N08/4/ENVSY/SP2/ENG/TZ0/XX/M+

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MARKSCHEME

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ENVIRONMENTAL SYSTEMS

Standard Level

Paper 2

14 pages

Subject Details: Environmental Systems SL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A **[30 marks]** and **ONE** question in Section B **[20 marks]**. Maximum total = **[50 marks]**.

1. A markscheme often has more marking points than the total allows. This is intentional. Do **not** award more than the maximum marks allowed for part of a question.

2. Each marking point has a separate line and the end is signified 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 writing ***OWTTE*** (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. Indicate this with **ECF (**error carried forward).

10. Only consider units at the end of a calculation. Unless directed otherwise in the markscheme, unit errors should only be penalized once in the paper. Indicate this by writing **–1(U)** at the first point it occurs and **U** on the cover page.

SECTION A

1. (a) $\frac{27000}{15}$;

$= 1800$ kg ha^{-1} yr^{-1} *units required*; ***[2 max]***

*Award **[1]** for working, **[1]** for answer.*

(b) (i) $27000 + 25782 = 52782$

$\frac{25782}{52782} \times 100 = 48.9\%$ *or* 49%; ***[1]***

*Award **[1]** for working plus answer.*

(ii) $51536 + 42393 = 93929$

$\frac{42393}{93929} \times 100 = 45.1\%$ *or* 45%; ***[1]***

*Award **[1]** for working plus answer.*

(c) *Describe:*
ecosystem B has much higher total biomass than ecosystem A;
especially above ground biomass;
ecosystem B has higher nitrogen content than ecosystem A;
difference is more significant with below ground N;
above ground N has increased by about a quarter;
below ground N has more than doubled;
ecosystem B has more P than ecosystem A;
above ground phosphorus is the same for both ecosystems;
most of the increase in P has been below ground;

Explain:
ecosystem A represents a community in the relatively early stages of succession;
ecosystem B represents a community much later in succession / possibly close to climax;
the differences reflect this successional change;
e.g. biomass has steadily accumulated through succession;
N and P have accumulated as community develops;
e.g. as N-fixing bacteria become active;
and as N and P are accumulated within biomass; ***[5 max]***
Any other reasonable points.
Must have at least three "Explain" points for full marks.

2. (a) the return of part of the output of a system as input, so as to affect succeeding outputs (Glossary) / *OWTTE*; ***[1]***

(b) positive feedback;
burning of the plant material → encourages the growth of inflammable species → increases likelihood of fire;
example of vicious circle;
the more the vegetation burns, the more probable it is that it will burn again; ***[2 max]***
*Reward with **[1 mark]** any valid explanation that shows concept has been grasped.*
May be expressed in diagram form.

3. (a) *Award **[1]** for any **two** of the following.*
mineral materials;
nutrients;
sand;
silt;
clay;
organisms/biota;
dead organic matter / humus;
water;
air/gases; ***[2 max]***
Any other reasonable alternatives.
*Do not allow **both** mineral materials **and** sand/silt/ clay.*

(b) (i) decomposition of organic matter;
oxidation;
hydration;
fixation of N;
chemical weathering;
microorganisms activity;
nutrient/biogeochemical cycling;
Any other reasonable alternatives should be credited. ***[1 max]***

(ii) deposition;
infiltration;
leaching;
mass movement;
uptake by plants;
Any other reasonable alternatives should be credited. ***[1 max]***

4. (a) the maximum number/population of a species that can be sustainably supported by a given environment (Glossary) / *OWTTE;* ***[1]***

(b) typical "s" or "f" shaped curve / sigmoidal curve;
at start of measuring period, population close to zero/very low;
period of rapid increase / steep curve;
as numbers increase positive feedback / greater numbers in population allow rate of breeding to accelerate **(E)**;
in absence of limiting factors **(E)**;
ultimately numbers level out / plateau phase;
as carrying capacity reached
limiting factors, *e.g.* food, space, take effect **(E)**; ***[3 max]***
*Must have at least one **(E)** – Explain – point for full marks.*

5. (a) hydrological cycle = the circulation of water in the environment;
between different components, *e.g.* atmosphere, oceans, ice-caps, groundwater, rivers and lakes / freshwater, organisms / biota *(needs to mention at least three components for a mark)*;
as the result of the input of energy from the sun;
Allow in form of a diagram. ***[2 max]***

(b) irrigation;
supply of water to stock;
construction of dams/reservoirs;
water supply to cities / industries;
pumping of water from aquifers;
artificial rainmaking;
removal of forests/natural vegetation;
planting of forests / reforestation;
increase in CO_2 leads to increase in temperature causing more evaporation / melting of polar ice-caps;
Any other reasonable alternative should be credited. ***[2 max]***

(c) (i) $20\,000\ m^3$ / $20\times10^3\ m^3$ *units required*;
Do not award marks for the answer 20. ***[1]***

(ii) open system <u>and</u> it exchanges matter (water) and energy with its surroundings; ***[1]***

6. (a) *For example*: Hayley Wood, deciduous woodland, Cambridgeshire, UK;
Penguin Island, small island off coast of south-west Australia;
High altitude heathland, Mt Field National Park, Tasmania;
Area of seral woodland, Fairgrounds Road, Woodbridge, Connecticut, USA;
Coniferous forest on mountainside, near Westendorf, Tyrol, Austria;

No marks allocated to this, but response to the following question part must relate to ecosystem named.

If the food-chain drawn doesn't correspond to the ecosystem described, then allow ***[2 max]***.

Award ***[1 mark]*** *for names of three or more organisms (need not be actual species, but names must not be too vague [tree, plant, bird not accepted, scientific names accepted, but not essential);*
Award ***[1 mark]*** *for correct trophic levels;*
Award ***[1 mark]*** *for arrows in the right direction.* ***[3 max]***

If otherwise correct, but a food-web is drawn allow ***[2 max]***.

For example:
for Hayley Wood:

Oak-tree (acorns) → wood mouse → tawny owl;;

(Producer) (herbivore) (carnivore);

for Penguin Island:

Carrion (garbage) → silver gull (eggs and nestlings) → king skink (lizard);;

(Dead organic matter) (omnivore) (carnivore);

Analogous terms such as "photosynthesising plant", "1st level consumer", may be accepted.

(b) Group of organisms of the same species living in the same area at the same time, and which are capable of interbreeding; ***[1]***
Candidates must have a substantial part of this.

SECTION B

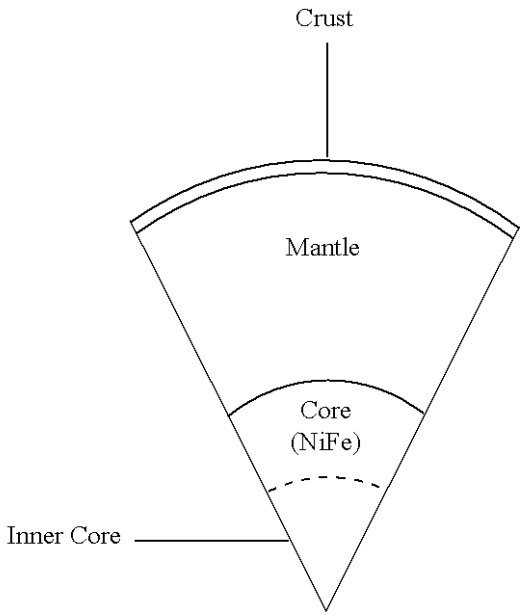
General Essay Markscheme

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) *The diagram may show complete cross-section of sphere or slice.*



three main components – core, mantle, crust (labelled);
core, mantle, crust (in correct order);
core, mantle, crust in approximately correct proportions; ***[3]***
Accept alternatives such as inner/outer core, asthenosphere, lithosphere.
*Award **[0 marks]** if diagram is not satisfactory.*

(b) lithosphere exists as separate and distinct tectonic plates;
more-or-less rigid crustal plates;
two types of crust also differ in thickness / continental crust being considerably thicker than oceanic;
oceanic (SiMa) and continental (SiAl) plates can be distinguished;
plates are moved by convectional currents/plumes in the asthenosphere/mantle;
at a very slow rate (1-5cm per year);
the location where two plates meet is called a plate boundary / margin;
plate boundaries are commonly associated with creation of topographic features such as mountains / volcanoes / mid-oceanic ridges / oceanic trenches;
plate margins are areas of instability/earthquakes/volcanic activity;
these may be constructive/divergent/spreading apart;
i.e. where material from below attaches to separating plates;
e.g. Mid-Atlantic ridge;
or destructive, where subduction occurs, and crustal material is destroyed;
some plates slide past each other (transform faults);
e.g. San Andreas Fault;
former supercontinents have been broken up and crustal fragments separated;
examples, break-up of Gondwana into Australia / India / Africa / S America *etc*.; ***[7 max]***
Expression of these points in diagram form is permissible.

(c) formation of barriers such as oceans/mountains/rift valleys;
separation of gene-pools;
isolation of biota;
e.g. distinctive flora and fauna of Australia/Madagascar;
formation of land bridges allowing movement between previously separated plates;
e.g. East Indies/Bering Strait;
movement of plates through different climatic zones;
causes new habitats to be presented;
and new forms to evolve to inhabit them;
e.g. northward movement of Australian plate and "drying" of much of the continent;
formation of islands along plate margins;
provides new isolated habitats;
and development of biota with high degree of endemism/many unique forms;

[7 max]

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

8. (a) natural capital = the stock of natural resource;
while natural income = the flow of material or services that can be harvested from it (if it is appropriately managed) / *OWTTE*; ***[2 max]***

For example:
natural capital – an area of forest/the fish stocks in a commercial fishery;
natural income – the yield of timber, water, game, recreation from a forest / the crop of fish obtained from a sustainably managed fishery / any other suitable example; ***[2 max]***

[4 max]

(b) a resource may be evaluated in terms of its economic or monetary value (£, €, $, ¥);
natural income may be calculated as the monetary value of the product each year (fish, water, timber);
the value of the total natural capital might be assessed on the basis of the long term income;
ecological products such as waste assimilation / flood control / nitrogen fixation / provide valuable services;
ecological products such as waste assimilation, flood control, nitrogen fixation, provide valuable services;
but monetary evaluation of these is difficult or impossible;
although attempts have sometimes been made to calculate a financial value;
organisms/ecosystems/landscapes may have aesthetic, intrinsic or spiritual values;
these vary widely from one society/individual to another and are therefore very difficult to evaluate;
Award marks for any other reasonable points and reward good use of examples.

[7 max]

(c) a resource is managed sustainably when its long-term yield is not compromised by short-term harvesting;
if too great a harvest is taken from a resource / if resource is over exploited, the natural capital will decline;
e.g. overfishing of North Sea herring stocks / Grand Banks cod stocks / over-clearing of southeast Asia tropical forests;
calculation of sustainable yield allows the crop that may be taken without damage to natural capital to be determined;
i.e. that which is produced by normal growth and reproduction to be taken;

For example:
SY = {total biomass/ energy stored at time t_1} – {total biomass/ energy at time t_2};
so timber removed from a forest each year must not be greater than the amount produced by net primary productivity (*OWTTE*);
SY = {annual growth and recruitment} – {annual deaths and emigration};
so number of deer culled must be related to number recruited to population;
Any other appropriate points may be credited. ***[6 max]***

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

9. (a) levels approximately constant 1955 – 1970s;
steep decline 1970s – 1990s;
some evidence of recent recovery;
isolated peak in 2002 might be spurious;
released O combines with $O_2 \rightarrow O_3$;
UV radiation is absorbed by oxygen;
halogenated organic gases/CFCs liberate chlorine/halogen atoms when exposed to UV radiation in stratosphere;
CFCs are/were used as propellants for aerosols/ refrigerants;
the released halogen atoms react with O;
to slow the rate of ozone formation;
equilibrium of ozone production system disturbed;
uncertainties of results;
Any other reasonable points.
*Award **[3 max]** for description of graph.* ***[6 max]***

(b) increased UV radiation;
may have damaging effects on living tissues;
such as increased mutation rate;
may cause increased skin cancer rate in humans;
may damage photosynthesising organisms;
and thus disrupt food-chains;
e.g. phytoplankton → zooplankton in oceans;
Any other reasonable suggestions should be credited. ***[4 max]***

(c) *Describe:*
reduce manufacture/release of ozone-depleting chemicals *e.g.* careful recycling of refrigerants and air-conditioning chemicals;
find/use alternatives to CFCs as propellants;
regulate use of CFCs by national legislation;
e.g. Ozone Protection Act (Commonwealth of Australia, 1989) / similar statutes elsewhere;
also, by international agreements;
e.g. Vienna Convention (1985) / Montreal Protocols (1987, 1990, 1992) / EU Directive 91/594;
international monitoring encouraged by UNEP;

Evaluate:
many countries now have appropriate legislation;
considerable international co-operation now occurs;
considerable international co-operation now occurs. Many countries are now party to above agreements;
but international agreements must be followed by ratification;
ozone-depleting gases have a long half-life;
and continue depleting ozone cyclically;
there is a long time-lag between reduction of use of ozone depleting chemicals and effect on atmosphere;
therefore ozone recovery may take many years;
some countries are still producing large quantities;
cost of developing / using alternatives for CFCs;
Any other reasonable suggestions.
Must have at least three "Evaluate" points for full marks. ***[7 max]***

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