M11/4/ENVSO/SP1/ENG/TZ0/XX/M

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MARKSCHEME

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ENVIRONMENTAL SYSTEMS AND SOCIETIES

Standard Level

Paper 1

12 pages

General Marking Instructions

Assistant Examiners (AEs) will be contacted by their team leader (TL) through Scoris™, by e-mail or telephone – if through Scoris™ or 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 through Scoris™ or by e-mail at any time if they have any problems/queries during the marking process.

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

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1. Follow the markscheme provided, award only whole marks and mark only in **RED**.

2. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded**.

3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation to explain your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.

4. Personal codes/notations are unacceptable.

5. Make sure that the question you are about to mark is highlighted in the right hand window.

6. Where an answer to a part question is worth no marks, put a zero in the right hand window.

7. Check **every** page carefully.

8. 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. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the "CON" stamp.

9. "NR" should only be used once a script is completely marked and for complete questions not attempted.

Subject Details: Environmental Systems and Societies SLP1 Markscheme

General

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.

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 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.

1. (a) *Brazil*: pyramid Y;
Ethiopia: pyramid X;
Japan: pyramid Z; ***[1 max]***
*All three responses required for **[1]**.*

(b) *Pyramid X*: stage 1 / stage 2 / stage 1 or 2;
Pyramid Y: stage 3 / stage 4 / stage 3 or 4;
Pyramid Z: stage 4 / stage 5 / stage 4 or 5; ***[1 max]***
As there is some debate about the DMT and its stages, accept this range of responses.
*All three responses required for **[1]**.*

(c) the area of land (and water) required to support a human population/individual at a given standard of living/indefinitely/sustainably/in a sustainable way / area (of productive land) required to provide all the resources needed and assimilate all wastes of a human population/individual / *OWTTE*; ***[1]***

(d) stage 1 ecological footprint (EF) will be smaller than EF for stage 4 / stage 4 EF will be larger than the EF for stage 1; ***[1]***

(e) diet differences as those in stage 4 countries tend to eat more meat / those in stage 1 countries have a vegetarian/grain diet;
energy use will be much greater in stage 4 as people have more appliances;
greater amounts of transport/travel by individuals in stage 4, so more carbon emissions;
more imported goods in stage 4, so more pollutants/food miles;
greater production of domestic waste in stage 4 so more area needed to absorb it;
greater levels of industrialization in stage 4 lead to more pollutants; ***[3 max]***
*Award **[1]** for each point only if reason **and** an explanation are given.*
*Do not award **[1]** if only the reason is given e.g. different diets.*
Award credit for responses which argue that highly developed countries may now be reducing footprints through e.g. energy efficiency strategies.

(f) *Strengths*/*advantages*: ***[1 max]***
a useful snapshot of the sustainability of a population's lifestyle;
a tangible tool for individuals/governments/countries to measure their environmental impact/to identify necessary changes in lifestyle;
iconic symbol/image for raising awareness of environmental issues;

Limitations/disadvantages: ***[1 max]***
does not include all information on the environmental impacts of human activities;
only a model so simplified/not precise;
approximation of actual figures which cannot be accurately calculated;
does not show types of resources used / shows only total resources;
negative in approach so could be perceived as de-motivating; ***[2 max]***

2. (a)

	Advantage	***Disadvantage***
Recycling [1 max]	reduced amount of energy required to recycle compared with exploiting the resource / reduces amount of material in landfill sites / can be used to make new products / largely prevents GHG/greenhouse gas emissions / creates job opportunities / encourage local industries;	requires energy / involves transport of sometimes heavy/ bulky goods / may produce toxic waste/pollutants / time/labour required;
Landfill [1 max]	cheap/easy disposal of waste / way of producing energy (in the form of methane) from waste / no time/labour required / creates land *e.g.* in Hong Kong;	pollution of watercourses by leachate / unpleasant odours / increases vermin / attract animals and insect pests / can cause disease/sickness/illnesses to spread / produces methane which is a GHG/greenhouse gas / takes up land area / potential of subsidence/contamination for future building land;
Incineration [1 max]	cheap way of producing energy from waste / energy can be fed into the grid/used to power the incinerator / reduces bulk minimizing need for landfill / by-product/ash left over is a useful building material; *Do not accept easy as it is not easy.*	release of pollutants/dioxin / high cost of building/maintenance if in an industrial environment / strict legislation on building incinerators makes it hard to do / local resident protests may stop the implementation / ash is left over / not a total disposal method as some left;

[3 max]

Accept other reasonable advantages and disadvantages.

(b) *Both method and material must be correct for **[1]**.*

*Award **[1 max]***
Method of solid waste disposal: *e.g.* composting/wormeries
Material managed in this way: *e.g.* organic matter/waste food/garden waste;

*Award **[1 max]***
Method of solid waste disposal: *e.g.* dumping at sea
Material managed in this way: *e.g.* any solid domestic waste;

*Award **[1 max]***
Method of solid waste disposal: *e.g.* pulverised and added to waste water by disposal unit / sent to sewers/flushed away
Material managed in this way: *e.g.* waste food; ***[1 max]***

Do not accept methods that are in Figure 3 as question asks for one other method.
Accept other suitable examples.

(c) government policy/legislation/guidelines *e.g.* strategy to encourage recycling;
population density / amount of land available for landfill;
involvement in international agreements to cut *e.g.* greenhouse gases / dumping at sea;
cultural attitudes to environment/resource use;
political context *e.g.* controlled economies *vs* free market economies;
involvement of significant environmental pressure groups/NGOs *e.g.* Greenpeace, in influencing attitudes;
geographic/climate characteristics, *e.g.* access to coastline;
economic considerations *e.g.* costs of energy/transport; ***[2 max]***

(d) decomposition/composting of organic waste produces carbon dioxide/methane;
carbon dioxide/methane is a greenhouse gas;
methane is a more powerful/potent GHG/greenhouse gas than carbon dioxide;
composting organic material/manure/waste food produces biogas/methane;
biogas/methane generates carbon dioxide when the methane is burnt;
incinerating solid domestic waste to produce heat (to generate electricity) produces carbon dioxide; ***[2 max]***
Accept other reasonable explanations.

3. (a) the producers are large individuals / could be trees/shrubs; ***[1]***

(b) *e.g.* oak tree → caterpillar → robin → sparrowhawk/buzzard/hawk;
e.g. duckweed → water snail → wood duck → swamp harrier; ***[1 max]***
*Award **[1]** for appropriate names of organisms and arrows in correct direction. Appropriate names could be species with common names or scientific name or broader groups of organisms e.g. oak tree, water snail. Do not accept more general terms e.g. plant, fish, birds.*
Accept food chains with four or more named organisms (i.e. at least three links). Food chains must start with a producer.
Do not accept a food web (as food chain is required).

(c) pyramid of biomass/stored energy; ***[1]***

(d) *strength*:
simple/easy method of giving an overview / good for comparing changes in number of individuals over time/season;

weakness:
all organisms are included regardless of their size / they do not allow for juveniles or immature forms / numbers can be too great to represent accurately / question of where to put animals that feed at more than one trophic level (omnivores) / species not shown, only individuals; ***[2]***
*Award **[1]** for strength and **[1]** for weakness.*

(e) *Award **[1]** for named human activity and description of how pyramid structure is changed. Do not credit responses that solely name the human activity.*
e.g. crop farming
increases producer bar / decreases higher trophic levels;

e.g. livestock farming
increases primary consumer bar / decreases secondary and tertiary consumers;

e.g. trophy hunting / hunting
removes top carnivores;

e.g. deforestation
reduces producer bar on biomass pyramid; ***[2 max]***

Accept any other reasonable responses.

4. (a) the gain in energy/biomass by producers/plants after allowing for losses to respiration per unit area per unit time / gross primary productivity minus respiration/respiratory loss; ***[1]***
Accept word equation but not $GPP - R = NPP$.

(b) the gain in energy/biomass by consumers by absorption per unit area per unit time / the gain in energy/biomass minus fecal loss per unit area per unit time / gross secondary productivity is net secondary productivity plus respiration/ respiratory loss; ***[1]***
Accept word equation but not $GSP = NSP + R$.

(c) $\frac{37\,225}{1\,700\,000} \times 100 = 2.2\ \%$ (accept 2 %) / $\frac{37\,225}{7\,100\,000} \times 100 = 0.52\ \%$ (accept 0.5 %); ***[1]***
Although alternative is not the intended response, accept this figure for total insolation as this is stated in Figure 5.

(d) does not reach the Earth/emitted into space away from the Earth / reflected by atmosphere / reflected by clouds / reflected by Earth's surface / reflected by water/sea / reflected by leaf surfaces / transmitted by leaves / not red or blue wavelengths so not used in photosynthesis / absorbed by Earth's surface / absorbed by water so does not reach aquatic plants; ***[2]***
Accept any four reasonable responses.
*Award **[0]** for one correct response.*
*Award **[1]** for two or three correct responses.*
*Award **[2]** for four correct responses.*

(e) loss to respiration by primary consumers means there is less energy for the next trophic level;
loss to decomposition of most primary consumer biomass/energy means there is less available for the next trophic level;
most primary consumers/herbivores are not eaten in this ecosystem;
greater activity of animals means more energy is lost / warm-blooded animals lose more heat than cold-blooded animals;
about 90 % of energy is lost in each trophic level / only about 10 % of energy is available in the next tropic level; ***[2 max]***

(f) aquatic plants are less productive than terrestrial / lower energy efficiency in aquatic food production systems;
sunlight is absorbed/reflected by the water / less solar radiation reaches aquatic plants/phytoplankton;
most aquatic animals are poikilotherms so lose less heat to stay alive so more can be passed on to the next trophic level;
in aquatic systems most is harvested from higher trophic levels; ***[2 max]***
Accept converse for terrestrial systems.

5. (a) (i) *Highest total CO_2 emissions*: USA;
Highest CO_2 emissions from land use change: Indonesia; ***[1 max]***
*Both required for **[1]**.*

(ii) these countries (Brazil, Indonesia, Malaysia) all have high rates of deforestation of tropical rainforest;
burning rainforests releases CO_2;
loss of rainforests means that these trees cannot absorb excess CO_2;
these countries (Brazil, Indonesia, Malaysia) are relatively under-developed/ have low industrialization/low car use/low use of fossil fuels;
these countries (Brazil, Indonesia, Malaysia) have high initial forest coverage (compared with others); ***[2 max]***

(iii) there is a net afforestation/tree planting in the USA / forested land area may increase due to plantations/secondary forest/succession; ***[1]***

(b)

Human activity	***Method of reducing emissions of greenhouse gases***
Generating electricity by burning fossil fuels	use carbon capture and storage / replace fossil fuels with renewable energy sources for electricity generation / reduce energy consumption / reduce energy wastage;
Livestock farming	fewer ruminants (so less methane released) / change diet of ruminants (to reduce methane production) / convert land to arable farming;
Driving a car	using public transport/car pools/electric cars/energy efficient cars / walking / cycling / taxes on four-wheel drive vehicles/SUVs;

[3]

Allow any other reasonable suggestions.

6. (a) solar / wind / tidal; ***[1]***
*Award **[1]** for any two of the above.*

(b) sees nuclear as a risky alternative to other sources;
oil economy/fossil fuels seen as finite/polluting and need for alternatives;
sees nuclear as a clean alternative/only source that is big enough to meet energy needs;
implies cars will not continue to run on fossil fuels;
suggests that neither renewable sources nor nuclear are viable alternatives to oil for cars;
general public confused over which energy source should be developed;
political message of nuclear being unsafe; ***[2 max]***
Accept any other reasonable interpretation.

(c) the maximum number of a species/load that can be sustainably supported by a given environment / the maximum number of a species/load that a given environment can sustain; ***[1]***

(d) because carrying capacity is not just about the population density but also about the resources available;
because the current rates of resource usage may not be sustainable;
Australia's water supply is limited (because of low precipitation in some areas);
large parts of Australia cannot support many people;
parts of Australia's deserts have very low (net) productivity;
Australia is mostly desert in the centre; ***[1 max]***