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BACCALAUREATE INTERNATIONAL INTERNACIONAL
N04/460/S(3)M

MARKSCHEME

November 2004

ENVIRONMENTAL SYSTEMS

Standard Level

Paper 3

13 pages

General Marking Instructions

After marking a sufficient number of scripts to become familiar with the markscheme and candidates' responses to all or the majority of questions, Assistant Examiners (AEs) will be contacted by their Team Leader (TL) by telephone. The purpose of this contact is to discuss the standard of marking, the interpretation of the markscheme and any difficulties with particular questions. It may be necessary to review your initial marking after contacting your TL. **DO NOT BEGIN THE FINAL MARKING OF YOUR SCRIPTS IN RED INK UNTIL YOU RECEIVE NOTIFICATION THAT THE MARKSCHEME IS FINALIZED.** *You will be informed by e-mail, fax or post of modifications to the markscheme and should receive these about one week after the date of the examination. If you have not received them within 10 days you should contact your Team Leader by telephone. Make an allowance for any difference in time zone before calling.* **AEs WHO DO NOT COMPLY WITH THESE INSTRUCTIONS MAY NOT BE INVITED TO MARK IN FUTURE SESSIONS.**

You should contact the TL whose name appears on your "Allocation of Schools listing" sheet.

Note:
Please use a personal courier service when sending sample materials to TLs unless postal services can be guaranteed. Record the costs on your examiner claim form.

1. Follow the markscheme provided, do **not** use decimals or fractions and mark in **RED**.

2. Where a mark is awarded, a tick (✓) should be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark.

3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation in the **left hand margin** to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking.

4. Unexplained symbols or personal codes/notations on their own are unacceptable.

5. Record subtotals (where applicable) in the right-hand margin against the part of the answer to which they refer next to the mark allocation. Do **not** circle subtotals. **Circle the total mark for the question in the right-hand margin opposite the last line of the answer.**

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

7. For each Option: Add the totals for each question in the Option and write it in the Examiner column on the cover sheet.
Total: Add the marks awarded and enter this in the box marked TOTAL in the Examiner column on the cover sheet.

8. After entering the marks on the cover sheet, check your addition to ensure that you have not made an error. Check also that you have transferred the marks correctly to the cover sheet. **We have script checking and a note of all clerical errors may be given in feedback to examiners.**

9. Every page and every question must have an indication that you have marked it. Do this by **writing your initials** on each page where you have made no other mark.

10. If a candidate has attempted more than the prescribed number of Options within the paper, mark only the required number of Options in the order in which they are presented in the paper, **unless the candidate has indicated the Options s/he wants to be marked on the cover sheet**.

11. A candidate can be penalized if he/she clearly contradicts him/herself within an answer. Make a comment to this effect in the left hand margin.

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 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 **"U-1"** 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.

Option A – Analysing Ecosystems

A1. (a) (i) name and brief description (*e.g.* intertidal rock pool at Tagus river, Portugal); ***[1]***

(ii) *Candidates must state two abiotic factors appropriate to ecosystem to receive **[1]**.*
e.g.
salinity;
pH;
temperature;
dissolved oxygen;
wave action;
turbidity;
flow velocity;
light intensity;
wind speed;
particle size;
slope;
soil moisture;
drainage;
mineral content; ***[1 max]***

(iii) *e.g.*:
freshwater ecosystem, abiotic factor – temperature
use thermometer;
take account of: temperature may change with depth of the lake;
temperature may change at different hours of the day / seasons;
so need to take several observations to calculate mean;

aquatic ecosystem, abiotic factor – pH
use pH meter / pH paper;
take account of: pH is a logarithmic scale (increase of 1 point on the scale represents 10 times);
pH may change with depth of water column;
so need to take several observations to calculate mean;

terrestrial ecosystem, abiotic factor – soil texture
use of sieves;
use of triangular graph with proportions of sand, silt and clay;
take account of: field sample may be wet, so must be dried before testing;
sample must be well shaken to separate particles;
soil may vary within profile / locally;
so need to take several samples;
presence of living organisms;
presence of organic matter; ***[3 max]***

(b) appropriate example (name of organism);

*Award **[1]** for appropriate method.*
e.g. non-motile animal or plant by quadrat;
transect sampling;
by capture-mark-recapture if motile animal;
Method must be appropriate for the species named.

*Award **[1]** for description.*
repeat sampling procedure (time);
ensure sampling is consistent and replicated;
calibration of instrument;
location of sampling;

*Award **[1]** for evaluation of method. Take account of e.g.*:
birth;
death;
immigration;
emigration; ***[4 max]***

(c) (i) $D = \frac{50 \times 49}{(25 \times 24) + (25 \times 24)}$;

$= 2.04$; ***[2]***

(ii) there is a difference between the (relative) abundance of organisms;
one area has been disturbed by human activities;
two areas are at different seral stages; ***[1 max]***
Any other reasonable suggestion.

A2. (a) presence / absence of legs;
number of legs;
presence / absence of tentacles;
number of tentacles;
shape;
visible eyes;
bristles; ***[3 max]***
Any other reasonable suggestion, but not size, colour, habitat.

(b) size;
colour;
habitat;
behaviour; ***[2 max]***

(c) organism not in key;
difficult terminology;
no key available for organisms under investigation;
may require dissection / chemical tests or other techniques; ***[1 max]***
Any other reasonable suggestion.

(d) hard to collect;
difficult to determine dry weight;
difficulty of estimating area of irregularly shaped habitat;
seasonal variations in abundance; ***[2 max]***
Any other reasonable suggestion.

Option B – Impacts of Resource Exploitation

B1. (a) coal was the major source of energy in 1940;
coal has been continuously decreasing / from about 90 % to 25 %;
nuclear energy only appeared in 1980;
renewable resources have increased / representing 15 % in year 2000;
oil has continuously increased / from about 8 % in 1940 to 35 % in 2000; ***[2 max]***
Credit any other valid description.

(b) (i) *Answers must list two advantages to receive **[1]**.*
causes less pollution / no production of waste;
eliminates the need for oil imports;
running costs lower;
it is a renewable resource / free;
does not contribute to acid rain;
does not contribute to global warming;
creates more jobs per unit of electricity produced; ***[1 max]***

(ii) *Answers must state two disadvantages to receive **[1]**.*
not appropriate for every region / geographical limitations;
capital intensive / high initial cost;
large surface area needed;
needs backup / storage system;
still in development stage / technology needs improving / low efficiency; ***[1 max]***

(c) named farming system *(e.g.* olive plantation in Sicily, Italy);

inputs:
fertilizers;
irrigation water;
pesticides / herbicides;
fossil fuels;
seeds;

outputs:
foods;
pollutants;
soil erosion; ***[4 max]***
*Award **[3 max]** if system not named.*

B2. (a) (i) 200 %; ***[1]***

(ii) 16 %; ***[1]***

(b) initial rise in productivity from 1950 to 1980;
decline in productivity from 1980 to 2000;
increase due to improvements in technology / machinery;
use of fertilizers and pesticides;
increase in population;
over exploitation of land / land degradation;
loss of marginal land due to climate change between 1980 and 2000; ***[4 max]***
Any other reasonable suggestion.

(c) (i) high level of proteins;
production of secondary products, such as milk / wool / hides;
high value product;
allows use of otherwise barren/unproductive land, *e.g.* European hill farms / semi-arid areas; ***[1 max]***

(ii) low energy efficiency / food from high trophic level;
high environmental demands / large area;
long time to produce;
expensive; ***[1 max]***

(d) (i) the area of land and water required to support a defined human population at a given standard of living / *OWTTE*; ***[1]***

(ii) city in a developed country would have a larger ecological footprint;
higher consumption (food / water);
higher waste production (CO_2 from fossil fuels / household garbage);
large population in small land area; ***[3 max]***

Option C – Conservation and Biodiversity

C1. (a) loss of habitat;
logging of forests;
fragmentation of habitats;
pollution;
hunting;
natural hazards; ***[1 max]***
*Two correct points required for **[1]**.*

(b) lack of data from many areas;
data predicted by models;
need for long time to observe changes / need to observe changes over prolonged period;
birds are difficult to monitor because they are very mobile;
difficulties in taxonomy / identification; ***[2 max]***

(c) lack of international agreements;
regular hunting at any point in life cycle;
need for conservation in breeding and wintering areas (and between them);
unpredictable losses due to hazards on long migration routes; ***[2 max]***
Credit any reasonable answer.

C2. (a) the range of different habitats in an ecosystem, community or biome; ***[1]***

(b) name of place;
names of at least **two** habitats / microhabitats (*e.g.* Kakadu National Park, Northern Territory Australia: grassland, wetland, escarpment, forest); ***[2]***

(c) different habitats associated with different species;
some species require more than one habitat;
at different times of day / year / breeding cycle;
diversity greatest where two or more habitats adjoining (ecotone);
therefore higher habitat diversity often associated with higher species diversity;
appropriate examples; ***[4 max]***
Any reasonable additional points.

C3. (a) *agree*:
risk of losing some medicinal plants;
biodiversity is needed to maintain ecological integrity;
loss of beauty / aesthetic values;
study of wild species may help scientists understand events from the past;
important from an ethical / spiritual / philosophical perspective;
non-natural processes, such as pollution, are increasing the loss of biodiversity;

disagree:
evidence of past extinctions;
appropriate examples (dinosaurs, ammonites);
reasons for natural extinctions (meteorite impact, climatic change, glaciation);
natural turnover of taxa through evolution; ***[2 max]***
Credit other appropriate reasons.

(b) (i) long-term goal of returning species to the wild;
possibility of using techniques such as artificial insemination;
allows for cross-fostering;
positive experiences, such as Arabian oryx; ***[2 max]***
Credit any reasonable answer.

(ii) risk of inbreeding;
unsuitable for large species;
zoos as prisons of once-wild animals;
not an economically feasible solution; ***[2 max]***
Credit any reasonable answer.

(c) *strengths*:
supported by many countries (145);
lists many species (almost 700);
bans commercialization of many products / species;
appropriate examples (rhinoceros horn, ivory, tiger parts);

weaknesses:
enforcement is difficult;
small fines;
many countries have not signed;
support by some countries has been lukewarm;
favours large / conspicuous / attractive organisms;
appropriate examples (poaching of ivory in Africa continues); ***[2 max]***

Option D – Pollution Management

D1. (a) (i) largest = zinc, smallest = mercury; ***[1]***

(ii) 78 % ± 2 %; ***[1]***

(b) development of alternative technologies;
substitution / elimination of any of the pollutants (*i.e.* unleaded gasoline / petrol);
setting and imposing lower emission standards;
introduce technologies to extract metals from waste emissions (chimneys / liquid discharges / solid discharges);
extracting the metal from the environment (river / sediment); ***[3 max]***

(c) gases from exhausts of vehicles;
runoff;
acid rain; ***[1 max]***
Credit any reasonable example.

D2. (a) normally shallow;
low water visibility (generally murky brown or green);
high net primary productivity;
high levels of nutrients;
dense vegetation on lakes shores / by lake shores; ***[3 max]***

(b) dredging bottom sediment to remove excess nutrients;
remove excess of weeds / vegetation;
use of herbicides and algaecides;
pumping air to avoid oxygen depletion;
restocking with clean water species; ***[2 max]***

(c) use biotic index;
this involves levels of tolerance / diversity / abundance of organisms;
compare a polluted and unpolluted site;
e.g. bloodworms in polluted water; ***[2 max]***

D3. (a) *Award **[1]** for three of the following.*

describe:
as household size increases, so does the total amount of waste produced, but *per capita* generation decreases;
when two people in household, the *per capita* rate is 1.4 kg day^{-1} but the rate decreases to 0.9 when three in household / any other valid comparison;
the *per capita* rate remains constant when more than eight in household;
the *per capita* rate drops by approximately half (from 1.4 to 0.7 kg day^{-1}) when four in household instead of two;
no data for single person household;

explain:
economies of scale;
larger packets have lower proportion of packaging to food;
larger families may be poorer and so consume less; ***[3 max]***
Any other reasonable suggestion.
*If no explanation given, **[2 max]**.*

(b) environmental impact assessment / survey of existing situation;
start recycling program: glass / paper / cans;
produce compost from left-over food / garden waste;
reuse more materials;
minimize packaging;
buy second-hand articles;
buy articles with longer life-span; ***[4 max]***
Any other reasonable suggestion.