N11/4/ENVSO/SP2/ENG/TZ0/XX/M

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

MARKSCHEME

November 2011

ENVIRONMENTAL SYSTEMS AND SOCIETIES

Standard Level

Paper 2

17 pages

Subject Details: Environmental Systems and Societies SLP2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A **[25 marks]** and **TWO** questions in Section B **[40 marks]**. Maximum total = **[65 marks]**.

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

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

3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are underlined are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity 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 ***OWTTE*** (or words to that effect).

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

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script.

10. Do not penalize candidates for errors in units or significant figures, unless it is specifically referred to in the markscheme.

SECTION A

1. (a) (i) *Award **[1]** for any **two** of the following.*
low oxygen concentration / salinity / varying/variable water level / varying nutrient availability; ***[1]***

(ii) less diverse; ***[1]***

(iii) reduction in length of fish;
reduction in range;
higher percentage of small fish;
range is greater in seagrass; ***[1 max]***
Credit responses given in the converse.

(iv) smaller fish moving into patch reef are more susceptible to predation;
nutrient loss / less food available (less detritus falling from mangroves);
impact to seagrass bed if shade is removed;
lowered diversity due to disruption of food chain;
increased fishing pressure;
collapse of food chain/web if Blue Striped Grunt is a keystone species;
release of toxins/chemicals previously trapped in mangroves;
decrease in habitat/shelter / fewer niches available;
fish nursery grounds are lost; ***[2 max]***
Accept any other reasonable suggestions.
Do not accept "just maintains water quality" with no qualification.

(b) (i) *inputs*: ***[1 max]***
antibiotics / pesticides;
ocean/sea/salt water;
shrimp feed / nutrients;
fossil fuels / electricity;
baby shrimp / larvae;
fertilizers for plant growth;

outputs: ***[1 max]***
mature/bigger/adult shrimp / increased shrimp yield;
feces / dead organic matter / nutrients;
greenhouse gases;
income to the shrimp farmer from sales; ***[2 max]***
Do not accept "energy" or "wastes" as an output.
*Award **[1]** for two inputs/outputs.*

(ii) *semi-intensive*: ***[1 max]***
diesel operation may result in oil slicks and contamination of water;
feeds and fertilizers increase primary productivity and may result in algal blooms;
may result in more waste (nitrogen);
may result in further eutrophication;
less water quality impacts on the sea as the farms are removed from the sea/inland from the coast;

extensive: ***[1 max]***
less impact on water quality (lower density of shrimp);
no/less use of diesel;
fertilizers are used increasing nitrogen levels of water;
natural water flow from tides keeps water quality higher than in semi-intensive;

comparison:
both result in mangrove loss and ecosystem services provided (less filtration of water / disturbance of silt);
removal of mangroves results in greater water turbidity; ***[2 max]***

(iii) non-point source pollution is pollution where the source is not identifiable/ comes from a wide range of sources;
we don't know which farm is producing pollution / pollutants may leach out over a broad front;
pollution will affect a wide area rapidly and so cannot be traced back; ***[2 max]***

(iv) tourism – building in desirable locations;
global warming / changes in climate;
lack of understanding about value of wetlands (undervalued);
pollution from industry/sewage/oil spill;
use of mangroves for wood and plant extracts;
buildings from industries/ports/urban areas;
clearance and drainage for agriculture; ***[2 max]***
Do not accept "fishing for crabs" etc as this does not indicate removal of mangroves.

(c) shrimp/aquaculture exports have been increasing over the last 10 years/from 1999–2007;
agriculture exports have remained about the same;
but agriculture exports are far greater than aquaculture;
the rate of aquaculture exports are likely to slow in the future/may be unsustainable at the rate of increase seen; ***[3 max]***

(d) *maximum capacity has been reached*:
no further space to develop agricultural systems;
soil/other environmental variable depleted or at maximum yield;
therefore if not sustainable, will not be able to produce more indefinitely;
a wide variety of technologies are already used and still don't feed the world;

maximum capacity has not been reached:
technologies (*e.g.* GM) being developed which further food production systems;
many resources that are unexplored;
not all arable land has been utilised yet;
sustainable development of food resources will increase yields in the long-term; ***[3 max]***
Responses can argue from both viewpoints or focus on one viewpoint.

(e) (i) timber that is harvested (sustainably);
fish that is harvested (sustainably) / *OWTTE*; ***[2]***
Accept any other suitable examples.

(ii) ecocentric/intrinsic value / value to human life / anthropocentric/aesthetic / ethical / ecological; ***[1]***

(iii) sustainability means living within the means of nature / harvesting lower amounts so not surpassing natural income;
natural capital renews itself/is renewable/replenishable;
natural income is derived/comes from natural capital;
natural income is income within the means of nature/that can replenish itself;
natural income is an economic aspect of/approach for sustainability;
if overexploited then future generations have less resources; ***[3 max]***
Do not accept "natural income is a form of sustainable income".

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) Gaia is a concept/model from James Lovelock (and named after an ancient Greek goddess);
the Earth is a self-regulating system / the Earth is considered a single entity/system;
the Earth is a living organism/superorganism in which feedback mechanisms maintain equilibrium;
Gaia looks at a daisyworld with white and black daisies as a simple model for a worldwide ecosystem;
the living and non-living components of the global biosphere/ecosphere regulate the conditions for life on Earth / a network of positive and negative feedback mechanisms help maintain equilibrium;
*Award **[2 max]** for description of Gaia concept.*

human disruption/pollution will be mitigated by negative feedback mechanisms;
e.g. sequestering pollutants in biomass;
some pollutants are not biodegradable and thus not able to be mitigated by biotic components of system;
pollution released in one location may affect another part of the earth system distantly located from source;
non point-source pollution can have a global impact;
different equilibrium may be established;
e.g. adaptations of populations/species to the change in conditions/pollutions; ***[4 max]***
*Award **[2 max]** for linking Gaia concept to pollution.*

(b) *Award **[1 max]** for a named pollutant.*
e.g. CFCs;

manage the human activity producing the pollutant:
stop the pollution by using alternative gases/substitutes;
or use of alternative technology *e.g.* use roll on deodorant instead of aerosol;
ban the use of CFCs / international treaties/protocols such as the Montreal Protocol;

manage the release of the pollutant:
e.g. recycle CFCs from disused refrigerators;
creation of emission standards/laws/regulations;
more efficient technology so less ozone-depleting substances (ODS) are used;

manage the long-term impact of the pollutant on the ecosystem:
the removal of CFCs from the atmosphere is not feasible;
protection from increased UV radiation;
e.g. protect human skin with sunscreen/protective clothing/advice on avoiding the hottest part of the day;
protect buildings/materials using UV resistant technologies;
improved crops with more UV resistance / genetically modified organisms (GMOs) with UV resistance; ***[5 max]***

Responses should include at least one point from each step of the model.
*Award **[3 max]** if only one step of the model mentioned.*
Do not accept the same argument under different steps of the model.
Allow for reasonable points under any step if they are clearly linked to the concept of that step – e.g. the recycling of CFCs could be credited in step one as well as step two, but would receive one mark.
Credit should be given for use of relevant examples.

(c) *cultural*:
capitalist societies often consider the profit over the environmental damage of the pollution;
often they would rather follow step three, when caught, than the other steps, as this may seem cheaper;
rural society, with low population density has an "out of sight" mindset, with pollution not being a problem if you cannot see it;
pollution tolerance levels vary from society to society;
some types of pollution are more tolerated than others by a particular society/culture;
e.g. noise or visual pollution in a rapidly urbanising city/area are accepted;
cultural/society inertia;
cultural perspective can be altered through education;

political:
less developed countries are often willing to allow pollution to encourage local industry;
the dumping of toxic waste from MEDCs to LEDCs is sometimes allowed by the governments/as the result of corruption;
lower standards for pollution to encourage industry are acceptable in certain countries/areas;
a political blind eye is often turned if the industry is profitable/paying taxes/creating jobs;
LEDCs often do not have the resources to enforce the laws which they do have in place;

economic:
rich countries can have a "throwaway" society and so generate a large amount of wastes/pollution;
but they also value a clean and tidy environment so pollution is not tolerated;
all three steps of the pollution model are likely to be carried out;
the most common step may be the second as the rich society may want to keep the pollution causing industry/manufacturing/agriculture but regulate it;
poorer countries often recycle large amounts of wastes/pollution through informal waste pickers;
LEDCs can only afford old polluting equipment;
LEDCs have no money for technology to clean up pollution;
UN protocols not ratified/signed as countries fear it may slow economy;
e.g. USA and Kyoto protocol;
as countries develop there is a trend to spend more money on pollution prevention;
LEDCs want MEDCs to pay for the costs of the pollution caused by MEDCs which affect whole world;
movement to push for transfer of technology from MEDCs to LEDCs to prevent/ reduce pollution; ***[9 max]***

Responses should contain at least one point for cultural, political and economic factors.
*Award **[7 max]** if no examples are used.*
*Award **[6 max]** if one factor is not mentioned.*
*Award **[3 max]** if two factors are not mentioned.*

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

Total: ***[20]***

3. (a) (rainforests) have an economic value to humans;
may contain food/medicines/materials for human use;
intrinsic value of the rainforest;
life support function for water cycles/carbon sink/oxygen provider;
contains high biodiversity;
aesthetic value;
tourism function can bring income;
indigenous peoples' home;
regeneration rate is slow;
spiritual/cultural/religious value to local communities;
stewardship value of having rainforests for future generations; ***[4 max]***

(b) maximum number of a species/population/load that can be sustainably supported by a given environment;
carrying capacity continuously changes in any given environment in response to fluctuations in biotic and abiotic factors;
*Award **[2 max]** for an outline of carrying capacity.*

not exceeded:
resources distribution is uneven;
e.g. enough food production to feed everyone in the world;
overuse of resources in some places, a more equal use is required;
not enough recycling/reuse/renewal of resources;
technology solutions to enhance our carrying capacity are available;
substitution of old resources and new resource usage through new technologies / adaptation of old technology allows for a larger population;
the problem is more geopolitical rather than ecological;

has exceeded:
reliance on non-renewable resources which are running out;
renewable and replenishable are not being used sustainably;
e.g. salinization of the soil due to over-irrigation in agricultural areas;
spread of communicable diseases indicates overpopulation;
quality of life/standard of living is low in majority of the world's population indicating too many people in the world;
technology often has unforeseen consequences linked to pollution, this can reduce the human population carrying capacity;
positive feedback from pollution may impact resources, especially agricultural potential;
famine indicates that resources are too few for the population;
war over resources, such as water, indicate overpopulation;
increasing migration rates out of an area might indicate overpopulation; ***[7 max]***

Accept the use of Malthus and Boserup to illustrate has exceeded and not exceeded.
*Award **[1 max]** for stating their viewpoint to the claim that human population has/has not exceeded its carrying capacity.*
*Award **[5 max]** for either viewpoint and any examples used to illustrate a point made.*

(c) *development policies*:
policies that target reduced death rate
e.g. improved public health and sanitation;
e.g. access to a clean water supply;
e.g. increased food supply;
e.g. vaccination/immunization programmes;
e.g. increased education for children to improve nutrition/farming/healthcare;
these policies can increase population growth;
an increased life expectancy can increase the population growth as fewer people die;
improved health care increases the ageing population and thus the population of a country;

policies that target fertility:
incentives to have children;
e.g. generous maternal benefits;
disincentives to have children;
e.g. fines for having extra children above the approved government number;
increased education for girls often decreases fertility;
e.g. later marriage / more child spacing / more use of birth control / family planning;
anti-natal policies decrease population growth / pro-natal policies increase population growth;
the Chinese government actively discourages births/one child policy;

policies that influence migration:
policies can encourage immigration to facilitate gap in labour market in falling birth rate countries;

cultural influences:
cultural/religious influence on contraception usage/non-usage can increase/decrease fertility;
education on birth control and contraception usually decreases fertility;
boys being more valued than girls in some cultures so increase fertility so more boys are born;
the culture of having children to support in old age/help farm the land;
marriage patterns – marrying young usually means increased fertility;
women's emancipation/increased freedom/control over their own life can decrease fertility; ***[7 max]***
*Award **[5 max]** if only developmental policies or cultural influences are discussed.*

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

Total: ***[20]***

4. (a) inputs of energy and matter;
outputs of energy and matter;
ecosystems are an open system;
matter is recycled;
the amount of matter in the biosphere remains constant;
energy enters (an ecosystem) as light;
energy transferred in matter *e.g.* food web;
energy leaves (an ecosystem) as heat;
appropriate use of entropy concept;
inputs of producers/consumers/decomposers/water/soil *etc*.;
outputs of producers/consumers/decomposers/water/soil *etc*.;
within the ecosystem the cycling/processing of producers/soil/water/nutrients; ***[4 max]***
Do not credit any reference to energy being recycled.
Award credit if examples are used correctly for inputs/outputs and processes.

(b) energy flow shows the pathway of energy through the system;
energy is lost at each trophic level in the food web;
the Sun provides incoming energy to most food webs on Earth;
in deep oceans incoming energy is from deep sea vents/black smokers/the mantle;
outgoing energy from all food webs is heat lost from respiration;
energy moved from a (photosynthesis-based) food web into the decomposer food web via wastes and death;
energy flow in a food chain/web illustrates the first law of thermodynamics;
not all energy from one trophic level is passed onto the next trophic level;
due to not everything being consumed, assimilated and losses due to biological activities, the second law of thermodynamics is illustrated;
in terrestrial food webs there is usually a 10 % flow of energy between trophic levels; ***[5 max]***

(c) *Award **[1 max]** if two contrasting energy sources are named – these should be **one** renewable/replenishable and **one** non-renewable. Nuclear could be used with any other energy source.*

e.g. solar and coal energy;

advantages of solar:
no polluting gases such as CO_2/NO_X or SO_X;
source is renewable/replenishable and potentially infinite;
safe to use;
individual supplies to houses so can be used in rural areas;

disadvantages of solar:
expensive to make the solar panels;
is a discontinuous supply / none at night and so needs storage;
not all areas of the world are suitable;

advantages of coal:
there is still a large supply / 250 years worth of coal left in the world;
technology is set up to use coal in industry/electricity production;
as a solid it is easy and safe to transport;
it is relatively cheap to mine and burns/combusts to create electricity/heat;

disadvantages of coal:
as a non-renewable resource it will eventually run out;
combustion releases polluting gases CO_2/NO_X or SO_X;
degradation of land due to mining;

*Award **[4 max]** for any reasonable evaluation. Responses must evaluate each advantage and disadvantage rather than a general list or one word answers. The structure of the answer should flow rather than be split into sub headings. Lists and sub headings would be penalized in the expression of ideas marks.*

*Award **[1 max]** for at least two clearly named societies.*
e.g. biogas in India **and** coal in China;

economic factors:
China is committed to using coal in heavy industry and electricity production, to change would cost too much;
China has plentiful supplies of easily available coal;
electricity from burning coal is cheap for China;
small scale biogas generators are easy to build;
they use local biomass, from cattle, to fuel the biogas generator, so it is cheap;
it is too costly for these Indian villages to connect to the main electricity grid; ***[9 max]***
*Award **[4 max]** for any reasonable society and economic factor given.*

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

Total: ***[20]***

5. (a) speciation occurs as a result of isolation of populations;
geographical barriers isolate populations of the same species;
these are mainly from plate tectonic movements / mountain building;
colonization of new islands, often volcanic due to plate activity, can lead to adaptations of a species to fill all the niches;
over time there will be reproductive isolation too, when members of the old and new species can no longer produce fertile offspring;
plate activity may bring populations that were separated millions of years ago back together and the speciation has created reproductive isolation;
e.g. Galapagos finches that have undergone speciation to fill many of the niches on the volcanic islands and they now are very different from the mainland original Finch;
convergence of land masses produces a mixing of genetic pools, promoting new ecological links and possibly hybridization; ***[4 max]***
Accept clear examples of species and plate activity.

(b) succession is the change in the community of an area over time until the climax community of that biome is reached / *OWTTE*;
the more diverse an ecosystem the more stable it is;
succession increases diversity and so stability increases;
each stage/sere of succession helps create a deeper and more nutrient-rich soil, so allowing larger plants to grow;
this increases the habitat diversity which leads to greater species and genetic diversity and thus greater stability;
climax communities/seres have a more complex system which is more stable;
more complex food webs have greater diversity, so more stability if one organism goes extinct;
humans often try to recreate pioneer seres in agriculture, these are less stable and so humans have to constantly monitor/work with the crops;
monocultures in agriculture are more vulnerable to disease and pests and so less stable;
succession can be interrupted naturally and by humans and this also reduces the stability of the ecosystem;
e.g. humans have tried to stop fires in Mediterranean biomes but when fires break out they are far more damaging to the diversity than the natural fires would have been; ***[6 max]***
Award credit to examples that clearly show the link.
*Award **[1max]** for a clear definition of succession.*

(c) *Most students will use UNEP for intergovernmental and either WWF or Greenpeace for non-governmental (NGOs), but allow any other reasonable example of an organization.*

*Award **[1]** for naming an appropriate intergovernmental and a non-governmental organization.*
e.g. UNEP **and** WWF/Greenpeace;

both organizations are trying to promote conservation of habitats/ecosystems and biodiversity;
NGOs use the media more to get specific messages across about conservation/preservation;
NGOs often run campaigns focused on large charismatic species such as whales/seals/pandas;
UNEP works more slowly and is concerned about government level changes to protect the environment;
international conventions are set up by UNEP to get governments to commit to conservation;
e.g. Rio Earth summit of 1992 and the Agenda 21 that countries signed;
e.g. Johannesburg Sustainability summit of 2002;
NGOs often lobby at UNEP organised conventions to encourage countries to sign treaties/agreements;
NGOs often protest at the UNEP conventions to highlight single issues they are concerned with;
intergovernmental organizations work within the law and often NGOs can be more confrontational;
NGOs often have publicity stunts that aim to draw attention to the conservation issue;
NGOs work at a local scale/grassroots level;
NGOs tend to have local groups to affect community involvement, more actively including communities;
NGOs provide education/information on issues; ***[8 max]***
Accept any clear example of one of these points and award marks for a detailed example.
At least one comparison must be made to gain full marks.

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

Total: ***[20]***