



MARKSCHEME

November 2013

ENVIRONMENTAL SYSTEMS AND SOCIETIES

Standard Level

Paper 1

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Subject Details: Environmental Systems and Societies SLP1 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions. Total = **[45 marks]**.

1. A markscheme often has more marking points than the total allows. This is intentional.
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 **WTTE** (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.

1. (a) a collection of ecosystems sharing similar climatic conditions / *WWTE*; **[1 max]**
- (b) Award **[1]** for any two correct responses from:
short growing season;
low average temperatures;
low availability of water due to low precipitation/ permafrost;
low solar insolation; **[1 max]**
Do not accept only “temperature”, “rainfall/precipitation” or “sunlight/solar insolation.”
- (c) (i) herbivory between caribou and grasses;
carnivorous between brown bears and lemmings;
predator prey between Arctic hares and snowy owls; **[1 max]**
Any other reasonable relationship directly taken from the food web.
- (ii) (trophic level) 3 / 2nd level consumers; **[1 max]**
Do not accept “carnivore” as a trophic level.
- (iii) **Strengths: [1 mark]**
easy to see the feeding relationships;
enables prediction of the impact of loss of one species on the rest of the food web;
not too much information so easy to read / a visual representation of relationships can be easier to understand;
shows direction of energy transfers;
Limitations: [1 mark]
actual numbers/biomass not represented;
over simplification / not all feeding relationships shown;
humans only seem to eat carnivores but humans are omnivores/ incomplete relationships shown with humans (not eating producers); **[2 max]**

2. (a) (i) $X = ((48-12)/10) = 3.6;$
 $X (=70/19) = 3.68/3.7; [1 \text{ mark}]$
- $Y (= 70/0.5) = 140/144; [1 \text{ mark}]$ *[2 max]*
- (ii) *High in Country B due to:*
 high agricultural work force / need for children to work on the farm;
 children may be seen as an economic asset;
 no/low access to contraception/family planning/birth control;
 lack of education / low female education;
 culture /religious factors encourages many children;
- Low in Country C due to:*
 high urban population / no space or need for large family;
 children may be seen as an economic liability;
 lower child mortality leads to lower birth rates (no need to compensate loss with having more children);
 economic development means less reliance on children to look after parents in old age;
 freely/easily available contraception/family planning/birth control;
 most of the population is educated past primary level/high female education;
 greater emancipation of women;
 economic costs of children outweigh cultural factors;
 religious factors;
 government has an anti-natal policy; *[2 max]*
- Accept any two different reasons from either list above.*
Do not credit the same reason twice eg “lack of contraception results in higher fertility rates and availability of contraception results in lower fertility rates.”
- (iii) stage 3 / late expanding; *[1 max]*

- (b) (i) calculating the amount of land required to provide all the resources required by a population (in a year);
 it includes the amount of land required to assimilate the waste produced;
 per capita land requirement = $\frac{\text{per capita food consumption (kg yr}^{-1}\text{)}}{\text{mean food production per hectare of local arable land (kg ha}^{-1}\text{ yr}^{-1}\text{)}/\text{WTTE}}$;
 for food production (ha)
- per capita land requirement = $\frac{\text{per capita CO}_2\text{ emission (kg C yr}^{-1}\text{)}}{\text{net carbon fixation per hectare of local natural vegetation (kg C ha}^{-1}\text{ yr}^{-1}\text{)}/\text{WTTE}}$; [2 max]
 for absorbing waste CO₂ from fossil fuels (ha)
- (ii) generally the smaller the ecological footprint the lower the stage of demographic transition / the higher the ecological footprint the higher the stage of demographic transition; [1 max]
Do not accept “ecological footprint is determined by large population”.
- (iii) vegetarians only eat plants/at trophic level two/at lower trophic level resulting in less energy loss/greater efficiency of energy transfer;
 less land is required to provide food for a vegetarian;
 less water is required in the production of food for a vegetarian;
 less CO₂/methane from food production of vegetarians as no meat required;
 this means less waste CO₂/methane needs to be absorbed by the vegetation;
 other lifestyle choices which consume resources/energy/produce waste also affect the ecological footprint; [2 max]
- (c) fewer resources are needed as a primary input into the school;
 reduces the manufacture/production of new resources;
 lowers the waste gas from the extraction/transport/manufacturing of the resources;
 lowers the decomposition of resources which releases CO₂;
 recycling reduces the amount of land needed for landfill;
 school community may take other actions like reduction/substitution/reusing which also lowers the footprint;
 unless the recycling is done consistently the ecological footprint may not change much; [3 max]
Accept other reasonable responses.
Do not credit only “reduced waste”.

3. (a) (i) parasitism; [1 max]
- (ii) reduces time off work due to malaria / increases productivity of workers;
reduces health care costs to government/employer/family/individual;
cheaper to kill malarial mosquitoes than to treat malaria; [1 max]
Accept other reasonable responses.
- (iii) all organisms have a right to live/intrinsic value from an ethical/spiritual/
philosophical view;
unknown value to food webs/could be a keystone species/ecological
argument;
mosquitoes help pollinate flowers;
there may be a future economic value to preservation;
aesthetic argument that organisms have beauty;
conservation of genetic variability; [2 max]
- (iv) biomes move further North/South so mosquitoes could spread to new
areas/expand their distribution;
zonation on mountains moves to higher altitudes allowing the mosquitoes to
have a distribution higher up the mountain;
more rainfall creating more breeding sites for mosquitoes/less rainfall so
less standing water; [2 max]
- (b) *Award [1] for any reasonable major influence*
Award [1] for a brief description of how the attitudes changed
eg Chernobyl nuclear disaster;
stopped the construction of nuclear power stations in most countries for many
years and led to the design of safer power stations;
- eg Greenpeace;*
highlighted the hunting of whales and seals and led to the public demanding the
hunting stopped;
Greenpeace and the whale hunt protests led to the International Whaling
Commission to ban commercial whaling;
- eg Kenyan Government burning ivory piles;*
Led to worldwide ban on ivory products; [2 max]

4. (a) *Name of indicator organism: [1 mark]*
eg Lichen;

Explanation: [2 marks]

lichens have different tolerances to pollution;
lichens are very sensitive to levels of sulphur dioxide and air pollutant;
by studying the distribution, diversity and abundance of lichens over an area;
the type of lichens found indicates the levels of pollution as the more sensitive lichens will be missing from the polluted areas;

[3 max]

- (b) (i) darker peppered moths where the air pollution is highest;
light peppered moths where there is less air pollution;

[1 max]

(ii) Light-coloured moths are adapted to non polluted trees in non-polluted areas and do not stand out/are better able to hide from their predators/are camouflaged;
Dark moths are adapted to soot covered trees/buildings in polluted areas and do not stand out/are better able to hide from their predators/are camouflaged;
Each population will tend to survive, through natural selection, and produce descendants / *WTTE*;

[1 max]

(iii) reduce the amount of fossil fuels burnt in the urban areas;
ban/reduce personal vehicle transport;
use alternative energy to reduce pollution;
make carbon charges high;
use filters to catch pollution;
plant vegetation to absorb pollution;
increase use of public transport;
Accept other reasonable responses.

[2 max]

- (c) absence of precipitation to remove pollutants from the air;
lack of wind to disperse pollutants/wind disperses pollutants;
...therefore with continued emissions, pollutants accumulate adding to air pollution;
...pollutants are spread and effect other areas;
thermal inversion layers trap the air in valleys;
...allowing accumulation of pollutants emitted into the atmosphere;
predominance of high pressure cells lead to cloudless skies and prevalence of sunlight;
sunlight fuels production of photochemical smog/ozone;
high humidity/saturated air allows formation of smog/ particulates and condensed water in saturate air form smog;
high/low temperatures encourages use of air conditioning/heating/appliances to use more fossil fuels;

[2 max]

Accept other reasonable responses, crediting development of detailed explanation.

5. (a) A community of organisms that is more or less stable, and that is in equilibrium with natural environmental conditions (such as climate) / the end point of ecological succession / *WTTE*; [1 max]
- (b) mining;
acid rain;
climate change / global warming;
clearance for agriculture by subsistence/commercial farmers;
urban development;
major hydroelectric/reservoir projects;
natural hazards;
introduced/invasive species;
hunting/collecting/harvesting; [2 max]
Accept any reasonable response.
Do not credit only "pollution / agriculture / deforestation".
- (c) (i) trees are the main producer/way in which energy enters the ecosystem;
there is a variety of nutrient and energy pathways / allows for varied food webs;
tree layers create a variety of habitats so increasing the diversity of species;
trees protect each other from high winds;
trees protect the soil from heavy precipitation/erosion;
interdependence of species means if the main plant types are gone then many other organisms cannot survive there either;
increased genetic diversity allows species to adapt to change;
the roots hold the soil together keeping the nutrient cycle going;
no trees increases the risk of soil erosion and loss of nutrients and a downward spiral of degradation and instability; [3 max]
- (ii) secondary succession depends upon soil type and seeds available;
seeds germinate / seedlings start to grow rapidly;
grass species common in early stages of tropical succession;
one tree species will out-compete the others to fill the space created;
a mixture of pioneer and competitor species will crowd the space made;
eventually the space will disappear as a climax tree fills in;
no succession may occur due to loss of soil nutrients from heavy precipitation; [2 max]
- (d) family background;
peers;
exposure to natural environment;
education level;
values promoted in education system;
community culture;
religious beliefs;
socio-political views;
government type;
economic background;
media; [1 max]
Accept other reasonable responses. Award [1] for any two of the above.
Do not credit statement of value systems eg ethical/aesthetic values.
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