

# Markscheme

May 2016

**Environmental systems and societies**

**Standard level**

**Paper 1**

12 pages

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**Subject details: Environmental systems and societies SLP1 markscheme****Mark allocation**

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

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 group of organisms that interbreed and produce fertile offspring; [1 max]

(b) (i)

<b>Row</b>	<b>Paired contrasting features</b>	<b>Name of Organisms</b>
<b>1</b>	<i>Body covered with feathers</i>	<i>Go to row 2</i>
	<i>Body not covered with feathers</i>	<i>Go to row 3</i>
<b>2</b>	has a black neck/chest/ has a straight beak;  neck is not black/ has a slightly upturned beak	<i>Name: oystercatcher/ Haematopus ostralegus;</i>  <i>Name: Avocet/ Recurvirostra avosetta;</i>
<b>3</b>	it has four legs/ has no shell /has no tentacles;  it does not have four legs/ it has a shell/has tentacles;	<i>Name: crested newt/ Triturus cristatus;</i>  <i>Name: bithynia/ Bithynia tentaculata;</i>

[2 max]

*Accept any other physical description based on the figures above.  
Do not accept highly subjective aspects eg 'has long or short legs/neck / is thin or fat / is mostly black or white'.  
One mark for two or three correctly identified species and two marks for four correctly identified species. No marks for only one correctly identified species.*

(ii) some features can change with season/gender/age/genetic variety;  
often requires detailed/specialised knowledge (of anatomical parts etc);  
judgement is subjective/difficult/easy to make a mistake;  
can be difficult to distinguish between similar species;  
using keys is time consuming / can involve a lot of time (eliminating other groups to find required name);  
only already discovered species can be identified;  
only applies to physical features not all attributes (such as differences in vision);

[1 max]

*Accept any other reasonable point.  
Do not accept location as an attribute. Do not accept 'many species have similar characteristics' without explanation eg difficult to distinguish between them/easy to make an error.*

(c) **EITHER**

capture-mark-release-recapture/capture-mark-release/capture-mark-recapture/Lincoln Index;  
trap birds (in mist nets) and mark/tag them before releasing ( $m_1$ );  
recapture a sample of birds after a sufficient period of time for individuals to mix;  
calculate total population (P) from proportion of marked/tagged birds ( $m_2$ ) in recaptured sample (R) / use Lincoln Index formula to calculate total population ( $P = (\text{number of animals first marked and released } (m_1) \times \text{number of animals captured in second sample } (R)) / \text{number of marked animals in recapture } (m_2)$ );  
suitable for closed population (not suitable for migrating birds);

**OR**

take aerial photograph of whole population/known fraction of population;  
divide photograph into quadrats of known area;  
count birds in a number of random quadrats;  
calculate total population by multiplying for the whole area;  
suitable for closed population (not suitable for migrating birds);

**OR**

set survey boundary/geographical range of species;  
divide area into quadrats;  
count birds within random quadrats/representative area (in real time rather than from photographs) / count all birds in area;  
extrapolate bird numbers found to the whole area / calculate total population by multiplying for the whole area;

**[3 max]**

(d) competition/niche-sharing;

**[1 max]**

(e) (i) primary consumer/herbivore/second trophic level/trophic level 2;

**[1 max]**

(ii) it is a carbon store;  
it absorbs (organic) carbon from producers;  
it provides (organic) carbon to consumers/carnivores;  
it releases (inorganic)  $\text{CO}_2$  through respiration;  
it provides (organic) carbon to decomposers;  
it provides carbon /carbon dioxide ( $\text{CO}_2$ ) to atmosphere as it decomposes;

**[2 max]**

*Do not accept 'feeds off plants without reference to carbon/carbon compounds'.*

2. (a) (i) it exchanges matter and energy (with its surroundings); **[1 max]**
- (ii) water flow/river Nia  
 evaporation  
 infiltration/groundwater flow  
 fish/biota  
 water (supply for local communities)  
 hydropower /electricity /energy from the dam  
 oxygen from plants  
 heat **[1 max]**  
*Award 1 mark for any two correct responses. No mark for only one correct response.*  
*Accept any other reasonable suggestions.*  
*Do not accept only 'energy' (as examples of matter and energy are required).*
- (iii) natural income is the annual growth/yield in natural capital /natural income is derived from natural capital;  
 natural income are marketable commodities produced by the lake / lake provides a yield or harvest of goods/services;  
  
*Example:*  
 goods such as water for the village/crops/cattle  
 goods such as fish/water plants  
 services such as flood protection /power or electricity from dam;  
*Do not accept natural income as money/revenue for selling resources or definition of sustainable yield.* **[2 max]**  
  
*[1] for explaining natural income and [1] for providing one example.*
- (iv) it is the maximum rate that it can be exploited without depleting the stock;  
 for example calculating the annual gain in biomass (of the cattle/stock)  
 /annual growth of the cattle minus death;  
 sustainable yield = (total biomass/energy at time t + 1) - (total biomass/energy at time t); **[2 max]**

(v)

<b>Level of management</b>	<b>Management strategy</b>
<i>Reducing production of pollutant</i>	limit/reduce amount of fertilizers (nitrates and phosphates) used on the farm (eg by timing application with growth of plants); do not apply fertilizers near the lake; use phosphate free detergent; reduce use of nitrates and phosphates through education (eg information on timing of application/avoiding slopes/areas near lakes and rivers) /reduce use of fertilizers through taxes;
<i>Reducing release of pollutant into lake</i>	regulate use of nitrate and phosphate products/fertilizers; laws limiting release of pollutants; treat runoff water; plant trees/buffer zones/strips around the lake to absorb nutrients;
<i>Restoring impacts of pollution.</i>	aerating lake; restock lake (with fish/plants); dredge bottom of lake/remove sludge; remove excessive plants; use of copper sulphate/iron sulphate/calcium hydroxide to precipitate phosphate from the water;

**[3 max]**

*Do not credit use of same management strategy more than once.  
Do not accept just 'contour ploughing/creating barriers/filter water/legislation/change behaviour/clean up' without explanation.  
Do not accept use of natural/organic fertilizers or addition of limestone / calcium carbonate (which releases phosphates from the sediments).*

3. (a) (i) recycling has increased; [1 max]

(ii) *Any two from:*  
 Norway (decrease)  
 Finland (decrease)  
 Malta (decrease)  
 Bulgaria (no change)  
 Turkey (no change)  
 Portugal (no change)  
 Iceland (no change) [1 max]

(iii) already reached full capacity for recycling;  
 political change away from Green politics;  
 economic constraints making recycling too expensive;  
 rapid increase in waste due to expanding population;  
 generated less recyclable waste in 2010 than in 2001; [1 max]  
*Accept any other reasonable point.*  
*Do not accept only political situation /no awareness of recycling /no regulation/use of incineration without a reason*

(b) **Strengths of using incineration: [3 max]**

cheaper/costs;  
 reduces amount of waste more quickly than recycling/incineration can be faster/quicker;  
 ash may be used as a raw material (e.g. road building/fertilizers);  
 can deal with waste that cannot be recycled;  
 can kill disease agents;  
 can reduce the toxicity of waste;  
 can produce energy;

**Weaknesses of using incineration: [3 max]**

residues still require disposal /residues require landfill space;  
 residues/ash from combustion can be toxic;  
 may produce undesirable air pollutants (such as carbon dioxide/GHGs/dioxins linked to cancer/linked to health problems);  
 transportation concerns/costs;  
 capacity limitations;  
 reluctance of some owners/operators/residents;  
 it does not reduce resource use as recycling does;

**Appraisal / Conclusion** which adequately considers both strengths and weaknesses of incineration and implies which side is stronger based on evidence provided. [1 max] [5 max]

*Note to examiners: An isolated statement eg “incineration has been better” or an unjustified opinion eg “I think incineration has been better” should not be considered as a valid conclusion. The conclusion must be **supported/justified** by points raised that must have at least addressed both sides of the argument. A valid conclusion may, however, be stated within the body of the response rather than at the end, and may involve some balanced decision.*



4. (a) (i) USA has a higher consumption that uses more resources than China / USA uses more resources /energy/electricity (thus more demand on natural capital)/ USA has a more meat rich diet /USA produces more waste; **[1 max]**  
*Accept responses in the converse.  
Do not accept USA is a MEDC/ has a higher standard of living or statements without reference to in which country is the activity higher/ lower.*
- (ii) increased level of industrialization uses more resources;  
increased level of industrialization produces more waste;  
change to a more consumer society uses more resources (eg energy);  
changes in diet i.e. western diet which uses more land to produce meat;  
change to a more consumer society produces more waste /improved standard of living resulting in greater car ownership and more pollution; **[2 max]**  
  
*Do not accept increase in population as ecological footprint is in global hectares per capita. Credited responses should link activity/change in behaviour to use of land/resources/energy or generation of waste.*
- (iii) methodology simple/data availability/easy to use;  
...allowing for wide application e.g. allows for comparisons between groups/information can be used to inform policies/legislation promoting sustainability;  
easy to communicate/understand;  
...allowing more people to appreciate factors affecting their ecological footprint/how they can change their ecological footprint;  
good marketing tool/easy to use in marketing/advertising;  
...so can be easily disseminated to public promoting changes leading to more sustainable actions;  
links global and local impacts / allows assessing relationships between different impacts / provides a holistic view;  
...assists in urban sustainability planning / assists in tracking global and local sustainability trends /allows countries to identify areas where change is needed to become more sustainable;  
easy to identify land use per capita / allows quantification of data;  
...allows for more informed regulation/policies to achieve sustainability; **[2 max]**  
  
*Accept any other reasonable point.  
Award 1 mark for stating/describing the advantage and 1 mark for explaining what its value to sustainability is/how it can be used.*

5. (a) (i) 51 %–60 %; [1 max]

(ii) methane/CH<sub>4</sub>;  
water vapour/H<sub>2</sub>O;  
nitrous oxides/N<sub>2</sub>O;  
tropospheric ozone/O<sub>3</sub>;  
chlorofluorocarbons (CFCs)/hydrofluorocarbons (HFCs)/  
perfluorocarbons (PFCs); [2 max]  
*Do not accept 'sulphur dioxide/carbon monoxide/nitrogen oxides (NO<sub>x</sub>)'.*

(b) *Positive feedback* amplifies/increases change / *Negative feedback* counteracts change;

*Example of positive feedback:*

increase in temperature, increases thawing of permafrost and release of methane which further raises the temperature;  
increase in temperature increases the amount of water evaporating, raising the levels of GHG and subsequently global temperature;  
increase in temperature melts ice and snow which reduces the albedo effect (amount of sunlight reflected back subsequently resulting in increase in solar energy absorbed) that further enhances the temperature;

*Example of where increase in temperature can lead to negative feedback:*

increase in temperature leads to more evaporation resulting in increased snowfall which in turn increases the Earth's albedo and lowers temperature/returns temperature to 'normal';  
increase in temperature can lead to enhancing photosynthesis and the uptake of carbon dioxide by plants, this in turn will reduce atmospheric levels of carbon dioxide/GHGs resulting in lowering of global temperature;

[2 max]

*Max of 1 mark for definition of positive/negative feedback.*

*Max of 2 marks for two examples.*

6. (a)

	<b>Stratospheric ozone</b>	<b>Tropospheric ozone</b>
<i>Change in concentration</i>	<i>Increase</i>	<i>Increase</i>
<i>Cause of change in concentration:</i>	ban of ozone depleting substances (ODS)/CFCs; Montreal protocol;	increased number of vehicles; increase in combustion of fossil fuels; increase in concentration of populations in urban areas/activities that produce air pollution; formation of photochemical smog; increase in release of hydrocarbons/VOCs and NO <sub>x</sub> (from burning of fossil fuels) that react in sunlight to form ozone;
<i>Impact on humans:</i>	less UV exposure / less biological damaging effects (e.g skin cancer and cataracts);	irritating/destroys living tissues/materials / damage to crops or forests/ irritates the eyes/ respiratory problems /cancer;

[2 max]

One mark for two or three correct responses and two marks for four correct responses.  
No marks for only one correct response.  
Do not accept only 'health problems'.

(b) *Weaknesses [3 max]*

after Montreal Protocol entered in effect ozone levels continued decreasing / stabilized for a few years before declining again;  
agreement of Montreal Protocol was not followed by an immediate response / the banning of ODS occurred in stages / not all countries initially participated in the Montreal Protocol;  
enforcing/policing implementation of the Montreal Protocol across all nations is difficult;  
following banning of ODS/Montreal Protocol a black market trade continued in these substances;  
Montreal Protocol did not stop further destruction of stratospheric ozone due to the long life spans of ODS;  
the effects of the Montreal Protocol will take a long time to occur and for the ozone hole to reduce;

*Strengths [3 max]*

the ozone hole stabilized between around 1993 and 2008;  
in 1988 ozone hole showed a significant decline/ results for 1988 are anomaly;  
in 2002 ozone hole showed a significant decline/ results for 2002 are anomaly;  
without the Montreal Protocol the ozone hole may have continued to increase at a faster rate/indefinitely/beyond 26.6 million km<sup>2</sup>;  
Protocol has led to reduction in production/use of ODS (eg.CFCs);  
due to reduction in ODS, ozone levels are expected to recover in the future (eg some scientist predict that by 2080 ozone levels will return to 1950 levels/ by 2014 there were signs the ozone hole was starting to recover);  
referred to as the most successful international environmental agreement /first universally agreed Protocol /agreed by all nations;  
it provides a model/example for other global environmental protection initiatives;

*Credit quantification of data eg: ozone hole increased by around 5 million km<sup>2</sup> between 1987 and 2008 compared to about 10 million km<sup>2</sup> between 1980 and 1986;*

**Appraisal / Conclusion [1 max]** - clear statement which adequately considers both strengths and weaknesses of the Montreal Protocol and implies which side is stronger based on evidence provided.

*N.B An isolated statement eg "the Montreal Protocol has been successful" or an unjustified opinion eg "I think the Montreal Protocol has been successful" should not be considered as a valid appraisal/conclusion. The appraisal/conclusion must be **supported/justified** by points raised that have addressed both sides of the argument.*

*Award max of 4 marks for responses that do not refer to the data.*

**[5 max]**