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PROGRAMME DU DIPLÔME DU BI
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N06/4/ENVSY/SP2/ENG/TZ0/XX/M+

MARKSCHEME

NOVEMBER 2006

ENVIRONMENTAL SYSTEMS

Standard Level

Paper 2

11 pages

Subject Details: Environmental Systems SL Paper 2 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 penalizing 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.

SECTION A

1. (a) the orderly process of community change over time in an ecosystem/community *(based on subject guide Glossary)* / *OWTTE;* ***[1]***

(b) the mass/weight of organic material in ecosystems or organisms, usually per unit area / *OWTTE;* ***[1]***

(c) *description*:
"S" shaped curve;
origin at zero;
initial exponential increase;
starts to level-off at about 120 years;
very slight long-term decline;

explanation:
very low initial value as there is no productivity on bare, recently exposed rocky surface;
biomass increases rapidly as productivity increases;
levels-off as equilibrium reached; ***[4 max]***
Any other valid points.
Must have at least one valid "explain" point to achieve ***[4]****.*

(d) spruce;
hemlock; ***[1]***
Both needed for ***[1]****.*

(e) alder; ***[1]***

(f) 305 tonnes ha^{-1} (*accept 300-320 tonnes* ha^{-1}); ***[1]***

2. separation of gene pools;
e.g. separation of South America from Africa;
similarity of fossils but differences in modern organisms;
formation of physical barriers *e.g.* fossil marsupials in all southern continents;
e.g. isolation of Australia / development of distinctive biota/marsupials/monotremes/eucalypts;
development of land bridges;
allowing animals to move across them;
e.g. Bering Strait / Isthmus of Panama / Suez;
formation of new habitats as continents are moved into new climatic belts;
e.g. development of aridity in Australia as continent moved north;
consequent evolution of new species/biological groups/adaptation of organism and biota to new environments;
movement of plates into extreme environments may reduce biodiversity;
e.g. movement of fragments of Gondwana into high southern latitudes → elimination of rich late Mesozoic and tertiary floras in and near Antarctica; ***[4 max]***
Any other reasonable points or examples.
For full credit, there must be two examples and two explanations.

3. *Diagram showing at least three organisms (two links)* ***[1]***
e.g. Grevillea leaves → caterpillar → kookaburra;
Spinifex seeds → ants → lizard → snake → eagle;
grass → cow → human;
The names of organisms are not actually required in the question so a generalized diagram is acceptable:
green plant/producer → herbivore/primary consumer → carnivore/secondary consumer;
Do not award credit for a food web diagram; arrows must be in correct direction.

explanation ***[1]***
a series of organisms at different trophic levels (that occur in the same environment/ habitat) / *OWTTE*; ***[2 max]***

4. insolation provides much more heat energy at the equator than at the poles;
ocean currents help to reduce temperature differences;
cold currents transport cold water from polar regions towards the tropics;
e.g. Humboldt Current off South America / Labrador Current off eastern Canada;
warm ocean currents transport energy from tropics towards poles;
e.g. North Atlantic Drift moderating climate of north-west Europe; ***[4 max]***
Any other reasonable points.

5. (a) (i) carrying capacity at 24°C is higher than at 19°C/ 200 at 19°C compared with 450 at 24°C / *OWTTE* ***[1]***

(ii) rate of growth is faster at 33°C than at 19°C / carrying capacity is reached after five days at 33°C but it takes 12 days at 19°C ***[1]***

(b) competition with other organisms;
abundance of food source;
predation; ***[1 max]***
Any other reasonable suggestion.

(c) the maximum number of a species or "load" that can be sustainably supported by a given environment (Glossary definition) / *OWTTE* ***[2]***
Award ***[1]*** *if partially complete.*

(d) resources may be substituted one for another;
resources required vary according to lifestyle;
resources required vary from time to time;
technology may provide new methods of obtaining resources;
technology may increase demand for new resources;
materials may be imported;
thus high densities may be supported on the basis of resources from afar (*e.g.* Hong Kong / Netherlands); ***[2 max]***
Any other reasonable points.

6. halogenated organic gases are usually very stable;
but in the stratosphere/upper atmosphere they are exposed to UV light;
UV light liberates halogen/chlorine/fluorine/bromine atoms;
these may combine with (monatomic) oxygen;
to form halogen monoxide / halogen oxide;
to slow down/disturb equilibrium of the rate of natural ozone formation;
possibly damaging the ozone layer; ***[4 max]***
Presentation of some of the above material in diagram form acceptable.
Any other reasonable points.
Do not accept details of the effects of ozone on organisms or measures to reduce CFC use.

SECTION B

General Essay Markscheme

Each essay is marked out of ***[20]*** of which ***[3]*** are for expression and development of ideas (EDI).

[0] No expression of relevant ideas.
[1] Expression and development of relevant ideas is limited.
[2] Ideas are relevant, satisfactorily expressed and reasonably well developed.
[3] Ideas are relevant, very well expressed and well developed.

Reward detail, sound environmental or ecological concepts, and good examples even if not stated exactly in the form given in the markscheme.

7. (a) *description*:

distributed mainly in tropical and sub-tropical areas approximately $15-30^{\circ}$ N and S;
e.g. Sahara / Arabia / Syria / Thar / central Australia / Kalahari / south-west USA / Atacama;
some exceptions, *e.g.* central Asia / Gobi / parts of western USA / Patagonia;
*Allow **[1 max]** for examples/names of deserts. Allow **[2 max]** for sketch map.*

explanation:
distribution is partially explained by general circulation of atmosphere / positions of planetary cells;
zone/belt of descending dry air;
distribution also influenced by prevailing winds;
i.e. rain shadow effect; ***[6 max]***
Any other reasonable points.
*Give appropriate credit for diagrams or sketch maps. Award **[4 max]** if there are no "explain'' points.*

(b) *Here the comparison is with a tropical rainforest. Answers will of course vary according to the biome selected.*
deserts have very low primary productivity and tropical rainforests have a very high primary productivity;
in tropical rainforest, rainfall is high all through year / water availability is high in contrast to desert;
deserts reflect more energy than tropical rainforest;
variation in temperature between day and night is more extreme in deserts;
photosynthesis proceeds rapidly in tropical rainforests and much more slowly in deserts;
multi-layered structure of tropical rainforests promotes photosynthesis compared with single-layered structure in deserts;
biomass per unit area is very high in tropical rainforests, much lower in deserts;
high secondary productivity in tropical rainforests compared with deserts;
animal life in tropical rainforests often more abundant than in deserts (reflecting multi-layered structure);
e.g. monkeys/fruit bats in the canopy / deer at ground level;
limited number of insects, reptiles, small mammals in deserts;
longer food-chains/more complex food-webs in tropical forests;
high salt content of desert soil may also restrict productivity;
abundance of bare ground in deserts; ***[11 max]***
Reject poverty of desert soils (some quite high in nutrients).
Any other reasonable points.

*Expression of ideas **[3 max]***

Total [20]

8. (a) *diagram*: ***[4]***
two storages with labels;
two further storages with labels;
two flows (in correct direction) with labels;
two further flows (in correct direction) with labels;

description: ***[5 max]***
water is stored in oceans (largest), ice caps (Greenland / Antarctica), freshwater bodies (*e.g.* lakes), the atmosphere (as water vapour), living organisms, water held in aquifers and soil;
*Award **[2]** for three or more storages and **[1]** for two storages.*

flows from oceans and freshwater to atmosphere by evaporation;
from organisms to atmosphere by transpiration and respiration;
from freshwater bodies to ocean through run-off;
from ice caps to ocean by melting;
from soils to organisms by water-uptake by plants;
Accept any valid processes.

energy from sun, directly or indirectly powers the circulation;
human intervention is now a significant factor;
e.g. pipelines, massive dams, reservoirs; ***[9 max]***
Any other reasonable points.

(b) an isolated system has inputs of neither matter nor energy / it only exists theoretically/as an abstract concept;
so the hydrological cycle cannot be such a system;
the planetary hydrological cycle as a whole receives the input of the sun's energy;
and loses energy radiated to space;
but the amount of water on the Earth is (more-or-less) fixed;
so it could be argued that it is a closed system;
but the water circulation in a more limited area (a continent, river catchment, ocean basin) receives inputs of both matter (water) and energy;
and so might be considered an open system; ***[4 max]***
Any other relevant points.

(c) N and water cycles often have same storages;
main storage of N is in the atmosphere but main storage of water is in oceans;
living organisms (*e.g.* N-fixing bacteria) essential for circulation of N;
water circulation driven by sun's energy;
turnover of N more rapid than water;
N proportionately more affected by humans (turnover greatly accelerated by artificial fixation, fertilizers *etc.*);
water cycle involves changes in state and transport;
N cycle may involve more chemical changes; ***[4 max]***
Any other reasonable points.

Expression of ideas ***[3 max]***

Total [20]

9. (a) renewable natural capital is living natural resources that if appropriately/ sustainably managed can produce a natural income of goods and services;
a forest is an example of renewable natural capital, as it can produce an income;
e.g. timber / game / recreation; ***[3 max]***
Any other relevant points, such as detailed examples.

(b) *example for forests*:
value may be economic;
i.e. financial value of timber / game;
value fluctuates with supply and demand;
value depends on ease of extraction;

ecological values;
e.g. CO_2 assimilation;
flood-control;
erosion control;
*Allow **[2 max]** for examples.*

important for well-being of biosphere;
conservation of biodiversity

aesthetic values;
e.g. attractive views/scenery;
plants/animals beautiful/interesting;

religious / moral / spiritual values;
e.g. plants/animals/ecosystems/landscapes might be considered to have rights;

many of these evaluations vary from culture to culture;
and time to time;
so measuring them is particularly difficult; ***[10 max]***
Any other relevant points – a range of relevant ideas and examples may be presented. Must have at least three types of values for full marks.

(c) sustainable use of a form of natural capital is its use in such a way/at such a rate;
that it does not deteriorate in the long-term / that its long-term productivity is not damaged;
if harvesting/yield is too great, it will be unsustainable / resource will ultimately be destroyed;
this requires measurement/calculation of sustainable yield;
thus SY = (biomass at time t + 1) – (biomass at time t);
or = (energy stored at time t + 1) – (energy stored at time t);
or = (annual growth and recruitment) – (annual death and emigration); ***[4 max]***
Expression of above in words is acceptable.

Expression of ideas ***[3 max]***

Total [20]