M09/4/ECOSO/SP2/ENG/TZ0/XX/M+

International Baccalaureate®
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MARKSCHEME

May 2009

ECOSYSTEMS AND SOCIETIES

Standard Level

Paper 2

16 pages

General Marking Instructions

Assistant Examiners (AEs) will be contacted by their team leader (TL) by e-mail (or telephone) – if by e-mail, please reply to confirm that you have downloaded the markscheme from IBIS. The purpose of this initial contact is to allow AEs to raise any queries they have regarding the markscheme and its interpretation. AEs should contact their team leader by e-mail at any time if they have any problems/queries during the marking process.

Note:

The DHL courier service must be used to send assessment material to your team leader/senior moderator and to IB Cardiff. (However, this service is not available in every country.) The cost is met directly by the IB. It is vitally important that the correct DHL account number is used.

If you have any queries on **administration** please contact:

Joanne Gregory
Examinations Administration Department (EAD)
IB Cardiff
Peterson House
Malthouse Avenue
Cardiff Gate
Cardiff CF23 8GL
GREAT BRITAIN

Tel: +(44) 29 2054 7777

Fax: +(44) 29 2054 7778

E-mail: joanne.gregory@ibo.org

1. Follow the markscheme provided, do **not** use decimals or fractions and mark only in **RED**.

2. Where a mark is awarded, a tick (✓) should be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark.

3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation in the **left hand margin** to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking.

4. Unexplained symbols or personal codes/notations on their own are unacceptable.

5. Record subtotals (where applicable) in the right-hand margin against the part of the answer to which they refer (next to the mark allocation for Section A). Do **not** circle sub-totals. **Circle the total mark for the question in the right-hand margin opposite the last line of the answer.**

6. For Section B, show a mark for each part question (a), (b), *etc*.

7. Where an answer to a part question is worth no marks, put a zero in the right-hand margin.

8. Section A: Add together the total for each question and write it in the Examiner column on the front cover.

Section B: Insert the total for each question in the Examiner column on the front cover.

Total: Add up the marks awarded and enter this in the box marked TOTAL in the Examiner column.

9. After entering the marks on the front cover check your addition to ensure that you have not made an error. Check also that you have transferred the marks correctly to the front cover. **We have script checking and a note of all clerical errors may be given in feedback to examiners.**

10. Every page and every question must have an indication that you have marked it. Do this by **writing your initials** on each page where you have made no other mark.

11. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers and use the marks of those answers that have the highest mark, obviously up to the prescribed number of questions for the paper or section of paper, **unless the candidate has indicated the question(s) he/she wants to be marked on the front cover**.

12. A candidate can be penalized if he/she clearly contradicts him/herself within an answer. Make a comment to this effect in the left hand margin.

Subject Details: Ecosystems and Societies SLP2 Markscheme

General

A markscheme often has more specific 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 underlined 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 mark scheme, then award the mark.
- Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalising 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 "**U-1**" 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) tundra; ***[1]***

(ii) water/light/temperature is limiting;
water is frozen for most of year in permafrost;
precipitation rates are low;
snow cover prevents light reaching plants for part of year;
it is dark for 4 months of the year;
precipitation is lowest in months when light levels are highest;
temperature is low due to low intensity of solar insolation;
infertile soil due to low temperatures/acidity/waterlogging/low nutrient turnover; ***[2 max]***
Accept any other reasonable suggestion.

(b) (i) warmer in summer/June to September in both periods;
temperatures consistently higher in 1991–2004;
especially in winter months/November to April;
smaller temperature ranges in 1991–2004;
temperature above freezing/warmer earlier in 1991–2004;

total precipitation lower in 1991–2004;
drier/lower precipitation in the summer/June to August in both periods;
total precipitation is more evenly distributed in 1991–2004;
anomalously low precipitation in October 1991–2004;
precipitation lower in every month in 1991–2004; ***[3 max]***
Accept any other reasonable suggestion.
*Award **[2 max]** if either precipitation or air temperature are not mentioned.*
Accept converse answer in each case but do not credit both.

(ii) climate change / global warming / natural variation / increased combustion of fossil fuels; ***[1]***

(c) (i) geographical isolation / no interbreeding with mainland reindeer;
adaptation to local conditions / no predators so no need for long legs / natural selection; ***[2 max]***
Accept any other reasonable suggestion.

(ii) *Do not award marks if arrows are drawn onto the table in the incorrect direction.*
Do not credit food chain for mainland reindeer if warble flies are missing.

Svalbard reindeer:
(solar insolation) → small arctic plants → reindeer ;

Mainland reindeer:
(solar insolation)→ reindeer moss/lichen → wild reindeer → wolf / warble fly ; ***[2 max]***

(iii) *Award **[1 max]**.*
Svalbard's food chain is less stable because;
*Award **[1 max]**.*
it has fewer trophic levels / interrelationships are simpler / chain not web;
habitat covers a smaller land area;
smaller populations are more likely to crash;
human impact on Svalbard may destabilize that food chain;
low nutrient value of food;
no predators to manage/control Svalbard reindeer population; ***[2 max]***
Do not award mark for stating wild reindeer food chain is less stable.
Accept other valid reasons.

(d) (i) positive feedback amplifies/increases change/leads to (exponential) deviation away from an equilibrium, whereas negative feedback damps down/ neutralizes/counteracts any deviation away from an equilibrium; *OTTWE* ***[1]***

(ii) *Positive feedback*: ***[2 max]***
methane gas released from mining increases global warming/greenhouse effect;
higher temperatures melt permafrost, releasing more methane so temperature increases further;
coal dust deposited on snow or ice reduces albedo/reflection of solar energy/increases solar energy absorbed so ice and snow melt;
with no snow cover, albedo is further reduced, so frozen soil thaws;
as permafrost melts, methane gas is released so temperatures increase further;

Negative feedback: ***[2 max]***
dust particles in the atmosphere act as condensation nuclei leading to more precipitation;
dust particles washed out of atmosphere by extra precipitation;
so atmospheric dust/precipitation levels return to normal; ***[4 max]***
Accept any other valid example.

(e) (i) very cold / permafrost/frozen;
low running costs / little electricity used;
few natural hazards;
little chance of civil unrest / little human disturbance; ***[2 max]***
Do not accept answers which relate to general advantages of having a seed vault or benefits to Svalbard e.g. jobs / tourism revenue.

(ii) many rare/endangered wild plants are threatened with extinction by human activity/natural hazards;
wild plants are often used for developing new drugs/providing genes to give disease resistance/ability to withstand adverse conditions to other species;
the species and/or genetic diversity of wild plants may be culturally and aesthetically significant (and therefore worth preserving);
ecosystems may become unstable if key species disappear/diversity is reduced;

maintaining genetic diversity of food crops is vital for breeding new varieties to cope with disease/adverse conditions;
many older varieties of food crops are no longer grown, so the genetic diversity they provided for development of new varieties is lost;
some transgenic crop varieties have a "terminator" gene, so cannot produce viable seed for farmers to plant the following season; ***[2 max]***

(f) (i) latitude: 76° (*accept 75°–77°*) – 81° (*accept 80°–82°*) North/N; ***[1]***

(ii) exploitation of more inaccessible resources becomes economically more viable as reserves diminish/prices rise;
increased demand for oil and gas encourages further exploitation in new areas;
improved technology is now available for coping with difficult Arctic weather and subsea conditions;
access becomes easier as ice thins/areas become ice free for more of the year;
countries want their own oil and gas supply for strategic reasons;
increasing demand for resources due to population growth;
increasing demand for resources to sustain increased expectations of higher standards of living;
recently discovered new reserves in the area; ***[2 max]***
Answers must relate to an increasing trend.

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.

2. (a) biodiversity is the amount of biological/living diversity per unit area;
biodiversity includes other concepts of diversity *e.g.* species diversity/habitat diversity/genetic diversity;
species diversity is the variety of different species only; ***[2 max]***

(b) *Award **[5 max]**.*
biodiversity will generally increase as the process of succession occurs;
in initial stages relatively few species are hardy enough to survive the harsh conditions so species diversity will be low;
pioneer species are *r*-strategists so rapidly colonize and out-compete *K*-strategists;
primary productivity/biomass at low trophic levels is limited so can support only short food chains/limited number of species;
each community will help to improve the physical environment making conditions for life more favourable;
soils will become more fertile/with better water retention/more organic matter;
gradually the diversity of habitats will increase with each seral stage;
range of habitats will provide more niches for different species increasing species diversity;
food webs will become more complex allowing for more niches;
small (colonizing) populations will have limited genetic diversity at first;
over time greater specialization/mutations/population growth will cause increase in genetic diversity;
biodiversity may actually drop a little before climax community;
due to all remaining sub-climax habitats in vicinity being lost;

*Award **[3 max]**.*
sometimes succession is interrupted/arrested before the climax community is reached (plagioclimax);
for example grazing livestock may allow grasses to persist where otherwise trees would take over;
clearing vegetation on river banks / river bank erosion can prevent pioneers becoming established in the first place;
crop harvesting where crops are harvested before life cycle of crops is complete;
if the interrupting factor is removed (*e.g.* grazed land is fenced off), succession may restart (secondary succession);
logging or burning climax vegetation can allow the process of succession to begin again;
changing climatic conditions can alter the climatic climax community that is established;
for example the shifting patterns of biomes globally due to the enhanced greenhouse effect/global warming; ***[8 max]***

(c) *Award **[6 max]**.*

ethical arguments stress the right (biorights) of living organisms/landscapes to remain unmolested;
aesthetic arguments stress the importance of beauty / intrinsic appeal of diversity in landscapes/environments/species;
genetic resource arguments stress the value of genetic diversity for the future;
either because of the potential socio/economic benefits of different species in helping humanity to solve *e.g.* medical/food supply issues;
or because of the importance of preserving genetic diversity to ensure the health of endangered populations;
ecological arguments stress the value of diversity in maintaining stability (on every scale);
e.g. ecosystems with high species and habitat diversity can withstand environmental changes better/are more stable;
e.g. preserving a diversity of ecosystems maintains global stability as some ecosystems play unique roles in providing global life support systems, such as climate regulation/global productivity/balance of mineral cycles;

*Award **[3 max]**.*

World Conservation Strategy (WCS) has as its main objectives: maintaining ecological processes/life support systems, preserving genetic diversity, and ensuring sustainable utilization of species and ecosystems;
socio-economic, genetic resource, and ecological arguments are likely to be more important;
perhaps because these are more universally agreed by people with different environmental paradigms / not everyone shares the ethical/aesthetic arguments;
perhaps because these are more scientifically verifiable than ethical or aesthetic arguments;
and most influential nations/nations involved in drawing up WCS attach more value to scientific validity; ***[8 max]***

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

Total: ***[20]***

3. (a) use of global resources at a rate that allows natural regeneration;
and minimizes damage to the environment; ***[2]***

(b) demands on water resources are increasing due to population increase/increasing demands by agriculture/industry;
yet the capacity of fresh water stores to replenish themselves is not unlimited;
therefore water resources need to be managed to ensure demand does not exceed supply;
an example where this has not happened is the Aral Sea (Kazakhstan and Uzbekistan), which has shrunk in size and been degraded by unsustainable use of water resources;
the two rivers (Syr Darya and Amu Darya) which input water into the Aral Sea had been diverted to irrigate cotton fields upstream in Uzbekistan;
insufficient water reached the Aral causing it to shrink to a third of its original size;
water has become contaminated with pesticide run-off and salt due to evaporation and reduced freshwater supplies;
hence, river water has been harvested for irrigation and used at a rate greater than it can be replenished by fresh water;
this has had knock-on effects on lake species/water supplies for lake communities/fishing industries/local climate; ***[6 max]***
*Award **[1]** for naming an appropriate case study. Examples may demonstrate sustainable or unsustainable use.*

(c) *e.g.* the Dogon people in West Africa and industrial capitalism of Western Europe;
*Award **[1]** for stating two societies which demonstrate significant differences*.

*Award **[5 max]** for each society*.
e.g. the Dogon operate a mixed farming system with cultivation of millet and tobacco, livestock herding and hunter gathering;
the ecosystem (bushland) surrounding their settlement is seen as the source of all the resources (food, building materials, fuel and medicine) that they need;
subsistence depends on harnessing the power of the bush through work;
but the bush is also the home of potentially vindictive spirits;
respect is an essential part of the relationship between the Dogon and their environment;
trees are particularly respected, wood is not wasted and wooden objects are left to deteriorate once no longer useful;

e.g. in industrial capitalism economic growth (and the consumption patterns that sustain growth) can be idealized/worshipped in place of the spiritual dimension of an ecosystem;
just as in the Dogon system, ecosystems are seen as economic resources which can be exploited through work in order to develop economies/meet needs;
but the scale and technological power of these systems means that in the past this has led to exploitation of resources at unsustainable rates *e.g.* the massive deforestation of ancient forests in Europe for fuel and building materials;
but increasingly it is being argued that ecosystems should be seen as natural capital which can yield an income if exploited sustainably;
and so quotas are set, for example for fishing catches, to preserve the natural capital; ***[10 max]***

*Award **[5 max]** if no attempt is made to relate the value system to how the resources are used.*
*Award **[5 max]** if no attempt is made to compare the societies.*

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

Total: ***[20]***

4. (a) *Award **[2 max]**.*
pyramid of biomass represents the standing stock of each trophic level measured in units such as grams of biomass or energy per sq m; *(units required)*
pyramid of numbers represents the number of individuals in each trophic level within a food chain;

*Award **[2 max]**.*
pyramid structure of ecosystems means that non-biodegradable toxins can become concentrated in upper levels;
it also demonstrates why there is a limit to the number of trophic levels that can be supported;
and why species at the top of the pyramid may be more vulnerable to *e.g.* hunting; ***[4 max]***

(b) *Disadvantages of banning DDT*: ***[3 max]***
DDT effectively killed malarial mosquitoes, and since the ban populations of mosquitoes have increased;
incidence of malaria has increased as a result;
malaria is a disease to which children are particularly vulnerable and has huge socio-economic implications;
90% of all malaria cases are in Africa, a country least able to deal with the socio-economic consequences of the disease;

Advantages of banning DDT: ***[3 max]***
environmental side-effects of DDT have been avoided by banning its use;
e.g. DDT is not biodegradable and accumulates in the tissues of living organisms (bioaccumulation) damaging or even eliminating populations;
e.g. because DDT becomes more concentrated along food chains (bioconcentration) top carnivores tend to be most affected and these may play a very significant role in maintaining balance of whole ecosystem;
target insects can develop resistance, but DDT also kills other insects which may be natural predators of the mosquitoes, so the ban allows natural balance to be restored; ***[6 max]***

(c) *Methods for improving productivity of soil*:
improving fertility of the soil with (organic fertilizers/manure/chemical) fertilizers;
reducing losses due to pests/disease with chemical treatments;
improving nitrogen fixation by planting leguminous crops *e.g.* beans;
reducing loss of nutrients due to soil erosion by terracing fields;
reducing loss of nutrients/topsoil due to wind erosion by planting shelter belts;
avoiding over-intensive farming by allowing fields fallow/rest periods;
avoiding depletion of nutrients by rotating crops;
improving yields through irrigation;
avoiding over-compaction of soil through use of appropriate/low impact technology;
reducing wastage by increasing field size *e.g.* through removal of hedgerows;
use of GM / Green Revolution crops *e.g.* higher yielding varieties of rice;

Contrasting approaches of ecocentric and technocentric farmers:
both ecocentric and technocentric farmers might apply fertilizers, but choice of fertilizer might reflect their values *e.g.* ecocentric using manure (to work with natural processes), whereas technocentric might use chemical fertilizers;
technocentrics might favour high tech solutions such as GM crops whereas ecocentrics might be concerned about the ethical issues of GM;
ecocentrics often express a lack of faith in large scale technology so might oppose strategies used by agribusiness *e.g.* high tech irrigation systems; ***[8 max]***

Award credit for any other answers of equivalent validity, relevance and substance.
Award ***[6 max]*** *if no contrast is made between ecocentric and technocentric farmers.*
Allocation of marks can be split flexibly for part (c).

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

Total: ***[20]***

5. (a) greenhouse gases help to insulate the earth by retaining longwave radiation and maintaining temperatures;
increases in the concentration of greenhouse gases in the atmosphere are correlated with/cause/believed to cause increasing global temperatures; ***[2]***

(b) some societies more affected than others due to their geographical location;
e.g. increased sea levels will not be an issue for landlocked countries / some countries will be flooded or disappear;
e.g. heavily glaciated areas may suffer more from melting/flooding with increase in global temperatures;
e.g. the ozone layer is thinner in higher latitudes;
e.g. for some areas, impacts may be positive, such as increased temperature/rainfall may improve farming/tourism in dry cold areas;

the *same* impacts may affect societies differently because of socio-economic factors;
e.g. LEDCs that depend heavily on farming may be harder hit than countries that can afford to import their food if climate is affected;
e.g. MEDCs with better health and education may be able to protect population better against skin cancers from increased UV;
e.g. MEDCs with greater wealth and technological development can mitigate against climate change more readily *(*through constructing sea defences/hurricane warning systems); ***[6 max]***
Award credit for any other answers of equivalent validity, relevance and substance.

(c) *Preventive*: ***[3 max]***

reducing emissions of carbon dioxide, methane, HCFCs/HFCs, nitrogen oxides through changes to current practice;
reducing fossil fuel use *e.g.* through developing alternative energy sources *e.g.* renewables/nuclear;
technology to improve energy efficiency *e.g.* in buildings/transport;
changing farming practice *e.g.* reducing cattle farming (methane)/artificial fertilizer use (nitrogen oxides);
incentives provided through *e.g.* international targets/carbon taxes;
increasing natural recycling of carbon, by reducing deforestation/increasing afforestation;
high technology solutions *e.g.* climate engineering / phytoplankton farms / carbon sequestration;
plans to suspend small mirrors in space between the sun and the Earth to deflect solar radiation;
plans to add sulfur to jet fuel to increase sulfur dioxide in atmosphere (adding particulates) so reducing solar radiation reaching Earth's surface;

Reactive: ***[3 max]***

engineering works to protect coastal areas from flooding;
improving prediction and warning systems to reduce impact of increased natural hazards *e.g.* hurricanes;
migration of people to cooler/wetter areas;
land use planning, reducing the densities of people living in most vulnerable areas;
contingency planning, investing in emergency services/stockpiling food stores to offset disaster in emergency situations;

Evaluation: ***[4 max]***

preventive might be more important because they are trying to stop the problem happening in the first place;
however, reactive might be more important, because even if we stop releasing greenhouse gases today, the argument is that the effects will still be felt from gases emitted in the past;
reactive might be more cost effective, because we are not sure exactly what effects will be felt where, and so money can be targeted when real problems emerge;
preventive may be more important because if we reduce greenhouse gas emission now we can offset the worst effects of climate change;
preventive might be more important because they depend on international cooperation, and countries working together are more likely to bring about effective change; ***[10 max]***

*Award **[4 max]** if no distinction is made between preventative and reactive.*

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

Total: ***[20]***