

# **MARKSCHEME**

**November 2002**

## **ENVIRONMENTAL SYSTEMS**

**Standard Level**

**Paper 2**

## 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) natural increase =  $\frac{\text{crude birth rate} - \text{crude death rate}}{10}$  ; [1]

*Definition in continuous prose is allowed.*

(b) Gaza has the highest NIR;

$$\text{Gaza NI} = \frac{49 - 5}{10} = 4.4 ;$$

$$\text{doubling time} = \frac{70}{4.4} = 15.9 \text{ years ;} \quad [3]$$

(c) both territories could be described as having high population growth, but for different reasons;

*India:*

very large population base so a modest rate of increase (1.9 %);  
means that population increases by a large absolute number each year (18.75 million);

*Gaza:*

very small total population (1.2 million) so a high rate of increase (4.4 %);  
produces only a modest increase in numbers (52,800);  
larger absolute population size of India likely to have larger impact globally;  
high rate of increase in Gaza may mean large numbers of people entering reproductive age / future problems;

[5 max]

(d) *Any two of the following.*

- area of land;
- available resources;
- rate of resource consumption;
- imports and exports;

[2 max]

(e) carrying capacity = the maximum number of a species or “load” that can be sustainably supported by a given environment / *OWTTE*;

human communities can exchange (through imports and exports) resources with others;

... thus a country may have a “footprint” / resource base that extends beyond its boundaries;

capacity also depends on level of technology;

some argue there are no limits to capacity;

... some small countries (e.g. Netherlands) are able to support high population densities at a high standard of living;

*per capita* consumptions are not constant from time to time / place to place; [3 max]

2. (a) (i) inputs = outputs, therefore no net change; [1]  
*Do not allow constant input and output.*
- (ii)  $X = 2$  [1]
- (b) open; [1]  
matter (and energy) are inputs and outputs; [1]  
*Candidates must state "matter" for the mark.*
- (c) *Allow any logical and appropriate argument for [2 max], e.g.*  
temperature increases → evaporation increases → stream inflow decreases →  
runoff and percolation decreases; [2]
- OR**
- evaporation increases → precipitation increases → runoff and percolation  
increases; [2]

**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.

3. (a) the ageing forest is passing through succession;  
biodiversity of all groups increases with succession;  
absolute numbers of bird species highest, tree species next, primates lowest;  
possibly because monkeys less specialised – “broader” niches than specialised birds (at least some species);  
increase of birds and primates possibly due to increase in tree diversity;  
taller trees and greater variety of species present more niches for vertebrates, *i.e.* greater structural complexity;  
later stages of succession present higher biomass / energy / food resources than “pioneer” stages;  
numbers of bird and primate species increase approximately tenfold in 300 years, numbers of trees approximately fivefold;  
absolute numbers are high compared to other ecosystems due to high productivity of tropical forest systems;  
any other valid points; **[7 max]**

- (b) *Allow [2 max] for distribution.*  
*distribution:*  
humid tropics within about 12 to 15 degrees of the equator;  
*e.g.* Amazon basin, Central America, Congo basin, South-east Asia, North Queensland, Pacific Islands (*any valid example(s) [1]*) / not present at very highest altitudes (Andes, PNG mountains);

- factors:*  
high temperatures;  
high precipitation totals;  
high sunlight intensity; ... therefore high productivity;  
any other valid points; **[6 max]**

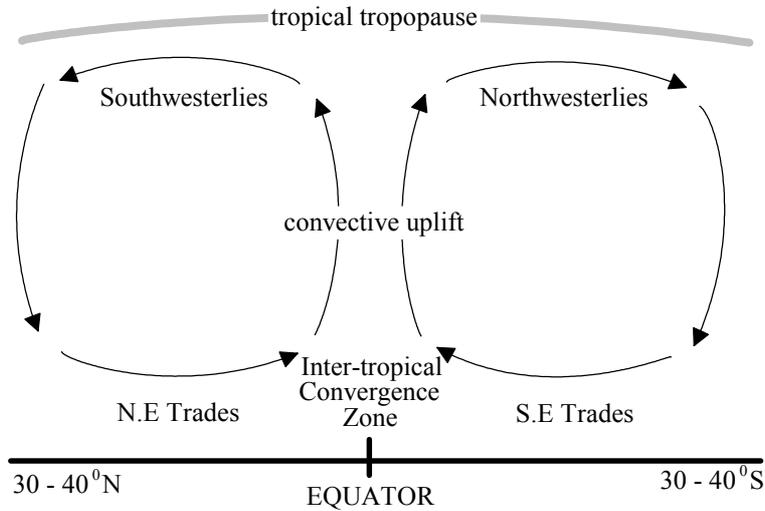
- (c) very substantial reduction;  
due to human clearance of forest for timber / agriculture / cattle rearing;  
rate of clearance has been accelerating;  
setting aside reserves and international treaties may reduce rate of clearance in future;  
any other valid points; **[4 max]**

*Expression of ideas max [3 marks]*

**Total [20 marks]**

4. (a) diagram;

[2]



labelling of cells, winds and latitude;

[2]

Accept either Northern or Southern hemisphere version on its own.

high insolation in tropics causes convection;

... upward limb of Hadley cell;

trade winds compensate for low pressure in tropics;

upper air flows reverse of ground level trade winds;

descending air in sub-tropics associated with high pressure;

spiral movement of air;

[7 max]

(b) net effect is to cause flow of energy from high insolation regions (overhead noon sun) of tropics;

... to low insolation polar regions (low angle of incidence);

planetary wind system influences ocean currents which also shift energy from tropics towards poles;

latent heat carried in water vapour;

[3 max]

(c) distribution of biomes is linked to temperature, precipitation and sunlight;

these are tightly linked to global pressure and wind systems;

high rainfall, high insolation in tropics due to Hadley Cell → tropical rain forests (i.e. Amazon, Congo);

[2]

trade winds blowing over land → aridity → trade wind deserts (e.g. Sahara) and descending limb of Hadley cell carrying dry air;

[2]

low temperatures and resulting low humidity of polar regions → less energy available in tundra and polar biomes;

atmospheric circulation allows biomes to spread more towards poles;

[7 max]

Expression of ideas max [3 marks]

Total [20 marks]

5. (a) Award [1] for each definition and [1] for example for each.

natural capital is a term sometimes used for the wealth of resources in the environment that can be used by humans;  
if properly managed, this natural capital can provide a flow of natural income - valuable goods and services that can be supplied sustainably / indefinitely;  
e.g. of capital = the forest;  
e.g. of income = the timber / recreation / catchment protection the forest provides sustainably ([1 max] for appropriate example);

sustainable yield - the yield or "income" that a resource can provide without long term detriment;  
e.g. sustainable harvesting of fish = annual growth in fish population; [6 max]

(b) Determination of sustainable yield [5 max].

$$\text{sustainable yield} = \left( \frac{\text{total biomass}}{\text{energy}} \text{ at time } t + 1 \right) - \left( \frac{\text{total biomass}}{\text{energy}} \text{ at time } t \right);$$

$$\text{or} = (\text{annual growth and recruitment}) - (\text{annual death and emigration});$$

or comparable explanation in words; [2]

*Details of use of concept will depend on examples selected.*  
measurement / estimation of natural capital / resource base;  
e.g. total biomass in a forest; total stock in a fishery;  
regular monitoring of income or yield;  
e.g. timber yield; number of fish harvested;

*evaluation: [6 max]*

sustainable yield is useful in setting regulations / legislation;  
to ensure sustainable practices;  
sustainable yield management helps prevent excessive harvesting;  
and long term productivity decline;

management should, as well as taking account of biomass / productivity / numbers, consider

- minerals lost from harvesting of crop;
- impacts on social structures of wildlife organisms;
- e.g. disturbance of sex / age ratios;
- other damage caused by harvesting processes;

[11 max]

*Expression of ideas max [3 marks]*

**Total [20 marks]**