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MARKSCHEME

November 2002

ENVIRONMENTAL SYSTEMS

Standard Level

Paper 3

9 pages

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) (i) name and brief description *e.g.*
            intertidal rock pool at Robin Hood's Bay beach, North Yorkshire;
            Little Armstrong Bay, Rottnest Island, Western Australia;   *[1 max]*

   If this section is not answered, ensure rest of question is internally consistent.
   Deduct up to [2] if it is not.

      (ii) *Must have two appropriate factors for [1].*
            e.g. light, temperature in a rock pool;
            influence on productivity *e.g.* tidal changes in light penetration causes daily
            changes in photosynthesis *[1]* and seasonal changes in temperature cause
            changes in productivity *[1]*;   *[3]*

   (b) *Common or local names acceptable e.g. herring, wild service tree, but vague*
        generalities like "fish" or "trees" are not. Species must be assigned to correct
        trophic level to contribute to mark.

        six correctly named *[1]* and placed species *[1]*;
        arrows linking producers to consumers
        all species must have at least one arrow entering or leaving, arrows must all be in
        correct directions;   *[3]*
        Award [2 max] if a food chain is given.

   (c) (i) *Detail will depend on system selected, but the following must be present:*

            measurement of initial biomass / O_2 concentration of sample;
            measurement of final biomass / O_2 concentration of sample;
            both in known and fixed area and time period;
            convert biomass to energy by burning **dried** sample in calorimeter (bomb) /
            using conversion tables;   *[3 max]*

      (ii) subtract original biomass / O_2 concentration from final biomass / O_2
            concentration to get NPP;   *[1]*

      (iii) *Any two of the following.*
            differences in abiotic factors;
            weather;
            human interference;
            natural hazards;
            due to limited size of samples;
            any other reasonable suggestion or example;   *[2 max]*

   (d) number of species may vary because of immigration / emigration or any other
        reasonable suggestion;
        sizes of populations of each species may increase or decrease because of any
        named factor (*e.g.* rock pool may be exposed to extreme weather conditions;
        predation may be unusually heavy) that can cause population fluctuations;   *[2 max]*
        Allow natural disaster e.g. flooding / human activities e.g. tree felling.

2. (a) (i) high values *[1 max]*: Europe and Asia used the most N fertiliser / largest productive land regions / climate suitable for cereals;
North America next largest – prairies used for grain production;

low values *[1 max]*: Africa – low levels as poorer countries;
Australasia smallest amount / large area of desert in Australia / extensive rather than intensive agriculture;   *[3 max]*

Allow [1] for explaining high values, [1] for explaining low values and any other one.

(ii) it has increased in all regions *[1]* more people requiring more food *[1]* Asian countries increased most due to wealth;
bought far more / as agriculture became more intensive / populations grew;
Europe more intensive agriculture / common agricultural policy and subsidies;
North America / Australia / South America more intensive as more foods required;   *[3 max]*

(b) decreases size of ecological footprint;
as increased mean grain yield / area;
so smaller area required to produce given amount of food;
use of fertilisers may lead to long term decrease in sustainability / fertilisers need resources to make them *[1]* so could increase size of footprint;   *[3 max]*

(c) *Any three of the following or other suitable suggestions.*
increased use of mechanisation;
increased pesticide use;
higher yield of crops per unit area;
genetically engineered species;
improved varieties;
intensification of agriculture;
increased irrigation and cultivation of semi-arid areas;
increase in aquaculture;
less demand *per capita* for meat;   *[3 max]*

(d) named system *e.g.* cattle and sheep hill farm in temperate latitudes;
Impacts up to [2 max] e.g.
pesticides in grassland decreased biodiversity;
run-off of slurry led to eutrophication of streams;
silage production reduced wild flower populations;
succession arrested by management;   *[3 max]*

3. (a) a general term for diversity;
which includes species, habitat and genetic diversity;
per unit area;   *[2 max]*

(b) *Allow [1] for each two arguments e.g.*
ethical / aesthetic / genetic resource for humans / commercial resources /
life-support functions / maintain ecosystem stability / conserve rare habitats;   *[2 max]*

(c) *Allow any three of the following.*
isolation – geographic or reproductive;
changing environments;
variation in populations;
mutation in populations;
natural selection;
survival of the fittest;
competition;   *[3 max]*

(d) *advantages*
easier to involve humans in identification of attractive species / *e.g.* WWF and
pandas;
breeding programmes in zoos → increasing population numbers;
possible to control international trade / CITES;

disadvantages
not protecting habitats;
organisms cannot survive if not in habitat;
only focuses on endangered / conspicuous / attractive species;
led by public opinion;   *[4 max]*

(e) *Allow [1] for each pair considered. Allow for any reasoned argument.*

might support greater species diversity / higher population numbers of each species /
greater productivity at each trophic level → longer food chains;

edge effect increased in B → risk of disturbance / drift of pollutants / greater
productivity → more top carnivores in A / territory greater for top carnivores in A /
smaller units in B cannot support as high biodiversity as A;

gene flow between reserves easier in A / movement of species easier – top
carnivores / can move between reserves in A;

edge effect lower in A / perimeter : area ratio lower in A (see also (2) above) /
smaller units in B cannot support as high diversity as A;   *[4]*

4.   (a)   (i)   various countries have different legal limits / developing countries have less strict regulations;   *[1]*

(ii)   *Must have at least one effect on environment for [2 max].*
lead is harmful to humans / children;
reduces IQ;
harms brain development / mental retardation;
hyperactivity;
hearing damage;
palsy or partial paralysis / blindness if severe;
toxic to other organisms;
accumulates along food chains;
blocks stomata of plants so photosynthesis reduced;   *[2 max]*

(iii)   lower levels of lead in petrol / leaded petrol phased out / replaced by petrol with phosphorus and magnesium added;   *[1]*

(b)   (i)   *e.g.* nitrates / pesticides / fertilisers;   *[1]*

(ii)   effect *e.g.* eutrophication;   *[1]*

(iii)   *Any two of the following.*
reduce use;
change to cleaner product;
clean up after use;   *[2 max]*

(c)   *Allow any two methods for any of air, soil and water. e.g.*
air – use sticky tape on glass slides to trap particulates;
water – dissolved oxygen with Winkler titration or electrode;
soil – regular and repeated testing / monitor over a given area;   *[2]*

(d)   named industry *e.g.* metal extraction from ore;

description [2 max]
extraction technique(s);
filter / catalytic converters / chemical scrubbers;
setting emission standards;
recycling / less waste if using alternative processes;

evaluation [2 max]
earlier control is better / removal of waste is expensive / might sell by-products of waste removal;   *[5 max]*