

MARKSCHEME

May 2002

ENVIRONMENTAL SYSTEMS

Standard Level

Paper 3

Subject Details: Environmental Systems SL Paper 3 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.
- ◆ 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 not achieved or 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 penalised. 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 penalised 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 penalise candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

1. (a) any ecosystem that is suitable for sampling in quadrats *e.g.* coral reef, grasslands, bog (**not** bathyal, river, stream, lake); [1]
- (b) (i) number of species / taxa and relative number of species; [1]
Candidates must have both for the mark.
- (ii) indices weight variables differently;
site X has greater equitability (numbers more equally distributed between species);
and Simpson's index gives greater weight to species abundance than Margalef's; [2 max]
- (c) (i) *Accept any two reasonable answers*
e.g. for terrestrial:
grazing by animals / trampling / selective harvesting / different soils / aspect / light / pH;
e.g. for aquatic
pollution levels / silting covering organisms / current / salinity levels; [1 max]
Allow ECF from (a).
- (ii) human – *e.g.* wood cutting / grazing / overuse of fertilisers / introduction of another species / fire;
natural – drought / climate / disturbance setting succession back to an earlier seral stage / fire / seasonal change / migration; [1 max]
Do not allow the same factor twice. Allow ECF from (a).
- (d) *Allow [1] each for any two of:*
use field-guide or key / take marked sample for lab identification / record characteristics / photograph or sketch / consider habitat / study behaviour / DNA testing / ask a local expert / *OWTTE*; [2 max]
- (e) if aquatic: light and dark bottle technique;
measure changes in O₂ concentration;
using O₂ sensor / titration;
subtract O₂ in dark from O₂ in light to give GP;
subtract O₂ in light bottle from O₂ in control bottle containing distilled water to give NPP;
- if terrestrial: set up covered and uncovered quadrats;
harvest plants / measure biomass / allow for roots;
subtract biomass of covered from uncovered to give GP;
subtract from GP, initial mass of covered quadrat minus final mass of covered quadrat, to give NPP; [3 max]

- (f) (i) *Allow [1] each for any two of:*
non-motile / discrete units / possessing clear boundaries (e.g. lichen) / visible
with naked eye / primarily two dimensional distribution / small size; **[2]**
Allow for measurement of individuals or percentage cover.
- (ii) mark a grid on graph paper of the plots;
mark the site itself;
use random number tables / computer program to generate random co-ordinates /
pick two sets of co-ordinates from a hat;
throw quadrats over shoulder; **[2 max]**

2. (a) per head of population / per individual / for each individual; [1]

(b) (i) *The calculation is based on the assumption that the same area does not both absorb carbon and produce food. If a candidate states that the calculation is impossible because this assumption is incorrect, then [2] should be awarded.*

	Local land required per capita for food	Local land required per capita for CO₂ emissions	Total (ha)
North America	$\frac{600}{300} = 2$	$\frac{1500}{3000} = 0.5$	2.5

[2 max]

A candidate may argue that the same land has both food production and CO₂ absorption capability, in which case accept 2.0, 2.5 or a value between these.

[1] for correct method, [1] for correct answer.

(ii) African value is lower because African region is naturally more productive so vegetation is able to absorb more CO₂;
 large parts of North America are tundra which absorb very little CO₂;
 North America more industrialised;
 and has more cars producing CO₂;
 grain production higher in Africa ;
 but Africans eat less;

[2 max]

(iii) multiply by size of population;

[1]

(iv) if footprint > land area, population is living beyond carrying capacity, not sustainable;
 and dependant on imports or support (e.g. in CO₂ absorption capacity) from elsewhere;

[2 max]

Accept opposite answer i.e. footprint < land area – sustainable.

(c) e.g. solar energy;
 advantage: clean / no CO₂ emissions / replenishable / sustainable;
 disadvantage: expensive / dependent on insolation / sophisticated technology;

e.g. nuclear power;
 advantage: no CO₂ or other pollutants produced / large amount of energy from small mass of fuel / OWTTE;
 disadvantage: expense of building / decommissioning / danger of radioactivity escaping / terrorism / problem of disposal of radioactive waste with very long half-life / OWTTE;

[3 max]

(d) North America – intensive / high input of energy and resources;
 Africa – more extensive / less inputs;
 North America – commercial;
 large machinery / more technology;
 Africa – subsistence;
 more human power / use of animal power;
 Credit any other reasonable differences.

[4 max]

3. (a) World Conservation Strategy – main objectives.
Any two of:
maintenance of essential life support systems (climate, water cycle, soils) and ecological processes;
preservation of species and genetic diversity;
sustainable use of species and ecosystems; **[2 max]**
- (b) (i) right whale; **[1]**
- (ii) pollution of seas / overfishing / overexploitation of food species / *e.g.* harvesting of krill in Antarctic / climate change – degradation of habitats / distortion of food chains; **[1 max]**
- (iii) *Any three of:*
degree of specialisation / *e.g.* dietary needs too specialised;
distribution limited to some oceans;
slow reproductive rate / *K*-selected species / small number of young;
higher trophic levels – may accumulate toxins;
long migration routes; **[3 max]**
- (iv) difficult to monitor and estimate numbers;
easy for hunters to avoid detection;
no one’s property / “tragedy of the commons”;
difficult to keep open ocean species in captivity / *OWTTE*; **[2 max]**
- (c) *Allow for any reasonable comparisons e.g.*
Greenpeace – fast response to issues;
actively uses media / “stunts” / may break national laws;
UNEP – works more slowly;
has to get agreement of nations / national bodies may be in conflict;
capable of initiating international laws; **[3 max]**
- (d) named habitat;
importance of species / communities / habitat;
other arguments for preservation relevant to local example; **[3 max]**
Allow an actual name or a habitat type e.g. name: Walberswick National Nature Reserve, Suffolk / John Forrest National Park, Western Australia or habitat type: (English lowland heathland / Jarrah forest).

4. (a) (i) Any reasonable answer such as:

<i>Pollutant</i>	<i>Source</i>	<i>Effect</i>
<i>suspended particles</i>	diesel engines / vehicle exhaust emissions;	asthma / breathing difficulties in humans;
<i>sulfuric acid</i>	factories / coal burning / oil burning;	acid deposition;
<i>lead</i>	leaded petrol (gasoline) / industry;	brain damage / lowered IQ;

[3 max]

[1] for each correct source and effect. Do not accept lead paint or lead piping as a source for lead.

(ii) lead; [1]

(iii) lead released from industry / transport in city;
heavy metal, so falls out of the atmosphere / heavy particles, so fall;
attracted to other particles;
absorbed; [max 2]
Allow ECF.

(b) • suspended particles – filters on chimneys / alternative energy sources
• H₂SO₄ – reduce burning of fossil fuels / coal / scrubbers on chimneys;
• lead – lead free or alternative petrols / gasolines / alternative fuels for transport
(gasohol) / increase costs of / tax fuels to reduce use; [3 max]

(c) (i) suspended organic matter reduces light input / increases turbidity;
decomposition of organic matter increases BOD / eutrophication caused as
organic matter releases nitrates and phosphates;
directly toxic components; [2 max]
reduction in aesthetic appeal /smell

(ii) eutrophication caused by nitrates and phosphates;
heavy metals – direct toxicity / concentrated up food chains;
reduces light;
clog pores / gills; [2 max]

(iii) reduces organic content by oxidation / decomposition;
removes heavy metals / inorganic salts;
filters out large particulate matter; [2 max]