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M02/460/S(2)M+

MARKSCHEME

May 2002

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 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.

SECTION A

1. (a) $1540 - 705 = (835)$;

$\frac{835}{705} \times 100$;
$= 118\,\%$;

or

$\frac{1540}{750} \times 100\,\%$;
218 % – 100 %;
= 118 %;

[1]** for correct figures; **[1]** for correct manipulation; **[1]** for correct answer.* ***[3]

(b) yes;
because percentage growth rate in 1941 has decreased compared with 1939 and 1937 / rate of increase in 1942 less than in 1941; ***[2]***
Do not credit "yes" or "no" unless some valid explanation is given.

(c) gradient is increasing / rapid growth / *OWTTE* / has some characteristics of initial exponential curve / "J" or "S" curve;
due to rapid rate of increase of population with few controls / birth rate exceeds death rate;
e.g. food / space / predation not important limiting factors;
however some decline in numbers each winter;
possibly due to decline of food / extreme weather;
some evidence rate/percentage of increase was declining by 1941;
possibly due to competition;
population might have stabilised;
i.e. population might have become an "S" shaped curve if conditions had remained undisturbed;
shooting might have decreased numbers;
appropriate comments on *r*- / *K*- selected species; ***[5 max]***
*Allow **[3 max]** for description and explanation of exponential growth. Allow **[2 max]** for description and explanation of fluctuations.*

2. (a) *examples:*

Diatoms or plants → herbivorous → young fish → older fish
zooplankton

or

Diatoms or plants → midge → leeches → older fish
larvae

organisms;
correct arrow direction; ***[2]***
Accept any appropriate food chain.

(b) inputs are balanced by outputs / energy input = energy output (so there is no net change in the energy content of the ecosystem); ***[1]***

(c) input = GPP = 28 000;
output losses = 3 500 + 420 + 60 + 650 + 2 000 + 700 + 10 000 = 17 330;
X = 28 000 – 17 330 = 10 670 (kJ m^{-2} yr^{-1}); ***[3]***
*If candidate has listed/summed outputs correctly, but subtracted them from solar energy input or NPP, allow **[1]**.*

(d) inputs = 2 780 + 45 + 60 + 4 + 615 + 17 + 95 = 3 616;
inputs 3 616 – outputs 3 500 = 116 (kJ m^{-2} yr^{-1}); ***[2]***

(e) *example:*
as older fish numbers increase, they eat more midge larvae;
so number of midge larvae decreases, leading to a decrease in older fish numbers; ***[2]***
Accept other appropriate examples.

SECTION B

3. (a) diagram; ***[2]***

For full marks, either in the diagram(s) or in the accompanying text, both storages and flows must be mentioned. Examples might include:
storages (*e.g.* ice caps, glaciers, groundwater, rivers and lakes, oceans, atmosphere); ***[2]***
flows (*e.g.* precipitation, runoff, evaporation, melting, freezing, condensation); ***[2]***
[6 max]

Not all the above examples need to be included to achieve full marks.

(b) (i) cold currents from poles → tropics;
appropriate example *e.g.* Newfoundland;
warm currents tropics → poles;
appropriate example *e.g.* North Atlantic Drift;
driven by wind / rotation of the earth;
influence of oceanic conveyor belt; ***[4 max]***

(ii) water body slow to absorb and release heat;
tends to stabilise temperatures;
currents bring heat to temperate regions;
example North Atlantic Drift ;
effect of El Niño;
currents affect wind temperature / direction;
disruption of oceanic conveyor in North Atlantic by increased melting of ice-cap could dramatically affect climate of North West Europe; ***[4 max]***

(iii) warm currents may increase productivity on adjacent land masses;
e.g. Scandinavia;
warm currents increase evaporation leading to increased precipitation over land which increases productivity;
cold currents decrease productivity**;**
e.g. Labrador;
mixing of cold currents in oceans sometimes associated with high productivity;
e.g. Grand Banks, Newfoundland and along Antarctic convergence; ***[3 max]***

[11 max]

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

Total [20 max]

4. (a) *Suggest **[7 max]** for principles and **[2 max]** for examples.*
immigration and emigration are in balance;
populations are kept stable by feedback links between an organism's population and its environment;
density dependent factors;
food supply – if food supply declines temporarily, numbers of organisms will decrease, and *vice-versa* (insects → swifts); ***[2]***
predation – if organisms increase in abundance, numbers of predatory organisms / next level in food chain / pyramid will increase and act as a check (swifts → birds of prey); ***[2]***
parasitism in high density of host may lead to reduced fertility / survival; ***[2]***
populations may also be checked by density independent factors, such as climate; ***[2]***
increased survival rate following decline may restore equilibrium; ***[2]***
internal *versus* external factors;
protection by legislation / organizations / conservation measures stabilizes population numbers;
organisms often return to the same place to breed in following year;
[9 max]

The examples used will vary enormously; those from candidate's field and practical work are especially welcome. If material from the stem of the question is used, it must be developed in some way; thus "An increase in the numbers of flying insects may be associated with an increase in numbers of swifts".

(b) increase in insecticide use → decrease in number of swifts;
through lack of breeding success;
direct decrease in swifts' food supply;
accumulation of toxins in swifts' tissues may kill some birds and also reduces breeding success;
alternatively predators of swifts might be affected more than swifts themselves;
causing an increase in numbers of swifts; ***[4 max]***
Reward sound ecological argument, even if unconventional.

*The following argument would be worth **[3]**.*
since the use of insecticides **has** greatly increased since 1788, the present population represents stability, so no decrease would be expected;

(c) information on modifications to habitat (*e.g.* removal of buildings might reduce nesting sites);
evidence of human interference with breeding;
evidence of climatic change;
evidence of change in predator numbers;
tagging / ringing / banding organisms to measure populations / movements / population changes;
Any other reasonable suggestion. ***[4 max]***

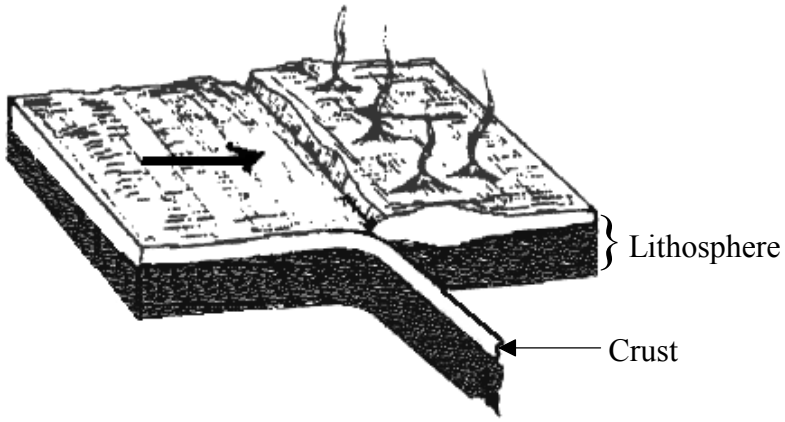
Expression of ideas ***[3 max]***

Total [20 max]

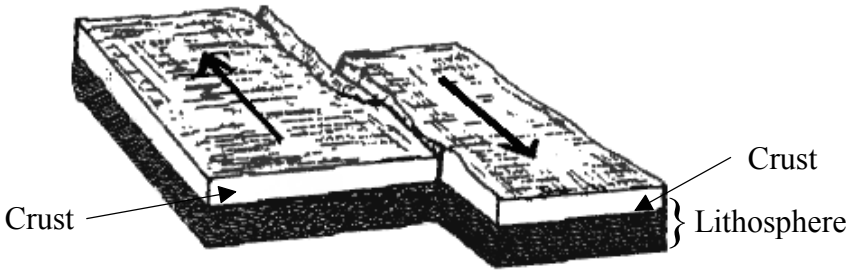
5. (a) diagrams of cross-section through plate margins; ***[4]***
*Since diagrams C and D are not explicitly on the syllabus, allow **[2]** each for two good diagrams and **[1]** each for less detailed diagrams up to **[4 max]**.*

A. Constructive (divergent)

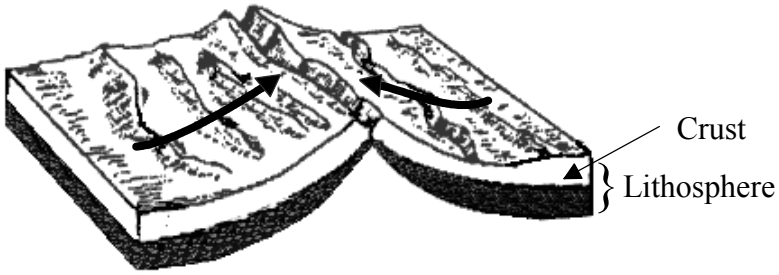
B. Destructive (convergent)



C. Transform fault



D. Constructive (convergent)



plates of crustal / continental / sialic material;
are "floating" on mantle of oceanic material;
convectional currents in mantle cause lateral movement of plates;
constructive plate margins associated with upward limbs of convectional cells;
e.g. Mid-Atlantic Ridge / inverted "Y" ridge system of Indian Ocean;
new material added to margins, as they move apart;
destructive margins associated with downward limbs and subduction zones;
differences in density cause one plate to slide beneath another;
e.g. island arcs of West Pacific rim;
plates may slide against each other (transform faults);
e.g. San Andreas Fault;
plates have been moving / fragmenting / fusing throughout geologic time;
e.g. Gondwana / southern land masses have fragmented;
to form Australia, New Zealand, Africa, Madagascar, South America, Antarctica;
India (former Gondwana fragment) has fused on to Asian plate;
sketch map or diagram of any particular example relevant to question;
volcanism / earthquakes occur at plate boundaries;
plates currently drift apart at a few centimetres a year;
evidence for separation of continents from "jigsaw" fit of existing continents; ***[12 max]***
Allow ***[2 max]*** *for details on evidence for plate movement.*

(b) separation of continental plates separates organisms with common ancestor;
e.g. ratites: emu – Australia, ostrich – Africa, rhea – South America;
leading to isolation;
and distinctive climates;
allow separate / divergent evolution and increase in biodiversity;
e.g. distinctive organisms / ecosystems of Australia / eucalypts / monotremes / marsupials;
collision of plates allows fusion of gene pools from two or more origins;
increasing biodiversity;
similarly separation of oceans by land masses may isolate marine organisms;
e.g. Atlantic / Pacific;
and continental break-up allows mixing of oceanic biota;
volcanic islands (at some plate margins) create new habitats; ***[5 max]***

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

Total [20 max]