



# **MARKSCHEME**

**November 2007**

**ECOSYSTEMS AND SOCIETIES**

**Standard Level**

**Paper 2**

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## 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) bathypelagic;  
(ii) abyssal plain; [1]  
*Both answers needed to receive [1].*
- (b) difficult/expensive to access because of hostile conditions *e.g.* dark/  
high pressure/cold;  
large area and relatively low density of species to catch; [1 max]
- (c) (i) insufficient light lower down for photosynthesis; [1]  
(ii) depth/light/temperature/pressure; [1]  
(iii) 4 / tertiary consumer / carnivore; [1]
- (d) *Possible adaptations could include:*  
red colouration;  
long legs;  
ability to produce bioluminescence; [2 max]
- (e) (i) vent/hydrogen sulfide → bacteria → shrimp/crabs/worms; [1]  
*To achieve [1] answer must begin with vent/hydrogen sulfide followed by bacteria.*  
(ii) specialized species (they are vulnerable if niche is lost);  
short food chains;  
high level of interdependence;  
harsh environmental conditions;  
slow growing organisms / late maturity / low fecundity; [2 max]  
(iii) fish removed by fishing industry;  
upwelling currents;  
birds eating fish/plankton; [1 max]

- (f) (i) initial increase followed by gradual decline;  
interest in species increased in early years as new technology allowed targeting of species;  
over fishing of stocks meant reduction in young fish and decline in populations; [3]
- (ii) *ecocentric: [2 max]*  
small scale technology should be adopted *e.g.* wide net mesh;  
community fisheries;  
consumer restraint;  
fishing quotas;  
limits on catch size;
- technocentric: [2 max]*  
stress role of market (costs increase as stocks dwindle so fewer will be fished);  
through technology *e.g.* intensive fish farming as an alternative;  
scientific research in monitoring populations; [4 max]  
*Award [2] for each environmental philosophy.*
- (g) (i) 39000 gigatonnes /  $39 \times 10^9$  tonnes; [1]  
*Units needed.*
- (ii) possible way to offset global warming as large amounts of carbon could be stored/locked away; [1]
- (iii) thermal expansion;  
icecaps/glaciers melting; [1]  
*Both answers needed to receive [1].*
- (h) *why little pressure [3 max]*  
no country has ownership of the deep ocean and therefore, difficult to control/legislate for/police;  
the deep ocean is remote and not visible to most people;  
little is known about the system, therefore, conservation issues are not raised/known about;  
deep-ocean systems are not occupied by humans;
- the need for conservation [3 max]*  
deep-ocean systems represent an important biological resource;  
deep-ocean systems are potentially fragile and susceptible to damage from outside influences;  
deep-ocean systems represent a biological resource that has not yet been fully understood; [4 max]  
*Award [3 max] if only why little public pressure or need for conservation is addressed.*

## 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) a simplified description;  
designed to show, the structure/workings of an object/system/concept;  
require approximations to be made; [2 max]
- (b) *predicting the growth of human populations: [3 max]*  
growth of human population depends (at a simple level) on birth rates and death rates;  
from this rates of natural increase can be calculated and population total predicted;  
population pyramids enable policy makers to chart what proportion of the population are in the fertile age bracket helping to predict likely birth rates;  
demographic transition model shows how population growth is linked to economic development;  
enables the reasons for population growth to be understood;  
but not all countries conform to the stages identified;  
models are hugely simplified, and may not reflect the complex and unpredictable factors which affect growth rates *e.g.* war / disease;
- predicting climate change: [3 max]*  
models can demonstrate anticipated changes to climate based on carbon emissions;  
model only as good as the data that goes in and it may be suspect;  
conflicting models can show different effects in same place;  
hugely complex in terms of numbers of factors involved in atmospheric systems so in process of oversimplification accuracy is lost;  
*e.g.* role of feedback/ocean systems not fully understood;  
*Accept other examples of feedback.*
- assessing demands human populations make on their environments: [3 max]*  
ecological footprints can be effective for comparing environmental impacts of different societies;  
able to provide a quantitative estimate of human carrying capacity;  
a quantification of what can be a very complex set of factors;  
can be useful tools for getting people to think about their impact;  
stresses the systems approach and interconnectedness of eco and social systems;  
very difficult to calculate figures *e.g.* *per capita* CO<sub>2</sub> emissions; [9 max]
- To receive full marks answers must have a balance of strengths and weaknesses.  
Award credit if other relevant models are evaluated.*

- (c) strategies for controlling growth include availability of contraception/financial incentives/public information/legislative changes (*e.g.* making abortion illegal); often the reasons for family size can be attributed to cultural factors so for policies to be effective they need to understand the underlying reasons why people decide to have a certain number of children;  
the need for male children in some cultures is linked to the traditional practices and structures *e.g.* inheritance by male heirs and dowries for females;  
sometimes cultural factors indirectly play a role in fertility rates *e.g.* education and employment opportunities for women lead to delayed marriages and lower birth rates;  
provision of contraception in *e.g.* remote, rural communities may not be enough – programmes to educate males to be willing to use the contraception are also needed;  
cultural norms may be ingrained/deeply felt and policies need to address these at the deepest level to change attitudes *e.g.* religious beliefs in catholic countries;  
culture and tradition evolve over time / cultural change can occur and governments can be a part of this;  
education and economic development are important factors in bringing about cultural change;

[7 max]

*Award [4 max] if no examples are used. Examples can be of cultural practices and do not need to be located in named geographical contexts.*

*Expression of ideas: [2 max]*

*Total: [20]*

3. (a) *definition: [2 max]*

the addition to an environment of a substance/an agent (*e.g.* heat) by human activity;  
at a rate greater than that at which it can be rendered harmless by the environment;  
and which has an appreciable effect on the organisms within it;

*impact: [4 max]*

*e.g.* nitrates from agricultural run-off leading to rapid growth of algae;  
accumulation of dead organic matter;  
high rate of decomposition and lack of oxygen (eutrophication);  
positive feedback within the system;  
food chains become shortened;  
death of aerobic organisms;  
increased turbidity;  
loss of macrophytes;  
and loss of species diversity;

[6 max]

*Award [2 max] if pollutant is not named. Award [3 max] if both structure and function are not addressed.*

(b) *description: [2 max]*

altering the human activity producing pollution *e.g.* by alternative methods of enhancing crop growth (manure);  
regulating and reducing pollutants at the point of emission *e.g.* by sewage treatment processes that remove nitrates from the waste;  
clean-up and restoration *e.g.* by pumping mud from eutrophic lakes and reintroducing plant and fish species;

*evaluation: [4 max]*

arguably more cost effective to adopt preventative rather than curative strategies;  
costs for implementing strategies will be borne by different communities as eutrophication can occur some way from the farms which caused the problem;  
difficult to identify who is causing the problem;  
polluter pays is a problematic strategy because it may push up food prices, which will be unpopular with consumers and have economic/political implications;

[6 max]



- (c) solid domestic waste includes paper, glass, metal, plastics and organic waste, they are produced in large volumes and contribute substantially to landfill;  
many types of domestic waste can be recycled and have an economic value;  
however, the cost of recycling can have a greater environmental impact than allowing the waste to go to landfill;  
charging (taxing) the public for the volume of waste they produce may encourage them to recycle more and/or purchase goods with less packaging;  
local government may resist recycling for financial reasons *e.g.* collection cost may be too high;  
products could be taxed on packaging volume;  
greater incentives to produce less waste from source;  
incineration of waste as a biogas/fuel could be a more environmentally acceptable answer to waste management than landfill;  
composting of organic waste is a simple and effective way of recycling waste;  
education and culture can strongly influence the quantity of recycling;  
*Award [5 max] if no personal viewpoint is expressed.*  
*Accept other reasonable justifications.*

**[6 max]**

*Expression of ideas: [2 max]*

*Total: [20]*

4. (a) use of resources at a rate that allows natural regeneration;  
and minimizes damage to the environment;  
*e.g.* a system of harvesting renewable resources at a rate that will be replaced by natural growth might be considered to demonstrate sustainability;  
any society that supports itself in part by depleting essential forms of natural capital is unsustainable;  
if human well-being is dependent on the goods and services provided by certain forms of natural capital, then long-term harvest (or pollution) rates should not exceed rates of capital renewal;  
sustainability means living within the means of nature, on the “interest” or sustainable income generated by natural capital;

[3 max]

- (b) global summits can play a leading role in shaping attitudes to sustainability  
*e.g.* UN Conference on Human Environment/Stockholm, 1972 was the first time that the international community met to consider global environment and development needs;  
and can play a pivotal role in setting targets and shaping action at both an international and local level *e.g.* Rio Earth summit (in 1992) led to Agenda 21 and Rio declaration, which set out key policies;  
and to legally binding conventions *e.g.* on climate change / Montreal (1987);  
however, countries can break these agreements and there is little the international community can do;  
in terms of shaping public opinion media can also be important *e.g.* Silent Spring by Rachel Carson was pivotal;  
attitude change may occur without summits *e.g.* UN commissioned the Brundtland report, which established initial definition for sustainable development;  
summits may not achieve their initial goals, however, they may act as a catalyst in changing the attitudes of governments, organizations and individuals;

[5 max]

*Accept any other reasonable answers.*

*Award [3 max] if summits are described but not evaluated.*

- (c) *factors could include availability, economic, cultural, environmental and technological factors:*

*e.g. fossil fuels in UK*

availability – large oil, coal and gas reserves in UK have historically meant they were an obvious choice for exploitation;

as the most easily accessible reserves have been used up, the costs of exploitation have increased and alternative sources have been sought;

changing awareness of environmental implications of fossil fuel exploitation has increased demand for renewable, non-polluting sources;

cultural fears based on perception of nuclear accidents/waste have made this an unpopular choice politically;

leading to greater investment and research into alternatives *e.g.* wind and tidal;

as public awareness of threats of global warming has increased there has been a shift in attitudes towards, say, wind power, despite the aesthetic and environmental implications;

*e.g. firewood in India*

in India a huge proportion of population rely on local sources of firewood for energy because it is most readily available/cheap;

it is the traditional source of energy, which has always been used;

and technology such as solar powered stoves is not available/affordable;

in a drive to develop economically the Indian government has sought to harness other sources of cheap energy to stimulate industrial development;

specifically hydroelectric power, which has sometimes been extremely controversial for social/environmental reasons *e.g.* Narmada dam;

**[10 max]**

*Award credit if figures are used. Award [5 max] if no societies are referred to.*

*Societies do not need to be contrasting, but energy sources should be.*

*Accept other reasonable responses.*

*Expression of ideas: [2 max]*

*Total: [20]*

5. (a) *Transfers: [3 max]*

transfers normally flow through a system and involve a change in location;  
water will flow through soil (infiltration) to replenish groundwater (transfer);  
excessive flow of water through a very porous soil will wash away the nitrates into rivers and sea (leaching);  
water can flow from soil into plants by uptake into roots;

*Transformation: [3 max]*

lead to an interaction within a system in the formation of a new end product / involve a change of state;  
soil water may evaporate back into the atmosphere (transformation);  
few plants have the ability to absorb atmospheric nitrogen directly, so it has to be converted by bacteria;  
these bacteria exist, in decaying remains/in the soil, to form nitrates which can be taken in by the plants in solution with water in the ground (nitrification);  
but people can also add nitrogen to the soil in the form of artificial fertilizers;  
by planting leguminous crops *e.g.* peas / beans / clover, which are able to fix atmospheric nitrogen;  
the soil is the home of bacteria and if it becomes waterlogged near the surface the bacteria are unable to breakdown the decaying plant and animal matter;  
then the poorly decomposed matter forms peat on the surface *e.g.* in a peat bog (denitrification);

[5 max]

- (b) large scale cereal cultivation in the prairies, USA – high technology approach to minimizing wind erosion;  
*e.g.* use of specially adapted ploughs;  
shelterbelts of trees planted;  
GM crops with shorter stalks to minimize wind damage and exposure of soil;  
application of fertilizer to retain fertility of soil;  
small scale agriculture *e.g.* vegetable farming in Thailand – manure from working livestock allowed to fertilize soil;  
terraces built by hand to reduce run-off;  
fields allowed to be fallow/rest by crop rotation / soil is rested;  
variety of crops grown reduces the likelihood of exposure of soil at different times;  
commercial farming system relies on a technological approach to managing the soil (technocentric);  
whereas subsistence depends more on traditional practices, which have evolved over time as people live on the land (ecocentric) *e.g.* application of manure;  
tend to be low tech and simple;  
but system can breakdown when population pressure leads to abandonment of traditional methods;  
*e.g.* shortage of firewood means manure is burnt for fuel instead of being returned to land;

[8 max]

*Accept any other reasonable answers.*

*Award [1] for naming commercial and subsistence farming systems. Award [4 max] if no named systems are mentioned.*

*Answer needs to show comparison. If systems are simply described award [6 max].*

- (c) systems are models with inputs, outputs and storages;  
activities such as overgrazing, deforestation, unsustainable agriculture and irrigation  
cause processes of degradation;  
these include soil erosion, toxification and salinization;  
systems approach stresses the interconnectedness of soils and emphasizes the  
knock-on impact that actions can have;  
with overgrazing an understanding of the balance of animals that can be supported  
before the critical threshold is reached will help farmers plan herd size;  
seeing soils as renewable resources in equilibrium (inputs of nutrients through  
rain and organic matter) and outputs through natural leaching;  
will help farmers to compensate for the losses to overall nutrient balance by  
removing crops, and the importance of returning nutrients through the use of  
fertilizers;  
understanding that soils are living systems which are integral parts of ecosystems  
will help farmers to take a broader perspective when managing their land  
*e.g.* deforestation on nearby slopes can have an impact on water flows and  
likelihood of soil erosion in flash flood conditions;  
some processes of degradation are examples of positive feedback  
*e.g.* less vegetation → greater wind speeds → more soil erosion → less top soil →  
less vegetation *etc.*, understanding this can help farmers to break the cycle;  
*Do not accept arguments that are not linked to the concept of systems.*

[5 max]

*Expression of ideas:* [2 max]

*Total:* [20]

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