**International Baccalaureate®**
Baccalauréat International
Bachillerato Internacional

# MARKSCHEME

# May 2010

# ENVIRONMENTAL SYSTEMS AND SOCIETIES

# Standard Level

# Paper 2

18 pages

*This markscheme is **confidential** and for the exclusive use of examiners in this examination session.*

*It is the property of the International Baccalaureate and must **not** be reproduced or distributed to any other person without the authorization of IB Cardiff.*

# Subject Details: Environmental Systems and Societies SLP2 Markscheme

## General

A markscheme often has more marking points worthy of a mark than the total allows. This is intentional. Do **not** award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each marking point has a separate line and the end is signified by means of a semicolon (;).

- An alternative answer or wording is indicated in the markscheme by a "/". Either wording can be accepted.

- Words in ( … ) in the markscheme are not necessary to gain the mark.

- Words that are <u>underlined</u> are essential for the mark.

- The order of points does not have to be as written (unless stated otherwise).

- If the candidate's answer has the same meaning or can be clearly interpreted as being the same as that in the markscheme, then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by writing *OWTTE* (or words to that effect).

- Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalizing them for what they have got wrong.

- Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with "**ECF**", error carried forward.

- Units should always be given where appropriate. Omission of units should only be penalized once. Indicate this by "**–1(U)**" at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.

- Do not penalize candidates for errors in significant figures, unless it is specifically referred to in the markscheme.
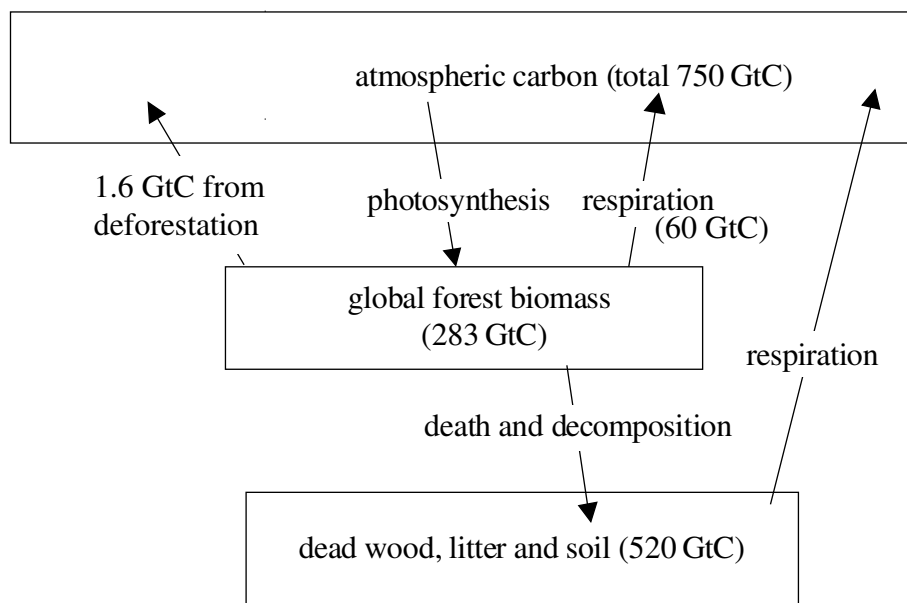
## SECTION A

**1.** (a) (i) tropical rainforest / coral reefs / mangrove swamps / alpine forest / montane forest / tropical grassland/savanna / cloud forest / palm oil plantation; *[1]*
*Award [1] for any **two** of the above.*
*Do not accept terrestrial / aquatic / marine / forest / river / ocean / riverbank / coast as they are too vague.*

(ii) high because solar radiation/temperature/light and water are abundant / water and light not limiting;
favourable climatic conditions lead to increased <u>photosynthesis/primary productivity</u>; *[1 max]*

(iii) high level of producer biomass / more food;
island where speciation has occurred / isolation from mainland species;
many ecological niches/food webs in rainforest;
mature ecosystems so time to develop complexity/stability;
variety of environment due to differences in altitude/habitat;
relatively undisturbed by human activity / lack of human activity (until recently) has meant that diversity has built up over time;
geologically active area creating dynamic/new habitats;
location of Borneo has meant mixing of gene pools from Gondwanaland and Laurasia, increasing speciation; *[1 max]*
*Award [1] for any **two** of the above.*

(b)  (i)  *Award [1] for*:
quantitative model (this can be shown either with proportional boxes and arrows *or* quantities labelled);
naming storages;
naming two or more flows/arrows *or* if all flows are in correct direction;    *[3]*
*Apply some flexibility in the approach to marking the flow diagram.*

*e.g.*

atmospheric carbon (total 750 GtC)

1.6 GtC from deforestation

photosynthesis    respiration (60 GtC)

global forest biomass (283 GtC)

respiration

death and decomposition

dead wood, litter and soil (520 GtC)

*Award [0] if no diagram is drawn.*
*Award [1 max] if no distinction is made between stores / flows (by symbol or label).*
*Award [2 max] if no quantification but relationships are sound.*

(ii)

| *effects* | *explanation* |
|---|---|
| temperature rise | lower evaporation/transpiration *(do not accept 'affects water cycle')* / less shade / more $CO_2$; |
| less rainfall | less transpiration; *(do not accept 'affects water cycle')* |
| higher wind speeds | fewer trees to provide shelter; |
| lower humidity | less evaporation/transpiration; |
| increased albedo | soil more reflective than trees; |

*[2 max]*

*Award [1] for each correct row.*

(c)  (i)   *Award [1] for entry and [1] for exit.*
          entry barrier to stop poaching/illegal hunting / encroachment by farmers /
          felling of trees;
          exit barrier to stop animals being killed;                              *[2]*

     (ii)  may be a pioneer/*r*-selected species / fast growth rate stops others from
          germinating;
          <u>outcompetes</u> other species; *Do not accept 'stops others growing'.*
          shades out competition / releases toxins to stop other plants growing;
          nutrients locked up in grass so less available to other plants / nutrients not
          recycled as fast;
          not a food plant for many species;
          less shade (than trees) so fewer ecological niches than in the forest;     *[2 max]*

(d)  (i)   loss of habitat / fragmentation of habitat;
          poaching/hunting leads to decrease in population;
          edge effects of smaller areas of habitat / disruption of migration routes;
          humans taking babies as pets/for zoos;                                   *[2 max]*

     (ii)  *Award [1] for both name and justification.*

          *name*: Giant panda / black-footed ferret / tiger / other umbrella species;
          *Named species does not have to be an endangered species.*
          *N.B. An umbrella species is one which when protected in its habitat will
          afford protection to others there too, either because it has specific habitat
          needs or perhaps because it needs a large range.*

          *justification*: (because they are easily recognizable and) they are protected in
          their habitat and so other species also have protection;                 *[1 max]*
          *Do not credit justifications which are based on notion of keystone species
          i.e. role in food webs.*
          *Notion of species being protected in situ must be explicitly or implicitly
          stated.*

(e)  (i)  $\dfrac{220}{743} \times 100 = 29.6$ % (of the total land area of Borneo);  *[1]*

*Accept 30% if working is shown and candidate has calculated correctly with 29.6% shown.*

(ii)

|  | *Cost* | *Benefit* |
|---|---|---|
| *Environment*: | destruction of tropical rainforest / loss of species diversity / change of climate locally and globally / pesticide and herbicide use pollutes environment and reduces diversity / encourages deforestation in order to make money from biofuels / disrupts migration routes; | may capture more carbon than a mature tropical rainforest / keeps some carbon in vegetation / use as biofuel / alternative to burning fossil fuels so carbon neutral; |
| *Human health*: | effect of pesticides (bioaccumulation) / climate change causes increase in tropical diseases / heart disease (due to increased cholesterol level) / reduction in availability of fresh water; | (arguably) more healthy oil for human consumption / replaces trans fats in foods; |

*[4]*

(f) (i) saving Borneo will not save the world / what does save the world mean? / is it save the human species?;
Borneo is an example of what we can do / if we can save Borneo from loss of species diversity/loss of rainforest, we can do the same elsewhere;
Borneo is the third largest island in the world, such a large area could make a difference to climate change if reforested;
Borneo provides ecosystem services / which benefits the world *e.g.* high biodiversity / important part of water cycle / large carbon store;
tree with the leaves holding the world identifies the importance of the rainforest;
looks like the world is one big island/all interconnected/interdependent, which is a very good message;
but people might find it hard to relate to the message/slogan without an explanation; *[3 max]*
*Accept points which relate to the slogan and/or to the visual image in the poster.*
*Accept other reasonable comments.*

(ii) markets for rainforest products are global, only by limiting these can the resources be managed sustainably;
transnational corporations (TNCs) are international organizations and have the ability to coordinate global markets;
MEDCs have the funds to respond to conservation needs in LEDCs;
small scale/local projects can be more effective at bringing about change *e.g.* Samboja;
unless international agreements are enforced at a local scale they will be ineffective;
global strategies do not always take into account local conditions;
much of the wealth of MEDCs comes from exploitation of natural resources in LEDCs;
MEDCs have created global problems therefore MEDCs are morally responsible for supporting LEDCs;
cooperation enables exchange of ideas/shared knowledge/technology transfer so solutions might be more effective;
cooperation is essential as tropical rainforests cross international borders; *[2 max]*
*Accept other reasonable suggestions.*
*Do not credit arguments for/against the conservation of rainforests.*
*Responses can either argue that international cooperation will play a vital role or that it will be less effective than other methods or a balance of both.*

## SECTION B

> **General Essay Markscheme**
>
> Each essay is marked out of *[20]* of which *[2]* are for clarity of expression, structure and development of ideas.
>
> > *[0]* Quality of expression, structure and development is poor.
> > *[1]* Quality of expression, structure and development is limited.
> > *[2]* Quality of expression is clear, structure is good and ideas are well developed.
>
> *Do not penalize candidates for writing in bullet pointed lists – if this technique is used appropriately i.e. to summarize or outline a list of points within an essay at an appropriate point. However, a candidate who has not shown **any** evidence of being able to write a paragraph with a developed, logical line of reasoning would not be able to achieve maximum marks.*

**2.** (a) *Accept any **two** energy sources.*
*e.g. for fossil fuel: **[2 max]***
very efficient in the generation of energy when burned;
existing technologies are already designed/in place for these fuels;
can be used directly as fuel in cars/gas cookers **and** to generate electricity;
once found can be relatively cheaply accessed *e.g.* open cast coal mines;
supplies of some *e.g.* coal and gas are relatively abundant;
energy independence/using own sources of energy / not relying on external supplies;

*e.g. for wind: **[2 max]***
renewable energy source / wind will not run out / able to meet energy demands in the long term / sustainable energy source;
(start up costs may be high but) running costs are low / cheap form of energy;
scalable energy source (one turbine or a wind farm);
can be onshore in remote locations / or offshore so land is not taken up;
we have developed the technology / not still in the experimental stages of technological development like some alternatives;

*e.g. for nuclear*: **[2 max]**
will last longer than fossil fuels as it is dependent on uranium which is used in very small quantities;
considered to be "cleaner" than fossil fuels in terms of carbon emissions (at least in the operational stage);

*e.g. for hydroelectric power (HEP)*: **[2 max]**
renewable so will not run out/able to meet increasing energy demands in future;
reservoirs created may be multipurpose/bring other benefits *e.g.* recreational/fishing;
allows nations to have greater independence as the dams are constructed within their own territories on their own rivers;

*reason why it plays a greater role*: **[3 max]**
*e.g. for nuclear and HEP in France*
nuclear more prevalent in France because a lack of HEP sites/few fossil fuel resources;
as an MEDC France has the capital to invest in nuclear;
nuclear can meet large demand;
lower level of public resistance;
France has the technological expertise;                                    *[5 max]*

(b)   *acid deposition*:  **[4 max]**
fossil fuels burned releasing sulfur dioxide;
and nitrogen oxides;
deposited as sulfates and nitrates as dry deposition;
combine with rain to form sulfuric acid and nitric acid;
and deposited as wet deposition;

*photochemical smog*:  **[4 max]**
fossil fuels are burned and nitrogen monoxide/oxides released (in vehicle emissions);
under the influence/in the presence of sunlight;
these pollutant interact with others *e.g.* VOCs and PANs;
to produce (tropospheric) ozone;
cities in basins are particularly prone to photochemical smog because pollutants cannot disperse;                                                                    **[7 max]**

(c)   pollution management strategies can aim to alter human actions/reduce pollution at point of emission/clean up after pollutant has been emitted;
cultural values will determine readiness of population to change lifestyle;
*e.g.* Scandinavian countries have been relatively successful in developing alternative technologies/alternative lifestyles;
political systems will determine to what extent legislation is in place/enforced;
*e.g.* if standards for emissions at coal-fired power stations are enforced;
*e.g.* if recycling/reducing/reusing programmes are promoted;
level of economic development may affect whether long-term sustainability/short-term opportunism is the prevailing approach;
*e.g.* replanting programmes in deforested areas more likely in an area where people are looking for long-term profits;                                               **[6 max]**
*Award **[4 max]** for relevant human factors and **[3 max]** for named examples or detailed case study.*
*Responses may discuss a broad range of human factors or may focus on the human factors related to a specific case study.*
***N.B.** Be flexible in interpretation of 'human factors'. A human factor is any factor relating to people which could in some way affect the successful implementation of a strategy, so candidates could identify 'environmental attitudes' as a human factor or 'level of education about environmental issues'. Factors do not have to be classified as cultural / economic / political as stated in the syllabus.*

*Expression of ideas*: **[2 max]**

*Total*: **[20]**

**3.** (a) *factors*: **[2 max]**
population size;
reduction in population size;
numbers of mature individuals;
geographic range and degree of fragmentation;
quality of habitat;
area of occupancy;
probability of extinction;

*reasons*: **[2 max]**
*e.g. for population size*:
population must be sufficiently large for genetic diversity so population remains viable;

*e.g. for quality of habitat*:
even if a species is not directly under threat, if its habitat is being reduced/degraded this will indirectly have an effect on the species; **[4 max]**

*Reasons must relate to the factors given.*

(b) *e.g.* for modern agribusiness in temperate grasslands of Prairies, USA

*explanation*:
monoculture leads to loss of species diversity;
pesticides can kill all insect species not just the pests being targeted;
crops reduce species diversity as natural grasses are outcompeted;
selective herbicides that remove broad leaf species in cereal crops;

*e.g.* for cyanide fishing in tropical waters off the Philippines

*explanation*:
reefs are biological hotspots, cyanide kills many species directly;
cyanide kills coral polyps which form the base of the food chain;
and therefore other species are lost as they lose their food source; **[6 max]**

*Do not credit general / biome level biomes e.g. coral reef or rainforest. Ecosystems need to be located and there needs to be some description or mention of detail within the answer for the candidate to achieve [3 max].*
*Award [3 max] for each explanation.*
*Award [4 max] if no named examples of ecosystems given or if named ecosystems are general or vague.*

*Each human action must be linked to **how** it reduces diversity. Do not credit responses which merely state how the ecosystem is damaged.*

(c)     *species-based conservation*:  **[4 max]**
        focuses on vulnerable species and raising their profile;
        attracts attention and therefore funding for conservation;
        can be very successful for saving keystone species;
        can successfully preserve a species in zoos/botanic gardens;
        *e.g.* Golden lion tamarin / Thermal lily / any other acceptable examples of species;
        CITES addresses the cross border issues and can prevent illegal trade protecting species;
        seedbanks can preserve genetic diversity for future restocking of habitats;
        but if habitat is not preserved it is difficult to preserve species / ecosystem is a holistic unit / food sources/habitats need preservation too;
        but high cost due to enforcing trade restrictions at border crossings / maintenance costs in zoos;

        *protected areas*:  **[4 max]**
        protects the whole ecosystem/interrelationship so long-term survival is more likely;
        preservation of diversity more likely with a holistic approach as diversity can be species/habitat/genetic;
        visiting an intact ecosystem enables it to be studied to increase understanding of its functions;
        may be species that have not been discovered yet;
        protected areas can become islands and therefore lose biodiversity due to *e.g.* size/shape/edge effects;
        requires sufficient funding/protection to ensure not disturbed;
        visiting protected areas as an ecotourist raises awareness and profits are recycled back into biodiversity programmes;          **[8 max]**

        *Do not accept "raises awareness" unless it is linked to action which enhances diversity.*

        *Award [4 max] if only strengths or weaknesses are addressed.*
        *Award [1 max] for the same marking point if it is used as a weakness and as a strength.*

                                            *Expression of ideas*: **[2 max]**

                                                        *Total*: **[20]**

**4.** (a) *Award **[1 max]** for relating it to human activity in a named ecosystem.*
*e.g.* changes in microclimate due to deforestation in a temperate forest area;

*Award **[2 max]** for abiotic factor **linked to** appropriate methods.*
measure ground temperatures using a thermometer/temperature sensor;
measure light intensity using a light meter/sensor;
measure wind speed with an anemometer/wind speed recorder;

*Award **[2 max]** for additional information on method.*
compare readings for an area that has been deforested with an area that is intact;
repeat readings over a period of time in order to calculate averages;
sampling technique used *e.g.* transect/quadrat & results extrapolated;     ***[5 max]***

(b) *changes in biotic components*:  ***[3 max]***
biomes shift to higher latitudes/altitudes as climate changes;
expansion of areas inhabited by tropical disease vectors/mosquitoes;
loss of species diversity as species unable to adapt/limited scope for shifting and become extinct;
animals can migrate, plants shift their range more slowly;
increased rates of primary productivity;

*significance for humans*:  ***[3 max]***
shifting biomes mean crop growing areas will shift / some areas will be more/less productive than before;
shortage of resources could lead to increased conflict *e.g.* over water/food;
impact on human health as more areas affected by tropical diseases;
loss of economic/aesthetic/medical benefits of species diversity;     ***[6 max]***

*Accept other reasonable responses.*

(c)    *ecocentric responses*:  *[2 max]*
ecocentrism stresses the minimum disturbance of natural processes so ecocentrics
would advise reducing greenhouse gas emissions so as not to unbalance the natural
greenhouse effect;
ecocentrism stresses self imposed restraint on resource use;
*e.g.* individuals reducing their carbon footprint by walking to work;

*technocentric responses*:  *[2 max]*
technocentrism stresses that technology can provide solutions to environmental
problems;
technocentrics would support investing in alternative technologies;
*e.g.* nuclear/solar/carbon capture and storage to reduce atmospheric carbon;
technocentrism stresses the importance of market and economic growth;
so technocentrics would support carbon trading/economic advantages of trading in
low carbon technologies;

*Award [4 max] for describing the responses and these may be either principles or
specific actions.*
*Award marks to responses that explicitly recognize that the same action
e.g. constructing a low energy house can be seen as both ecocentric and
technocentric.*

*justifications*:  *[3 max]*

*e.g. ecocentric more effective because*:
we are not using resources sustainably and this cannot continue;
it puts sustainable living at the heart of the issue;
individuals changing their lifestyles will lead to real change;
it challenges the economic growth model/consumerism;
it involves increased environmental education;
ecocentric responses can be cheaper and have a more immediate impact;

*or*

*e.g. technocentric more effective because*:
people reluctant to accept reduction in standard of living;
technological solutions will reduce greenhouse gas emissions/mitigate climate
change without necessarily changing lifestyles;
LEDCs not developed yet, technocentric approach offers a means for them to
develop without the negative effects;
technology already exists which can help us to reduce carbon footprint;
it involves increased efficiency of technology;                    *[7 max]*
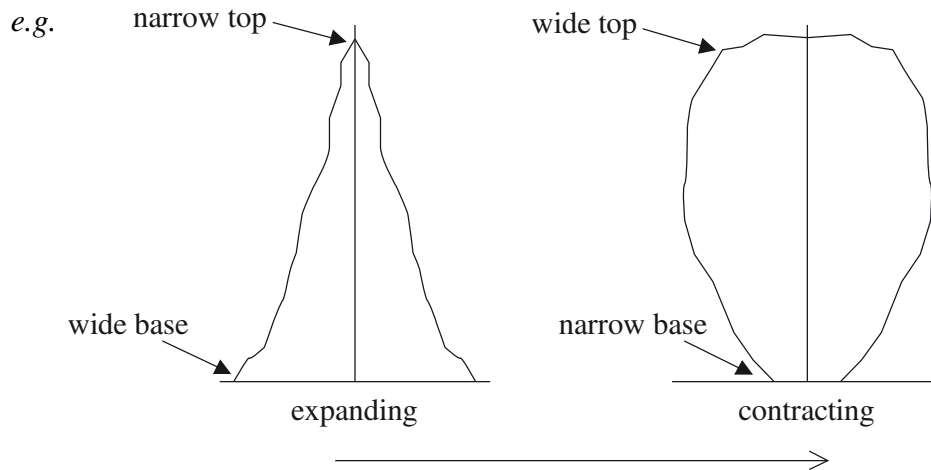
*Responses can argue either position.*

*Expression of ideas*: *[2 max]*

*Total*: *[20]*

**5.** (a) pyramid will narrow at the base (as birth rates go down);
pyramid will broaden at the top (as life expectancies increase);
pyramid shape will change from expanding to contracting;                    *[3]*

*Award the above marking points if these ideas are shown by way of an annotated diagram.*

*e.g.*



*Award [1 max] for an unlabelled diagram showing change over time.*
*Award [0] if descriptions are not related to pyramid shape.*

(b) significant events can change attitudes *e.g.* Bhopal showed people how dangerous factories can be;
people's attitudes can change due to significant books/films which raise awareness *e.g.* Silent Spring/Inconvenient Truth;
on first discovering/inventing a resource or product we are more likely to see benefits than potential problems, which emerge later *e.g.* technology of the car was initially seen as an entirely positive thing;
environmental pressure groups help to raise awareness by distributing leaflets/staging events *e.g.* Greenpeace;
environmental attitudes can become politically mainstream when economic consequences of pollution are seen *e.g.* Stern report and global warming;
school curricula can reflect/promote changing attitudes *e.g.* Environmental Systems and Societies;
changing technologies can help to spread new attitudes *e.g.* internet/blogs/YouTube;
international organizations *e.g.* United Nations Environment Programme (UNEP) can raise profile of environmental issues through conferences;
and in setting targets which will filter down through national government strategies *e.g.* Agenda 21 / Millennium Development Goals;                    *[6 max]*

*Award [3 max] if candidates focus more on historical events without identifying specific reasons for changing attitudes. Answers must focus on the reason **why** attitudes change.*

(c) *economic factors*: *[3 max]*
as countries develop they will undergo demographic transition;
as people become wealthier they will no longer need to have so many children to support them in old age/contribute to family income;
economic advances will lead to improved health and therefore reduce infant mortality/increased life expectancies;
so fertility rates decline as people have more confidence that their children will survive;
economic factors lead people to migrate affecting population structures;

*cultural factors*: *[3 max]*
traditions/religious beliefs can cause birth rates to remain high;
as women are educated/emancipated and have more options/control over their fertility, birth rates may fall;
attitudes will change as communities are less isolated/communities become more mixed *e.g.* due to urbanization;
as attitudes change contraception may be more/less widely used;
cultural attitudes such as favouring male children has led to practices such as female infanticide/selective abortions, unbalancing gender ratios;

*justification*: *[3 max]*

*e.g. economic most significant*:
because cultural changes often happen due to economic reasons *e.g.* urbanization due to migration for work leads to shifts in attitudes;
many cultural traditions have developed for economic reasons *e.g.* having children as a buffer against impoverished old age;
economic factors can change birth and death rates *e.g.* through healthcare even without cultural changes;
cultural factors may have been initially more important but now economic factors dominate in decision making as traditional values are replaced by a more consumer driven approach;

*or*

*e.g. cultural most significant*:
many studies show policies directed at education of women may be the most effective for reducing population pressure;
cultural attitudes can have a huge effect on behaviour *e.g.* resistance to condoms / attitudes to number/gender of children;
religious influences can be very powerful in shaping behaviour despite economic circumstances *e.g.* Catholic families on low incomes in Mexico reluctant to limit family size;                                          *[9 max]*

*Responses may argue for either factor.*

*Expression of ideas*: *[2 max]*

*Total*: *[20]*