development goals over the provision of safe water to **all** people, and may even deliberately marginalize some minority communities by not providing safe water.

At band D, responses will describe the provision of safe drinking water in countries, possibly with some description of how some segments of the local population are better served than others (due to wealth, location of residence, etc).

At band E, responses will <u>either</u> explain "two sides" of the question <u>or</u> will synthesize well developed themes to discuss how some segments of the population lack access to safe water because of factors such as wealth, location of residence, etc.

At band F, expect both.

Marks should be allocated according to the markbands.

Examiners report

[N/A]

"Ensuring adequate water supplies is a greater environmental challenge for the world than adapting to climate change." Referring to examples,

discuss this statement.

Markscheme

Coping with climate change may involve both taking measures to limit climate change as well as adopting strategies or policies designed to limit,

adapt to, or ameliorate its impacts. These impacts affect almost all human activities from energy generation and usage to agriculture, industry,

population migration, and the locations of settlement and transportation routes.

Climate change also directly affects future water supplies, but other reasons, such as over-abstraction of groundwater, and pollution of streams and groundwater, are also responsible for making the provision of adequate water a serious challenge for the future.

The phrase "adequate water supplies" can be seen as including both quantity and quality of water. The discussion could therefore extend to the concepts of water scarcity (physical and economic) and the factors affecting access to safe drinking water. Discussions of water supplies that focus unduly on the human/political dimensions of water provision are likely to be self-limiting since they are likely to stray away from the term "environmental challenge".

Responses may also choose to focus more closely on the phrase "most significant environmental impact" and introduce some discussion of the significance of environmental challenges other than climate change and water supply, such as deforestation, soil degradation, desertification and environmental restoration. This is also an acceptable approach.

Discussion of non-environmental challenges (eg population growth) should not be credited except in cases where the response provides some justification suggesting how or why the challenge can be considered to relate to the environment.

At band D, responses are likely to describe a number of points about climate change and water supplies.

It is not necessary for the discussion of climate change and water supplies to be of equal depth for the award of full marks.

At band E, responses are likely to provide sufficient supporting details during the discussion to arrive at an evidence-based conclusion and to recognize <u>either</u> that some aspects of water provision are a subset of climate change <u>or</u> that we also face other significant environmental challenges besides water and climate change.

At band F, responses are likely to provide sufficient supporting details during the discussion to arrive at an evidence-based conclusion while recognizing, and attempting to analyse, the connections between water provision and climate change.

Examiners report

This was the least popular choice. Most candidates were able to discuss water scarcity and global climate change with examples; however, a

significant number struggled to connect the two issues.

Examine the relationship between environmental change and human migrations.

Markscheme

Environmental changes (may be either positive or negative) include changes related to:

- · soil quality
- water quality and availability
- biodiversity
- climate
- hazard events.

Population migrations include:

- · forced/voluntary migrations
- rural-urban migration / international migration
- · places of origin and places of destination.

Environmental changes (and their impacts) may lead to population migrations, eg soil degradation leading to out-migration.

Population migrations may lead to environmental changes, eg habitat destruction in and around refugee camps.

Answers that do not address environmental change at all and instead write about political, social and economic causes and consequences of migration should to be limited to band C and below.

At band D expect descriptions of environmental change and population migration, with few links.

At band E expect <u>either</u> a more detailed explanation of environmental changes and population migrations (with one-directional connections), <u>or</u> may examine how many connections are two-way or complex.

At band F expect both.

Marks should be allocated according to the markbands.

[15 marks]

Examiners report

[N/A]

"The fact that the world's population is now growing less rapidly means that there will be less pressure on the environment." Discuss this statement.

Markscheme

Many responses are likely to agree with this statement saying that indeed slower growth in the world's population will lead to less pressure on

resources. They may give examples as to how and why the global natural increase rate has fallen in recent decades. They may identify certain

environmental benefits that could result from this, such as less demand on resources and less environmental pressure, with some stated examples.

However, to reach the higher markbands there should be an acknowledgement that the statement is over-simplistic as population growth as a rate is a

percentage of an increasingly large number of people, so although the rate may be falling, the actual increased numbers of people on our planet every year are still very high.

More significantly, most environmental issues are a consequence of increased standards of living and not of population growth. If one compares the ecological footprint of individuals in different nations it is often very low in the most populous nations, as it is linked more to one's level of consumption. Also, many previously less developed nations are developing and industrializing at an enormous rate, which is accompanied by increased use of fossil fuels and demands on other resources such as water, soil and forest products, all with associated environmental impacts. This said, development often correlates with increased rates of urbanization and reduced fertility; natural increase rates decline but the associated impact on the environment does not.

Answers that are simplistic and/or generalized with few or no relevant facts and figures are unlikely to progress beyond band C.

At band D, expect a balanced view supported by evidence linking demography and development with environmental degradation.

At band E, expect <u>either</u> a detailed explanation of how demography and development link to environmental degradation <u>or</u> discussion of a possible counter-view that pressure on the environment will continue or even increase due to changes in consumption.

At band F, expect both and an overall assessment of the statement.

Marks should be allocated according to the markbands.

[15 marks]

Examiners report

[N/A]

The diagram shows factors contributing to the loss of biodiversity in tropical rainforests.



•	Evelois Alwas vassas why bis diversity is transial usisferrate should be sussay ad	[220]
b.	Explain how any one of the factors given on the diagram contributes to a loss of biodiversity in tropical rainforests.	[4]
a.	State one physical factor and one human factor not shown on the diagram that contribute to a loss of biodiversity.	[2]

Markscheme

a. Award 1 mark for each factor.

Possible physical factors include: natural hazards such as floods, disease, droughts, volcanic eruptions, fires.

Possible human factors include: deforestation, mining, expansion of agricultural areas, expansion of settlements, overexploitation of susceptible species leading to their extinction.

b. The explanation will depend on the factor chosen, but should provide details of precisely how the factor can contribute to a loss of biodiversity, as

opposed to simply causing or leading to deforestation. Award up to 2 marks for explanations of the factor, for example, causes of deforestation,

reserving the final 2 marks for comments which show a clear understanding of how this reduces biodiversity.

No credit may be given for explanations of a second factor, or for explanation of any factor not shown on the diagram.

c. Award 1 mark for each basic explanation, with additional 1 mark for extension and or exemplification.

The reason for preservation **must** be linked to biodiversity.

Possible reasons include: the economic value of plant and animal species found therein; the importance of biodiversity in maintaining a healthy forest structure, with its implications for watershed protection; the importance of a healthy ground cover for soil protection; enhancing the value of rainforests for ecotourism; conserving global genetic diversity; concepts of stewardship/environmental ethics.

Examiners report

- a. Human factor deforestation was very common. Candidates struggled more with identifying a physical factor, with some choosing another human-induced factor.
- b. On the whole well answered if "cattle ranching" or "introduction of alien species" was chosen with answers directly linked to biodiversity loss.
 Answers that referred to climate change or pollution tended to be very vague and not specific to loss of biodiversity in tropical rainforests.
 Unfortunately some candidates did not use a factor "given on the diagram" and as such could not score any marks for this question.
- c. The best candidates were able to explain three reasons why biodiversity in tropical rainforests should be preserved. However, there were instances where candidates repeated similar points in the sub-parts of the question and could not be awarded further credit. Often the importance of biodiversity was not addressed and the answers lacked extension and development. It was also common for weaker candidates to concentrate on explanations for preserving tropical rainforests rather than the specific preservation of biodiversity within it.

"Falling fertility rates are no guarantee of reduced resource consumption." Discuss this statement, referring to examples.

Markscheme

There are many possible approaches to this question, and each should be marked on its merits.

It would be expected that responses show a clear understanding of fertility rates. This can be defined, stated or implied. It would also be expected that most responses agree with the statement. Even though fertility rates are falling (global fertility is 2.5 in 2013), population momentum and increased longevity mean populations are still growing significantly in most regions. Many Sub-Saharan nations still have predicted doubling times of less than 30 years (eg Ethiopia), despite falling fertility. So falling fertility does not immediately equate with fewer people consuming fewer resources.

There should also be some understanding that when fertility does fall it is generally as a result of, or goes hand in hand with, increases in the standard of living. In the present development paradigm this is associated with increased consumption of resources. Falling fertility is thus often accompanied by an increase in a country or region's ecological footprint.

There are some obvious long-term benefits of falling fertility such as the need for smaller houses, possibly resulting in less pressure on resources and space. Responses could also look at some of the issues related to fertility rates falling below replacement level <u>but</u> their answer must be in relation to how this impacts upon resource consumption.

Responses should make use of examples but responses that focus on describing population policies in some nations and not the consequences of falling fertility rates on resource consumption in that country will be self-limiting as this is not the question.

For band D expect some description of costs and benefits of falling fertility rates on resource consumption. This need not be balanced.

For band E expect some explanation of costs and benefits of falling fertility rates on resource consumption and there should be some attempt at an evaluation of the statement.

For band F expect some explanation of costs and benefits of falling fertility rates on resource consumption and there should be some attempt at an evaluation of the statement, with effective use of examples.

Marks should be allocated according to the markbands.

Examiners report

[N/A]





[Source: Jim Giles (29 March 2010), Hacking the Planet: Who Decides? New Scientist, issue 2754]

a.	Identify the two most cost-effective options shown on the graph.	[2]
b.	Explain how deforestation may contribute to global warming.	[3]
c.	Explain two possible environmental consequences of global climate change.	[3+3]

Markscheme

- a. Award [1 mark] for stratospheric sunshade and [1 mark] for afforestation.
- b. Deforestation burning of forests releasing CO2 / removes a valuable carbon sink [1 mark]

Increases CO₂ in the atmosphere [1 mark]

CO₂ is a greenhouse gas linked to global warming, through its role in helping raise the quantity of heat energy retained by the atmosphere [1 mark].

Credit should be given in a similar fashion to answers that refer to deforestation resulting in changed albedo.

The answer needs to focus on the loss of the trees - not on what replaces the trees for example, cattle ranching and methane.

c. The consequences may be at any scale and there are many possible answers.

Possible consequences include:

- rising sea levels [1 mark] due to thermal expansion [1 mark] floods lowlands [1 mark]
- melting ice / Earth's albedo reduced/increased intake of solar radiation / warms climate further
- increased temperature of oceans / greater incidence of tropical storms / devastation caused by hurricane Sandy in Haiti, Cuba
- melting ice releasing freshwater into North Atlantic / shuts down ocean / may lead to falling temperatures in Europe.

Other possibilities: extinctions, moving biomes, bleaching of coral reefs, desertification, etc.

In each case, award [1 mark] for identifying a valid consequence with a further [2 marks] for two distinct points in the explanation, one of which could be exemplification.

Examiners report

- a. Straightforward but the lack of units on the graph seemed to confuse some candidates.
- b. Most responses had excellent knowledge and understanding of how deforestation leads to global warming with reference to forests being carbon sinks or increases via burning and how the increase in greenhouse gases led to the trapping of long wave radiation.
- c. Most candidates could include valid consequences. They were able to identify a consequence such as rising sea levels and give an explanation of how this occurred. Weaker responses were characterized by very limited explanation. There were some who drifted from the environmental element of the question and explained the impacts on human activity, which was self-limiting.

The graph shows global temperature changes since 1850.



[Source: IPCC - data based on a graph in The Economist, 9 September 2006]

a.	State one natural external forcing which could have influenced the changes in temperature shown on the graph.	[1]
b.	Referring to the graph, describe how temperature has changed since 1850.	[3]
c.	Explain three possible environmental consequences of global climate change since 1950.	[3x2]

Markscheme

- a. Award 1 mark for naming a natural external forcing. Any changes in solar radiation; changes in the orbital path of the Earth; volcanic eruptions (these are acceptable as external to atmospheric system). The answer must be external to the Earth's atmospheric system.
- b. Average temperatures remained more or less stable at first/until 1910–1930 [1 mark]. After that time, average temperatures have risen

significantly/there has been an overall increase [1 mark]. The final 1 mark is reserved for quantification or for describing how temperatures have always oscillated/fluctuated, though these have not altered the overall trend.

c. There are many possible answers here. Award 1+1 marks for each valid environmental consequence, provided that it is developed by means of

examples, explanation or detail. No credit should be awarded for any consequence that is not environmental in nature, or for statements such as

"temperatures have risen" since that is implicit in the question.

Valid possible environmental consequences include: poleward shift in some natural vegetation belts; rise in sea levels; alterations to migration routes of animals; expansion of some deserts; greater frequency and severity of tropical storms and hurricanes; record-breaking climate extremes; melting of Arctic ice; retreat of glaciers in most parts of the world.

Examiners report

- a. There seemed to be quite a lot of confusion in identifying a natural external forcing. Technically this needs to be external to the Earth's atmospheric system and as such only a limited range of answers could be credited. As these correct answers were relatively few and far between and this is a new syllabus we allowed for some flexibility with this question. Please refer to the markscheme for the acceptable answers.
- b. Candidates have become more confident in describing trends. On the whole this was well answered. Those who did not gain all three points generally found it difficult to relate the first period in the graph (1850–1920) to the long-term temperature average.
- c. Most candidates had quite a lot to write here with detailed knowledge of potential environmental consequences with good explanation and exemplification. For example, ice caps melting habitat loss polar bears vulnerable. In some minor cases sticking to environmental impacts proved problematic, as responses came back to the impact on humans rather than ecosystems of natural environments.

"Climate change will only increase global disparities in wealth." Discuss this statement.

Markscheme

Refer to Paper 1 Section B markbands (available under the "Resources" tab) when marking this question.

There are many possible approaches to this question, and each should be marked on its merits.

It is hoped that candidates will interpret global climate change as having a wider meaning than "global warming". The disparities in wealth may be considered at any scale: regional, national or sub-national. Effects may be due to higher temperatures, change in rainfall amounts or timing, rising sea levels, and may impact the environment, population, settlement and economic activities. Effects may include: changes in farmland productivity; loss of tourism earnings; reduction in water quality and/or availability; population migration; change in distribution of natural vegetation zones; increased incidence of climatic hazards.

Discussion of the statement may have a number of approaches: there could be a discussion of the positive and negative impacts of climate change on wealth; a discussion of the magnitude of the impacts of climate change on wealth; a discussion of geographical variations in the impacts of climate change on wealth; a discussion of how the impacts of climate change on wealth vary over time; or a discussion of how the impacts of climate change on wealth vary with access to technology/investment.

Accept other valid discussions.

Responses at band D are likely to describe ways in which climate change could affect the wealth of different people and places.

At band E, expect <u>either</u> more detailed explanation of how climate change could increase and/or decrease the wealth of different people/places <u>or</u> a structured discussion of the concept of global disparities in the context of climate change from a positive and/or negative viewpoint.

At band F, expect both.

Marks should be allocated according to the markbands.

Examiners report

[N/A]

Examine the negative environmental impacts of economic development on water and biodiversity.

Markscheme

There are many possible approaches to this question, and each should be marked on its merits.

Negative impacts arise from development as the use of resources (and ecological footprint) increases. Both water quantity and quality may be adversely affected by development, and biodiversity is often reduced as forests are felled and land cleared for settlement or agriculture. Responses may consider how climate change, as a product of global development, may have a wide range of impacts on water and biodiversity.

It is possible that some responses may explore the idea that as countries become more developed they enact environmental controls and adopt strategies to reduce the stress on water and biodiversity.

Responses that fail to look at both biodiversity and water (does not have to be in equal depth) are unlikely to go beyond band D. To access bands E and F responses should either provide a range of case studies that show understanding or take an evaluative approach that recognizes that economic development is a complex concept.

Marks should be allocated according to the markbands.

Examiners report

[N/A]

"There is no truly sustainable solution to the world's growing energy problems." Discuss this statement.

Markscheme

Responses are likely to identify energy-related problems such as: meeting the growing demand; increasing the use of renewable sources of energy;

cutting energy costs, increasing energy availability; expansion of energy production into sensitive environments. There could be a brief explanation of

the causes of the problems identified.

Responses could also include some discussion of what a sustainable solution involves, with clear reference to being able to meet future demand.

Candidates are likely to divide energy resources into renewable (wind, solar, geothermal, hydro, tidal) and non-renewable (fossil fuels and possibly nuclear energy). Many answers are likely to discuss each of the renewable sources, pointing out their relative merits. However, development of renewable sources (generally considered to be sustainable) is unlikely to be able to meet the growing demand owing to high investment costs and locational considerations.

In considering some of the other energy problems, the discussion might extend to strategies of energy conservation/reduction.

To reach bands E and F, responses should show a sound understanding of sustainability and a good knowledge of at least two distinct energy problems.

Marks should be allocated according to the markbands.

Examiners report

This was the most popular question. In general the best answers had excellent knowledge of the term "sustainable" when applied to specific energy

issues. The grade E and F answers had a balanced approach of both energy conservation and alternative energy sources with pertinent

exemplification, for example, wind farms in Denmark. Weaker candidates tended to write about the advantages and disadvantages of numerous

alternative energies with little reference to either energy problems or sustainability. These were self-limiting.

"We still have the resources to live as wastefully as we want." Discuss this statement.

Markscheme

Whether or not the statement is accepted as holding any validity, it suggests many implications worth discussing. These implications include not only

considerations of demographic, social, cultural, economic and (geo-)political development/progress but also of environmental, social and economic

sustainability.

Many approaches are possible.

Some candidates may base their discussion around the distinction between renewable and non-renewable resources, arguing that by using the former, we can reduce or remove our concern about using the latter. Nuanced positions are also tenable since some non-renewable resources are present in such large amounts that they could easily supply our needs for many generations (no adverse implications), whereas other non-renewables are in such short supply that they do require immediate protection, conservation or substitution.

An alternative approach might be to look at the adverse effects of living wastefully and then consider how society or individuals can avoid these problems. For example, it might be argued that wastefulness could lead to positive impacts such as the stimulation of new technologies, new ideas, the substitution of resources, recycling and policies to reduce resource use.

Stronger candidates are likely to point out that there are some ways of assessing or measuring our impact(s), employing such approaches as environmental footprints and food miles. Stronger responses may also link the discussion to neo-Malthusian and opposing viewpoints about the relationship between population size and resource consumption.

Answers that are simplistic and/or generalized with few or no relevant examples are unlikely to advance beyond band C.

Responses that discuss a range of ideas, supported by evidence, within a structured framework (eg compares renewable and non-renewables, or different societies, eg rich/poor countries) and show some recognition that there is room for alternative viewpoints about this question are likely to be credited at band E/F.

Marks should be allocated according to the markbands.

Examiners report

This was also a popular question and many candidates approached this with a good knowledge and understanding of issues related to consumption

and resource use. The best responses tended to look at a range of resources and ideas supported with evidence or actual case studies. Some

responses neglected to use examples of places when discussing specific resources and this resulted in a very generic response, which was penalized

by the markbands. Many responses also tended to limit themselves just to oil or energy resources, this was fine but the question was open to many

other types of resources. Many candidates focused their discussions around the neo-Malthusian versus Boserup debate and examined the

relationship between population size and resource consumption. The best answers had appropriate application and were developed to cover most

aspects of the question. Good scripts demonstrated some evaluation of wasteful living and sustainability options.

"Global climate change will increase disparities in development." Discuss this statement, referring to examples.

Markscheme

There are many possible approaches to this question, and each should be marked on its merits.

It is hoped that candidates will interpret global climate change as having a wider meaning than "global warming". The disparities in wealth and development may be considered at any scale: regional, national or sub-national. Disparities can be spatial but they can also refer to different groups within areas. It is anticipated that responses will refer to some of the consequences of climate change – many of which are already evident. These consequences then need to be built upon in terms of how they impact upon wealth, gender gaps.

Responses at band D are likely to provide descriptive, possibly anecdotal, accounts of the links between global climate change, wealth and development, with only limited attention paid to the idea of disparities, and little or no attempt made to contest the statement.

At band E, responses will <u>either</u> focus their attention on the issue of disparities <u>or</u> begin to contest the statement. For example, they might demonstrate a clear understanding of disparities, possibly by comparing or contrasting the likely impacts of global climate change in different countries or in different regions of the same country; or effectively contest the idea that global climate change will increase disparities by offering arguments or examples where disparities are likely to be reduced.

At band F, responses will incorporate both these elements, and offer an evidence-based conclusion/evaluation of the statement. The discussion of cases where disparities will be increased and cases where they will be decreased need not be equal in depth for the award of full marks.

Marks should be allocated according to the markbands.

Examiners report

[N/A]

The graph shows the categories of global water consumption in 2010.



[Source: World Bank Development Report 2010. http://wdronline.worldbank.org/worldbank/a/c.html/world_development_report_2010/chapter_3_managing_land_water_feed_billion_people_protect_natural_syste Used with permission]

a.	Identify Category X on the diagram.	[1]
b.	Define the term <i>physical water scarcity</i> .	[2]
c.	Explain two physical factors that affect the availability of safe drinking water for a community.	[4]
d.	Analyse the role of water in the causes of soil degradation.	[4]

Markscheme

- a. Agriculture/farming [1 mark].
- b. Physical water scarcity occurs when the use of water resources [1 mark] approaches or exceeds sustainable levels [1 mark] (that is, it relates

water availability to demand, meaning that arid areas are not necessarily water-scarce areas if demand is small).

For a partial definition, eg water demand exceeds supply, award [1 mark] only.

c. Award [1 mark] for each factor and a further [1 mark] for explaining why it relates to a safe water supply.

Physical factors that affect access to safe water include climate (amount, type and timing of precipitation *eg* drought; climate change), geology (groundwater and aquifers), relief (surface water depressions, poor access probable if slopes are steep), drainage (rivers, lakes), isolation or distance from supply, natural hazard events such as earthquakes.

Note that the factor must be physical. This may lead to contamination, *eg* earthquakes lead to contamination by sewage. Do not award human factors alone such as industrial or agricultural pollution.

d. At least two ideas associated with causes should be developed for the award of the full [4 marks]. A greater range of ideas (in less depth) may also

be awarded full marks.

Possibilities include: erosion by water, removing soil, may follow overgrazing and the removal of vegetation. Flash floods can strip surface soil within minutes, leaving barren rock. The upward movement of water through soil may result in salinization, rendering the soils infertile. The downward movement of water through soils may leach valuable minerals out of the soil, reducing its fertility.

Examiners report

a. [N/A] b. [N/A] c. [N/A] d. [N/A]

"A falling fertility rate is always beneficial to a country." Discuss this statement.

Markscheme

There are many possible approaches to this question, and each should be marked on its merits.

Fertility rates should be defined, this can be stated or implied.

Benefits could be: reduced costs for schooling, adults can begin to save; less environmental pressure; possible reduction of resource consumption; traditional roles of women changing, increased number of women in the workforce; potential for greater gender empowerment.

Problems could be: aging population; smaller workforce; increased tax burden; reduced market; closure of schools/clinics; need for migrants to boost employment.

Responses should make use of examples.

Responses that focus on describing population policies in some nations and not the consequences of falling fertility rates in that country will be selflimiting as this is not the question. Responses that consider only one side of the argument are unlikely to progress beyond band D. Responses that look at both benefits and problems of a falling fertility rate in a more balanced manner are likely to access bands E and F.

Marks should be allocated according to the markbands.

Examiners report

[N/A]

"The causes of global climatic change are essentially human." Discuss this statement.

Markscheme

The wording accepts global warming as a fact, but expresses uncertainty about its origin. Responses would be expected to provide a description of

the main human causes of global warming (increased greenhouse gases and particulates (aerosols) from industrialization, land use, transport,

livestock) and an explanation of the enhanced greenhouse effect.

Some description of alternative natural explanations for global climatic change would also be expected: cosmic rays, solar cycles (sunspot cycles), orbital variations (Milankovitch cycle), volcanism.

Some candidates may consider the different causes of long-term and short-term climatic changes.

If only human factors are considered, the response should not move beyond band C. Responses that evaluate the balance of argument are likely to be credited at bands E/F.

Marks should be allocated according to the markbands.

Examiners report

[N/A]

The diagram shows the world distribution of areas of water scarcity.



[Source: modified from Comprehensive Assessment of Water Management in Agriculture 2007. Water for Food, Water for Life: A comprehensive Assessment of Water Management in Agriculture. London: Earthscan and Colombo: International Water Management Institute]

a.	Define physical water scarcity.	[2]
b.	Define economic water scarcity.	[2]
c.	Describe the global pattern of water scarcity shown on the map.	[3]
d.	Explain the factors affecting access to safe drinking water.	[5]

Markscheme

- a. This should be defined as when water resources are at or approaching unsustainable levels [1 mark]. It depends on water demand [1 mark] and implies that arid areas are not necessarily water scarce.
- b. This should be defined as a condition where economic/institutional/human restraints limit access to water [1 mark]; water is available locally but not accessible for everyone [1 mark].
- c. The pattern shows economic water scarcity mainly in the tropics/lower income countries [1 mark], and physical water scarcity mainly in low rainfall areas (deserts) [1 mark]. Some reference to areas with little or no water scarcity should be allocated 1 mark.
- d. The response should demonstrate knowledge of what safe drinking water is [1 mark]. Depending on the scale considered, the main factors would be increasing population, the rising *per capita* consumption of water and the absence of, or failures in, the management of water, although other possible factors (global climate change, infrastructure developments) could be mentioned [2×2 marks]. Other valid factors should be credited.

Examiners report

a. [N/A] b. [N/A] c. [N/A] d. [N/A]

Examine the reasons for and against preserving the biodiversity of tropical rainforests.

Markscheme

Responses should demonstrate some understanding of biodiversity and acknowledge that tropical rainforests have immense biodiversity.

Reasons for preserving biodiversity could include:

- · ecological/climate value (some plants store more carbon dioxide and emit more oxygen than others)
- · role as a carbon reserve and possible contribution to climate change mitigation attempts
- value in terms of gene pool (flora/fauna)
- · actual and potential future value for industry/medicine/food
- economic value for ecotourism, and other sustainable uses
- habitat for endangered peoples (and endangered animals/plants).

Reasons against might override the need to preserve biodiversity and could include:

- · clearance for timber or other resources
- · clearance of land for agriculture (livestock/soya beans), transport, settlement
- · most tropical rainforest is in developing countries that need the resources for development
- · elimination/reduction of tropical pests and diseases
- · the need to defoliate areas during warfare
- · the high cost of preserving forests in areas where population is growing and needs resources
- forest area may be reduced or lost in the future anyway due to climate change.

Answers that address only the importance of preserving the rainforest and not the importance of preserving the biodiversity of the rainforest should not progress beyond band C.

At band D, responses should show some understanding of biodiversity and are likely to examine a limited number of reasons, almost entirely for preservation, with limited development.

At band E, responses will be underpinned by an understanding of biodiversity, will examine several reasons and include some consideration of the reasons against preserving biodiversity, possibly with some simplistic evaluation.

At band F expect a more balanced approach using specific detailed knowledge, prior to drawing some evaluative conclusion.

Marks should be allocated according to the markbands.

Examiners report

This was the most popular of the three questions with some very strong responses. There was sound knowledge of the biome and the issues linked to its biodiversity. Many made good use of examples and it was nice to see areas beyond the Amazon being used by some centres such as Borneo and the Democratic Republic of the Congo. Many of the weaker scripts were characterized by a lack of specific geographical location. The arguments for preserving were generally very well written with sound use of examples effectively linked to biodiversity. Arguments such as medical research, ecotourism, ecological stability, indigenous culture/lifestyle and stewardship were the most common. The arguments against preservation tended to be a little thinner and were mainly associated with the use of the forest as an economic resource, food source, energy alternative with biofuels and area for housing of expanding population. Most common issues were the lack of focus on biodiversity and very vague use of case study material.



[Used with permission]

a.	Identify which country or region has the lowest emissions of CO ₂ per person.	[1]
b.	Explain why some countries have higher CO_2 emissions per person than others.	[4]
c.	Explain the relationship between atmospheric greenhouse gases and the temperature of the Earth's surface.	[5]

Markscheme

a. India.

b. Emissions are related to factors such as industry, manufacturing, energy demands, economic growth, standard of living, sources of energy, transport needs, climate (heating/cooling) and levels of consumption.

Award 1 mark for each valid idea with a further 1 mark for development and/or exemplification, up to the maximum 4 marks available. Full marks should only be awarded if it is clear that the response is talking about *per capita* emissions.

c. Greenhouse gases in the atmosphere include carbon dioxide, water vapour, methane, nitrous oxide, and tropospheric ozone. Award 1 mark for correctly identifying two or more greenhouse gases. Award a further 1 mark for correctly identifying the relationship between greenhouse gases and the Earth's surface temperature. Award 3 marks for an accurate explanation of how the greenhouse effect works: incoming solar/short-wave radiation; outgoing terrestrial/long-wave radiation; absorbed/trapped by the greenhouse gases.

There may be alternative valid approaches, for example, a historical analysis of the relationship, or an annotated diagram. These should also be awarded marks appropriately.

Examiners report

- a. Most candidates had the correct answer (India) here, but a surprising number wrote Japan.
- b. Many candidates did not refer to emissions per person and this limited the marks that could be awarded. Car usage seemed to dominate answers

and few went as far as considering the impact of regulation and clean fuel initiatives.

c. On the whole the process of the enhanced greenhouse effect was explained well, but a considerable number of candidates were unable to

differentiate between ozone depletion and the enhanced greenhouse effect and so offered muddled answers. It was very encouraging to see a number of candidates answer this question with an annotated diagram.

Examine the relationship between energy consumption and environmental sustainability.

Markscheme

There are many possible approaches to this question.

Sustainability should be explained - it is achieved when resources are used at a rate which does not deplete them for future generations.

In the context of sustainability, energy use includes not only the total amount of energy required by a society but also the sources of energy required. Renewable power, such as wind and solar power, are usually sustainable sources, whereas traditional non-renewable sources of power such as coal and oil are not physical. Human and socio-economic environments can all affect the choice of energy sources.

It is possible that responses may outline specific features of energy consumption and look at their impacts on the environment. Other approaches may review developments in renewable energy and examine how they decrease the impact on the environment. Some responses may take a case study approach and review energy consumption in one or more areas to emphasize contrasts.

Reference must be made to sustainability to move beyond band D - this may be implied.

Responses that fully examine the relationship and that arrive at a clear conclusion are likely to be awarded band E or above.

Marks should be allocated according to the markbands.

Examiners report

Many candidates did not show an understanding of environmental sustainability and as such their answers lacked the correct focus. The best answers

had detailed accounts of the relationship and included plenty of valid and accurate case studies. There was some detailed knowledge and

understanding of how some countries are developing alternative energies and thus improving their sustainability.

"The world is far too dependent on oil." To what extent do you agree with this statement?

Markscheme

Candidates are expected to consider the importance of oil in today's world as the major source of energy as well as its significance for geo-politics.

Responses are also expected to consider the changing importance of other energy sources.

Most responses are likely to focus on the finite/non-renewable nature of oil stocks and argue that the use of renewable resources is urgently needed in order to guarantee sufficient energy availability for the future and to mitigate the adverse effects of dependence on oil, especially its adverse environmental impacts such as pollution and global climate change. It is anticipated that more than one non-renewable resource would be considered, but the discussion of non-renewable sources need not be balanced for this approach to reach the highest markbands, provided any examples given are valid and well developed.

Some candidates may argue (correctly) that the world's oil reserves are currently as high or higher than they have ever been, and that therefore there is less pressing need to develop alternatives than supporters of renewable energy sources advocate. To reach the highest markbands such an approach would need to be well-balanced (taking into account environmental impacts, especially) as well as well-evidenced, with reference to newly discovered deposits being added to reserves, to the development of less conventional sources of oil such as tar/oil sands, and to improved technologies that have enabled higher effective extraction rates.

Alternative approaches may be equally valid and should be considered on their merits.

Responses that are generalized, with little or no data, figures or examples, are unlikely to advance beyond band D.

At band F, the conclusion should be well-grounded in evidence or will demonstrate different perspectives of the ways in which dependency is a problem.

Examiners report

There were some very good answers with candidates demonstrating a wide knowledge and understanding of major issues around oil. These included geopolitics; oil as a raw material for plastics, paints, fertilizers; environmental concerns, as well as oil as the major source of fuel. The best answers were intelligent and well crafted. These responses contained accurate, specific, well detailed knowledge and understanding with named examples and case studies which were well chosen and developed. These developed essays made interesting reading with both a clear focus and balance and covered various aspects of the dependency on oil. Most candidates concentrated on the finite/non-renewable nature of oil stocks as both fuel and raw material and argued that the use of renewable resources is urgently needed in order to guarantee sufficient energy availability for the future and to mitigate the adverse effects of dependence on oil, especially its adverse environmental impacts such as pollution and global climate change as well as geo-political issues. Several candidates made reference to "energy returned on energy invested" and were well versed on facts and figures of both oil production and oil consumption.

"Only high-income countries can effectively develop sustainable sources of energy." Discuss this statement, referring to examples.

Markscheme

There are many possible approaches to this question, and each should be marked on its merits.

It is expected that candidates will mention more than one type of sustainable energy and attempt to distinguish between them. The question also demands some comparison between high-income and low-income countries in terms of the uptake of sustainable energies/renewables.

Many responses may look at the successful strides many lower income nations are making in the effective use of renewables such as India with biogas, China with hydro electric power and solar energy, and Brazil with ethanol.

Responses at band D are likely to provide a descriptive account of sustainable sources of energy and their merits, without any real attempt to link the discussion to examples that reveal the idea that adopting sustainable sources of energy could be regarded as a costly venture that only high-income countries can afford. Responses at this level may conclude that some forms of sustainable energy are less costly than others to introduce and implement.

At band E, responses are likely to demonstrate <u>either</u> a clear understanding that changing to sustainable sources of energy implies significant economic and possibly social costs, but that such a change is essential for development to be ecologically sustainable <u>or</u> contest the statement by, for instance, offering examples that demonstrate that even some non-wealthy countries have made great strides in changing to sustainable sources of energy.

At band F, responses should incorporate both these ideas, though not necessarily in equal depth, and should provide a conclusion that matches the arguments advanced.

Marks should be allocated according to the markbands.

Examiners report

[N/A]

"Rapid population growth is the main cause of soil degradation and reduced biodiversity." Discuss this statement.

Markscheme

Responses should show some understanding of what is meant by rapid population growth and should be able to explain what is meant by soil

degradation and reduced biodiversity. The main focus of the response should then be on discussing the extent to which both of these environmental

issues are the outcome of increased population growth. The scale of discussion will depend on the examples chosen.

It is expected that responses will tend to give a balanced view:

- explaining how both soil degradation and biodiversity are caused by population growth: loss of habitat, deforestation to make way for human settlements, infrastructure, agricultural land to feed more people, growth of urban areas in both number and size
- explaining how factors other than population growth are contributing to the loss of biodiversity and soil degradation: increased standard of living, increased consumption, oil dependence, climate change, potential physical factors.

Responses that are generalized, with few or no examples, are unlikely to advance beyond band D.

Responses presenting accurate, specific and well detailed knowledge on the causes of reduced biodiversity and soil degradation and discussing the extent to which population growth is the main cause are likely to reach band E or F if the answer makes use of effective examples.

Marks should be allocated according to the markbands.

Examiners report

This question was answered by a large number of candidates. There were a number of good responses that recognized the impact of rapid population growth and gave a balanced approach which addressed both elements well. The better answers were able to expand on the link by outlining how population growth led to degradation and reduced biodiversity. There were some excellent responses that recognized that population was a factor not only in its size but also in the increased affluence of many countries and the desire for Western diets. Other candidates recognized that growth was not simply a matter of the amount of food required but also space and commented upon urban growth and its impacts on biodiversity. Many also highlighted that growth produced increased resource consumption such as oil and linked this to climate change, with its associated impact on soils and biodiversity. In addition, candidates made the point that natural processes could lead to both elements. In the weaker responses the main problem was often the lack of precise case study material, drawing on examples from "in Africa" or "in the Amazon rainforest". Some failed to link the ideas of soil degradation and reduced biodiversity to rapid population growth. These weaker scripts were characterized by sweeping generalizations and marginal and superficial content.

"Of all the environmental challenges we face, soil degradation is the most serious." Discuss this statement.

Markscheme

A good response may define the term "soil degradation", which includes erosion (wind, water), or nutrient depletion, salinization, duricrust growth, loss

of soil structure, and others.

There are a number of possible responses as the environmental challenges in the syllabus relate to soil and also to climate change, water, biodiversity and sustainability in general. The focus of the answer should be on assessing the importance of soil degradation, but reference to other issues is needed as well in discussing the statement as it calls for some evaluation. However, a candidate cannot dismiss soil and write an essay on climate change; they must answer the question posed and use their knowledge of soil degradation to explain why it is serious or why it is less serious than other challenges we face.

Responses must develop a substantiated argument that agrees or disagrees with the statement (either by saying other challenges are more important or that soil degradation does not prevent all forms of food production, for example, aquaculture).

Responses demonstrating a thorough knowledge and understanding of soil degradation with specific and accurate case study material and offering some evaluation of the statement will reach levels E and F.

Marks should be allocated according to the markbands.

Examiners report

Some candidates who answered the question had, generally speaking, little knowledge and understanding of soil degradation, hence scored very low

marks. Those who did possess a good basic knowledge of soil degradation wavered on the evaluation part. There were some responses that ignored the question completely and wrote about deforestation.

Examine the view that population change is responsible for water scarcity.

Markscheme

There are many possible approaches to this question.

Responses should understand the term water scarcity, both economic and physical. In terms of population change it can be broadly interpreted and could refer to a growth/decline and/or a change in structure.

Population growth is expected to be the change that is most commonly discussed. Population growth causes increased demand for water. In areas where water resources are under pressure this is likely to be a significant factor increasing water stress. Population growth causes increased demand for agricultural production and an associated demand for water. Population growth may be associated with increased industrial and domestic water demand. Areas that are resource poor are less likely to be able to support larger populations and are more susceptible to overconsumption of the limited resource (for example, Australia).

Responses could argue that demographic change alone has little impact on water scarcity and that other factors are more important such as the growing affluence of a population, as this determines levels of consumption. Affluent societies are likely to have a higher *per capita* water consumption and are thus more likely to lead to physical water scarcity. Affluence increases demand because of lifestyle (dishwashers, washing machines, showers/baths) and diet (water used in meat production). The relationship between supply and demand should be addressed. Another factor (other than population change) that could be addressed could be changes in supply, for example, drought.

The strongest answers, accessing bands E and F, will need to make effective use of a relevant example or examples and reach a conclusion regarding the statement.

Marks should be allocated according to the markbands.

Examiners report

The best answers had rigorous knowledge and understanding of water scarcity, both economic and physical and could relate this to population

change (although often only growth). Only the best candidates disagreed with the statement explaining that population growth is just one of a complex

number of factors that impact on water scarcity. Some of these responses were excellent, looking at political and economic factors such as

privatization of water and increased affluence. Case studies tended to be generalized but there were some instances of precise examples, particularly

from Australia.

"Population growth is the greatest threat to our planet's soil quality and biodiversity." Discuss this statement.

Markscheme

Refer to Paper 1 Section B markbands (available under the "Resources" tab) when marking this question.

Candidates can agree or disagree with the statement but need to be able to support their position. It is also possible that responses may agree partially with the statement. Either of these approaches is acceptable.

Population growth should be addressed in terms of the regional variations with some regions predicted to grow quite rapidly (Sub Saharan Africa) and others being predicted to experience negative growth (Japan, Europe).

Causes of soil degradation and loss of biodiversity of tropical rainforest (allow other biomes/ecosystems) should be addressed to assess the extent to which population growth is a contributing factor.

Candidates may also look at alternative threats to our planet's soil quality and biodiversity, such as climate change, how an increasing standard of living results in increased consumption irrespective of population growth, the concentration of population in urban areas and the expansion of cities, changing agricultural practices, pollution, invasive species, poaching *etc*.

Responses should make use of examples but responses that focus on describing soil quality and biodiversity and not focusing on the role of population growth will be self-limiting.

It is not necessary for the discussion of soil quality and biodiversity to be of equal depth for the award of full marks.

At band D, expect some description of the issues of population growth, soil quality and biodiversity.

At band E, expect either some explanation of a range of threats that population growth poses to soil quality and biodiversity or a discussion of why other factors besides population growth may be equally or more important in terms of their impacts on soil quality and biodiversity.

At band F, expect both.

Marks should be allocated according to Paper 1 Section B markbands

Examiners report

[N/A]

Patterns in environmental quality and sustainability

The graph shows one estimate of the long-term impact of global climate change on agricultural production.



[Source: Republished with permission of International Monetary Fund, from Global Warming and Agriculture in *Finance & Development*, William R. Cline, Vol 45, Issue 1, 2007; permission conveyed through Copyright Clearance Center, Inc.]

a.	Describe how the estimated impact of climate change on agricultural production varies with latitude.	[3]
b.	Suggest two reasons why global climate change may lead to an increase in agricultural production in some places.	[4]
c.	Distinguish between physical water scarcity and economic water scarcity.	[4]

Markscheme

a. Award [1] for each valid point, must have some quantification for [3]. Three valid comments are required before quantification can be applied.

Possibilities include:

- very adverse impacts at latitudes between 10° and 35° (-30 to -40%) [1]
- least impact, or a positive impact, at latitudes of 40° plus (-5 to +10%) [1]
- mixed range at very low latitudes, near equator, 0° to 10° (-5 to approx. -20%) [1]
- anomalies at certain latitudes (one country with higher increase than expected at latitude 27° and two countries with unusually adverse impacts at 17°) [1]
- overall impact decreases away from the Equator [1]
- impact worsens 0° to 20° [1]
- from 20° to 60° the impact gets less [1].

b. In each case, award [1] for a valid reason and [1] for further development/exemplification.

For example: Global climate change may lead to warmer temperatures, lengthening the growing season [1], which may enable farmers to produce two crops each year where it was previously only possible to produce a single crop [1].

Other possibilities include:

- · more rain than previously, so higher yields
- · warmer climate may extend growing season/cultivation into areas previously too marginal for farming
- milder winters may decrease cold stress on livestock
- more land available through glacial retreat or melting of permafrost can be used for farming.
- c. Award [2] for physical water scarcity and [2] for economic water scarcity.

In each case award [1] for a basic description and [1] for development/exemplification.

The definition in the subject guide is as follows:

- Physical water scarcity, where water resource development is approaching or has exceeded unsustainable levels; it relates water availability to
 water demand and implies that arid areas are not necessarily water scarce.
- Economic water scarcity, where water is available locally but not accessible for human, institutional or financial capital reasons.

For example:

- Physical water scarcity relates water availability/supply to water demand [1]. It means that water resource development is approaching (or has exceeded) a level that is unsustainable [1]. (Drought needs to be put into the context of supply/demand for development credit.)
- economic water scarcity means that water is available locally, but cannot be accessed [1] owing to issues of "human, institutional or financial capital" / cost / technology / incomes / etc [1].

Distinction can be implied and does not have to be explicit.

Examiners report

a. ^[N/A] b. ^[N/A] c. ^[N/A]

The graph shows how the percentage of forest cover in a country changes as the country develops over time. The graph includes some present-day

examples of countries at different stages of development.



[Source: adapted from The Economist, (2014), A clearing in the trees]

a.	Identify the country shown on the graph with the lowest percentage of forest cover.	[1]
b.	Distinguish between forest cover and biodiversity.	[2]
c.	Suggest two reasons why forest cover in some countries has increased in recent years.	[4]

Reason 1:

d. Explain two consequences of the reduction of biodiversity in some tropical rainforests.

Consequence 1:

Consequence 2:

Markscheme

a. Mexico

- b. forest cover is the proportion/percentage/area of a region/country [1]
 - biodiversity refers to all the different kinds of living organisms within a given area including plants, animals, fungi, and other living things [1] (or alternatively biodiversity is the existence of a wide variety of plant and animal species living in their natural environment [1]).
- c. In each case, award [1] for a distinct, valid reason, and [1] for development/exemplification.

There are two approaches that could be taken to answer this question – strategic reasons that explain the increase in forest cover, and operational reasons. Either approach, or a combination of the two, is acceptable.

Possible strategic approaches could include:

- Trees have been planted [1] to create new areas of woodland, including [1] commercial forestry plantations (reforestation) [1].
- The introduction of a moratorium (or strict control) on forest clearance [1], which allows natural forest regrowth to occur faster than clearance. [1]
- Designation of protected areas such as National Parks [1], such as those of Yunan Province, China, provide protection and allow the expansion of forests [1].

Possible operational approaches could include:

- · conservation to protect wildlife
- prevent soil erosion
- · increase the carbon sink
- · encourage tourism
- · disaster prevention in mountainous areas
- less land required for farming.
- d. In each case, award [1] for a valid consequence and [1] for explanation/exemplification.

Possible consequences include:

- · loss of biomedical resources (actual or potential)
- reduced genetic diversity
- · adverse impacts on way of life for some indigenous peoples
- · adverse impacts on regional water and/or food supplies
- · extinction of species
- · loss of natural resources
- reduction in value for ecotourism.

For example:

Loss of potential biomedical resources [1], with resultant adverse impacts for population and economy [1].

Less genetic diversity [1] leading to loss of ecological resilience when coping with climate change [1].

Examiners report



The graph shows external forcings, such as greenhouse gases, causing changes in the Earth's atmospheric system.

[Source: Figure SPM.2 from Climate Change 2007: The Physical Science Basis. Working Group I Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.]

a.	State which external forcing shown on the graph has the greatest impact on temperature in the atmosphere.	[1]
b.	Outline what is meant by "albedo".	[2]
c.	Briefly describe the difference between stratospheric ozone and tropospheric ozone.	[2]
d.	Explain two environmental consequences of global climatic change (global warming).	[6]

Consequence 1:

Consequence 2:

Markscheme

- a. CO2 / carbon dioxide / greenhouse gases [1]
- b. Solar radiation/heat reflected by the surface [1].

Award [1] for further development such as:

- the idea of amount/proportion
- measures how reflective a surface is
- · the more reflective a surface is the higher the albedo value
- link between low/high albedo and reflectivity

c. The difference can be addressed by using own knowledge or with reference to the graph.

Award [1] for valid difference and [1] for further development/detail.

Possibilities include:

- different location/elevation/zone/height within the atmosphere [1] with tropospheric ozone being lower/nearer the ground than stratospheric ozone [1]
- tropospheric ozone is mainly anthropogenic [1] stratospheric ozone is mainly natural [1]
- tropospheric ozone has a positive heating effect whereas stratospheric ozone has a negative effect [1], with quantification from graph [1]
- radiative forcing is less in stratosphere and more in troposphere [1], with quantification from graph [1]
- tropospheric ozone is harmful for breathing [1] whereas stratospheric ozone is protective as stops UV [1].

d. Award [1] for a valid consequence resulting from increased temperature of global warming and [2] for further development/exemplification related

to the natural environment.

For example: Global warming is leading to melting of the ice caps [1]; the meltwater from this leads to a global rise in sea level [1], which will result in the loss of some low-lying islands (or provides relevant example, eg Kiribati) [1].

Other possibilities include:

- · changes to ice caps/glaciers
- · sea level rise
- · drowning/flooding of low-lying islands
- · impacts on precipitation patterns
- changes in disease distributions
- · changes in the areas covered by different habitats, types of vegetation/fauna
- · extreme weather events
- · acidification of the oceans
- · coral bleaching.

Examiners report

a. [N/A] b. [N/A] c. [N/A]

d. ^[N/A]



The graph shows total carbon dioxide (CO₂) emissions by region from 1990 to 2010.

a. Describe the trend of CO_2 emissions in Asia between 1990 and 2010.

b. Suggest two reasons why CO2 emissions in Europe have decreased since 1990.

c. Distinguish between global climate change and the enhanced greenhouse effect.

[4]

Markscheme

a. Any two valid descriptive points for [2] plus [1] for accurate quantification/use of data from the vertical axis (actual figures or proportions).

- The emissions have increased.
- Sharp rise in emissions after 2002.
- Emissions relatively stable in the 90s.

b. Award [1+1] for each valid and distinct reason, provided that it is developed by means of detail and/or exemplification.

For example: Development of renewable/alternative sources of energy [1] replacing fossil fuels [1].

Possibilities include:

- · policies to reduce use of fossil fuels (including Kyoto protocol)
- · political will (including growth of green parties)
- more efficient vehicles/appliances
- · improved public transport systems
- · education/increased awareness lowering consumption
- industries relocating outside of the region.

Credit should also be given to attempts to explain the decrease by referring to periods of economic recession.

c. Award [1] for a valid description of global climate change and [1] for a valid description of the enhanced greenhouse effect. The final [1+1] are

reserved for any two valid distinguishing characteristics between the two.

Descriptions:

Global climate change is the *change in the global pattern of climate* precipitation, temperature, winds, pressure systems). The enhanced greenhouse effect is the *increasing amount of greenhouse gases in the atmosphere as a result of human activities*.

Distinguishing characteristics could be:

- GCC can relate to any aspect of climate whereas the EGE specifically impacts upon temperature
- · GCC can have natural causes whereas the EGE is anthropogenic
- · GCC can involve cooling/glacial periods whereas EGE is associated with global warming
- EGE is a major cause of GCC.

Examiners report

a. On the whole there were no problems describing the trends with a smaller increase in emissions until 2002 after which they increase significantly.

The quantification, however, was mostly poorly done since many candidates read the upper boundary of the Asian plot rather than the compound

values. This limited many responses to 2 of the 3 marks available.

- b. Mostly good answers with reference to the outsourcing of many polluting industries to elsewhere; increased awareness of the governments and individuals; targets linked to agreements like the Kyoto protocol; increased usage of renewables like wind or alternatives like nuclear; etc. Some responses were a bit minimalistic and lacked development or failed to identify two reasons that were distinct.
- c. A few very clear full mark responses that accurately described what each of these are and how they differ or are linked. Unfortunately many responses struggled to correctly understand what the enhanced greenhouse effect is, with much confusion about radiation and irrelevant reference to ozone. Often they were accurately described but the distinguishing characteristics were not presented clearly.

Patterns in environmental quality and sustainability

The diagram shows the level of poverty and the level of soil degradation in three countries.



[Source: adapted from FAO (2011), The state of the world's land and water resources for food and agriculture (SOLAW) – Managing systems at risk. Food and Agriculture Organization of the United Nations, Rome and Earthscan, London. Reproduced with permission.]

a.	Describe the relationship between the level of poverty and the level of soil degradation shown on the diagram.	[3]
b.	Explain one strategy that has been successful in reducing soil degradation.	[3]
c.	Explain the importance of maintaining biodiversity in tropical rainforests.	[5]

Markscheme

- a. Possible descriptions might include:
 - · low levels of poverty have lower levels of high soil degradation/high levels of poverty have higher levels of high soil degradation
 - low levels of poverty have the most improving soil
 - · low levels of poverty appear to suffer the most from moderate soil degradation.

Accept other valid descriptions.

Reserve the final [1 mark] for some attempt at quantification/use of the data.

b. Award [1 mark] for a valid choice, [1 mark] for its description, and [1 mark] for its explanation. Identification of a valid specific location may also

receive [1 mark], up to a maximum of [3 marks].

There are many possible choices including reforestation, shallow plowing, the use of ground covers during fallow periods, planting of wind breaks, controlled grazing, etc.

Example:

"One strategy is reforestation [1 mark] where the planting of trees on degraded soil can help stabilize the surface [1 mark] because their roots bind the soil together and make it less likely that erosion can occur [1 mark]."

c. Award [1 mark] for a definition, or clear or implied understanding of the term "biodiversity".

Award [1 mark] for each valid statement linking a reason to the importance of biodiversity, and [1 mark] for each development/exemplification, up to a maximum of [2 + 2 marks].

Possible reasons include: climate regulation; flood control/protection; gene bank maintenance; food/timber; soil conservation; value to indigenous people; tourism value; research opportunities; keeping food chains intact; value of medicinal products.

Examiners report

a. A relatively straightforward question, most candidates were able to give two valid descriptions with quantification/use of the data.

b. Again a very straightforward question where most candidates achieved the full marks. Some very good answers with clear valid choices often

illustrated with accurate and specific geographical locations.

c. On the whole well answered, although some responses did not reflect the question posed and instead focused their answer on why we should maintain tropical rainforests as opposed to why we should maintain their biodiversity. This was self-limiting. On the whole most candidates demonstrated a solid knowledge and understanding of biodiversity and tropical rainforests.

The graph shows the progress made by a manufacturing corporation since 2010 towards meeting its 2020 targets for environmental sustainability. All values are relative to an index value of 100 in 2010.



[Source:© Owens Corning 2016. Used by permission.]

a.	Describe what is meant by the term "environmental sustainability".	[2]
b.	State the aspect of environmental sustainability that should replace "A" on the graph.	[1]
c.	Describe the progress made by this corporation since 2010 towards meeting its 2020 targets for environmental sustainability.	[4]
d.	Suggest two environmental disadvantages of sending waste to landfill.	[4]

Markscheme

a. Environmental sustainability means development or utilizing resources in such a way as to meet the needs of the present [1] without

compromising the ability of future generations to meet their own needs [1].

[2 marks]

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b. water / water use / water pollution [1].
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- identifies that three targets are have already been met GHG emissions; particulates; toxic air emissions [1] c.
 - target A is on track to being met [1]
 - two targets show no progress at all reduced energy consumption and reduced landfill waste [1]
 - use of the data to support statements [1].

[4 marks]

d. Award [1] for each environmental disadvantage that is suggested, and [1] for further development/exemplification.

For example: Waste can emit GHGs that contribute to global warming [1], for instance methane from rotting organic waste [1].

Possible disadvantages include:

- need for land/space
- soil degradation (leaching)
- · groundwater contamination and so drinking water scarcity
- · harm to local ecosystems/biodiversity
- · attracts vermin
- · unpleasant smells
- · environmental costs of transporting waste
- · burning of waste in landfills.

[4 marks]

Examiners report

a. ^[N/A] b. [N/A] с. [N/A]

d. [N/A]

The table shows deforestation rates for six countries that share the Congo rainforest.

Country	Area of rainforest / thousands of hectares in 2010	Percentage of rainforest lost in the 1990s	Percentage of rainforest lost in the 2000s
Cameroon	20037	1.01	1.71
Congo	20932	0.80	1.61
Central African Republic	5833	0.90	1.01
Democratic Republic of the Congo	107 181	1.51	3.25
Equatorial Guinea	2163	1.31	0.00
Gabon	22416	0.80	0.70

[Sources: adapted from W Laurance et al, (2012), Averting biodiversity collapse in tropical forest protected areas, Nature, 489; http://rainforests.mongabay.com and www.nature.com]

a. Rank the three countries with the largest areas of rainforest from highest to lowest. [2] b. Referring to the data in the table, describe the trend in rainforest loss between the 1990s and 2000s. [3] c. Explain three reasons why it is important to maintain the biodiversity of tropical rainforests. [6]

Markscheme

a. DRC > Gabon > Congo [2]

This is the only acceptable answer.

b. In general, the rate of loss increased in almost all countries between the two time periods [1].

Each of the following statements merits an additional [1], up to a maximum of [2]:

- Equatorial Guinea reduction to zero
- Gabon reduced rate by 0.10
- the Democratic Republic of the Congo has increased the most more than doubled.

There must be some reference to data for full marks.

c. For each reason, award [1] for identifying and/or describing a valid reason, and [1] for explaining its importance in terms of biodiversity.

For example: It is good for ecotourism [1] because of a wide variety of species for visitors to see [1].

Other possible reasons include:

- ecosystem services (soil, water, habitats)
- · water filtration/nutrient recycling/climate amelioration
- biological resources (food, medicine, genetic stock, breeding stock)
- · aesthetic value (tourism, appreciation of need to conserve)
- ethical value (role/responsibility of people in preserving planetary ecosystem and preventing loss of endemic species of flora and fauna)
- cultural benefits (recreation/cultural integrity of indigenous groups).

The second mark should not be awarded for generic answers that do not link clearly to biodiversity.

Examiners report

a. [N/A] b. [N/A] c. [N/A]



[Source: http://www.env.go.jp/en/nature/desert/global_2.html, with the kind permission of the United Nations Environment Programme]

a.	State a likely cause for X.	[1]
b.	Referring to the diagram/map, describe the global pattern of soil degradation due to overgrazing.	[3]
c.	Explain two socio-economic consequences of soil degradation.	[4]
d.	Explain one management strategy that is likely to achieve environmental sustainability.	[4]

Markscheme

- a. Deforestation, salinization, urban growth, industrialization [1 mark].
- b. Any three valid statements referring to pattern for [1 mark] each.

Possibilities could include:

- overgrazing is the main cause of soil degradation in Australia 90%
- greatest hectares/area in hectares affected in Africa though
- highest % values are in the southern hemisphere
- highest % cause of soil degradation in all regions except the Americas
- lowest value is Asia at 32%.

Data must be utilized in describing the pattern for full marks.

c. Award [1+1 marks] for each valid consequence, provided that it is developed by means of explanation and/or exemplification.

Example: loss of agricultural productivity of land [1 mark] acts as a push factor to migration [1 mark].

Other possibilities could include:

- · loss of agricultural productivity, food shortages
- · reduced aquifer recharge damages farmers' incomes and water access
- · loss of employment, increased poverty in an area
- creates environmental refugees, problems of displaced population.
- d. There are many possible strategies at any scale (local, national, global). Only necessary to describe and explain the strategy to gain full marks; it is

not required to offer any evaluation.

Identification of strategy [1 mark]; description/location of strategy [1 mark]; developed explanation of how it links to sustainability *ie* preserves a resource for future generations while at the same time deriving economic and other benefits from their use [2 marks].

Examiners report

- a. Most candidates could state a cause worthy of credit.
- b. Most candidates could get full marks here giving a straightforward description with the use of spatial patterns (map) and quantitative data (diagrams both as % and real figures per million hectares). Some responses seemed to veer off into explanation which was not required by the command term (describe).
- c. Well answered on the whole, with good use of examples such as the Loess Plateau in China, or the Sahel region of Africa. There were some candidates who struggled to identify two socio-economic consequences and in some cases the entire question was left blank.
- d. This was a very open question which allowed many possible responses and there were many excellent answers ranging from international agreements like Kyoto to more local projects/strategies. Some answers failed to go beyond description and explain the links to environmental sustainability.

The map shows the severity of human-induced soil degradation.

Please rotate this page to view the map.



[[]Source: Food and Agriculture Organization of the United Nations, 1995, *Dimensions of need: An atlas of food and agriculture*, http://www.fao.org/docrep/u8480e/U8480E3z.jpg. Reproduced with permission.]

a.	Describe the distribution of areas of very high soil degradation.	[3]
b.	Suggest two reasons why areas of high soil degradation occur in Europe and/or North America.	[4]
	1.	
	2.	
c.	Explain two ways, other than food production, in which soil provides valuable environmental benefits for people.	[4]

1.

2.

Markscheme

a. Award [1] for a geographical overview, eg there are small areas in almost every continent.

Award [1] each for two further valid points.

Possibilities include:

- the largest single area is in China/Southeast Asia
- another large area exists in Southern Africa/Madagasgar
- Sub-Saharan Africa and Asia have largest areas of very severe soil degradation
- there is high soil degradation in the Middle East
- · limited areas in Central and South America
- · there is no area of very high soil degradation in Australia/New Zealand
- most areas of high soil degradation are in low income regions.

Responses that just list areas should be awarded a maximum of [1].

b. Award [1] for each distinct reason and a further [1] for development/exemplification.

For example: Commercial monoculture [1] may deplete the soil of certain vital minerals making it more vulnerable to erosion [1].

Other causes may include:

- overuse (possibly historical) of land/overgrazing
- · climate change may be causing an increase in aridity/desertification
- · rising sea levels/over-irrigation could be increasing salinization
- industrial uses including large-scale open-cast mining in which native vegetation is removed
- · removal of wind barriers of vegetation to create large fields where wind erosion is likely to be increased
- · Impacts of past and/or present acid rain
- urban construction.
- c. In each case, award [1] for identifying a valid way, and [1] for offering some expansion, detail or exemplification.

For example: Soil can be used for production of biofuel crops [1]. The use of biofuel reduces dependence on fossil fuels [1].

Other possibilities include:

- soil as a store for carbon, there degradation releases vast amounts of carbon into the atmosphere
- soil supports vegetation (eg rainforest), a needed carbon store to reduce the enhanced greenhouse effect carbon
- · soil regulates water resources through reduced flooding, improving quality
- · soil as a basis for biodiversity species preservation.

Examiners report

a. There were some responses that identified regions where soil degradation was very high, but few who actually recognized a pattern, namely that

very high soil degradation seems to be on most continents and is found in many regions.

- b. There were some strong responses that linked reasons for high soil degradation to the two developed regions. There were other responses that could identify a cause of soil degradation but failed to link it to the two regions in the question. Industrialization, urbanization and agro-business were often given as reasons but then the development to the degrading of soil was either non-existent or was very, very generalized. There were some very weak responses that referred to inappropriate geographical regions such as the Amazon.
- c. Responses tended to focus on soil's water filtering qualities, its carbon store qualities, the fact that soil is needed for the growth of rainforests as an essential carbon sink, that it can be used to grow biofuels, or that it has a high biodiversity. Responses were very varied in terms of the detail.

3. Patterns in environmental quality and sustainability

The map shows the global distribution of physical water scarcity.



[Source: adapted from www.fao.org]

a.	Describe the pattern of high physical water scarcity shown on the map.	[3]
b.	Explain why some of the world's arid areas are not areas of physical water scarcity.	[3]
c.	Explain the energy flows involved in the greenhouse effect.	[5]

Markscheme

a. Any of the following for [1 mark] each:

- a valid comment on latitudinal location
- mainly found in the northern hemisphere
- · especially in Northern and Eastern Africa and parts of Southern Africa
- Middle East
- · SW and/or Central Asia
- SW North America
- West coast of South America.
- b. Physical water scarcity occurs when water resource consumption is approaching or has reached unsustainable levels/demand exceeds 60% of

usable supply. Award [1 mark] for describing this concept. The world's arid areas have little available water, but usually have low

population/density [1 mark] and therefore water usage/demand may still not exceed sustainable levels/supply [1 mark].

- c. Any of the following:
 - · incoming solar radiation/shortwave radiation/insolation
 - some reaches the Earth's surface
 - the Earth's surface re-emits terrestrial/longwave radiation
 - · some of this energy/radiation is absorbed/trapped by greenhouse gases
 - · a little energy is lost to space
 - naming two or more valid greenhouse gases.

There is no requirement to explain the enhanced greenhouse effect.

A valid annotated diagram explaining five of the above is equally acceptable.

Examiners report

- a. This was a very straightforward question with most candidates achieving full marks. However, description needed to be specific and geographical in nature left and right or entire continents in the description were not credited. Many candidates incorrectly stated that most high physical water scarcity is on the equator, which is not the case. Some responses seemed to veer off into explanation, which was not required by the command term ("describe").
- b. This was probably the question that most candidates struggled with. The nature of this question allowed for only a very narrow response and if the candidates were unfamiliar with what physical water scarcity is they failed to answer this question appropriately. There were however some very clear answers that defined the term and identified the link between population numbers and demand, with many giving illustrations from a variety of global locations.
- c. Many good answers used an annotated diagram to illustrate the flows of energy although the majority answered through extended text. Many candidates are very familiar with the greenhouse effect and could adequately explain the energy flows and gases involved, often achieving full marks. There were still a surprising number who got muddled up with ozone depletion or who could only describe the enhanced greenhouse effect.