



# **MARKSCHEME**

**May 1999**

**ENVIRONMENTAL SYSTEMS**

**Subsidiary/Standard Level**

**Paper 3**

1. (Allow for obvious alternative ecosystems not listed in the syllabus, e.g. streams, boreal forest, heathland or actual named examples, e.g. coral reef on West Island, Cocos; mangroves near Derby, Western Australia, rocky shore at Boggle Hole, Yorkshire.)

- (a) Any three of:

|                           |                          |                           |
|---------------------------|--------------------------|---------------------------|
| marine:                   | terrestrial:             | freshwater:               |
| tides, depth of water,    | light/                   | light/ depth/ turbidity/  |
| time exposed to air/      | wind/temperature/        | temperature/ pH, nutrient |
| salinity/ light/ exposure | salt-spray/ pH of soil/  | status of water.          |
| to wave action/           | nutrient status of soil. |                           |
| temperature.              |                          |                           |

Must have all three and name the ecosystem for [1 mark].

max [1 mark]

- (b) Method obviously varies with factor selected but all require:  
brief description of technique and equipment [1 mark]; (e.g. temperature – thermometers or datalogger probes; turbidity – Secchi discs.)  
repeated measurements [1 mark]; at regular intervals [1 mark]/ using same technique [1 mark].

(Candidates' descriptions of methodology might include non-standard equipment if centres have improvised. Accept if scientific principle of the methodology is sound.)

Description of variation – increase/decrease/fluctuate [1 mark]

max [4 marks]

- (c) named human activity [1 mark]; description of the effect of the activity on appropriate physical factor [2 marks]; appropriate variation and effect of this [1 mark].

Example: in a mangrove ecosystem, drainage of the mangroves to reclaim land for building [1 mark]; reduces depth of water and so time organisms are submerged by sea water [1 mark]/ less feeding time for filter feeders [1 mark]/ death of some species [1 mark]; habitats for organisms altered by either build up of land levels or construction of sea wall to keep out tidal waters [1 mark]/ mangrove plant communities die and so associated animal communities also die [1 mark].

Any reasonable example acceptable.

max [4 marks]

- (d) naming of second ecosystem *[1 mark]*;  
 comparison and contrast of physical characteristics *[2 marks]*;  
 comparison and contrast of ecological characteristics *[3 marks]*.  
 Example: if first ecosystem is tropical rain forest (TRF) and second is desert *[1 mark]*;  
 TRF – high insolation, high rainfall, high temperature and little fluctuation over 24 hours or seasons *[1 mark]*; desert – high insolation, low rainfall, high max temperature but wide fluctuations *[1 mark]*;  
 TRF – high GPP and NPP if in succession as high rate of respiration, high biodiversity, high biomass, rapid decomposition rates as physical factors mostly not limiting *[1 mark]*;  
 desert – low GPP and NPP, low biomass, low biodiversity as rainfall limiting *[1 mark]*;  
 Attempt to compare and contrast and not just a list *[1 mark]*.

*max [6 marks]*

*Total [15 marks]*

2. (a) monoculture is the growing of a single crop in the same area over a long period without interruption or variation *[1 mark]*.  
*(Candidates should have at least three of these four points for a mark. Accept equivalents.)*  
*Must have some indication of repetition on same land. Require more than 'growing of a single crop' to gain [1 mark].*

*max [1 mark]*

- (b) *Any two of:*
- remove same nutrients from the soil *[1 mark]*/
  - danger of build up of pests and diseases *[1 mark]*/
  - pest/disease may spread rapidly from plant to plant *[1 mark]*/
  - economic dangers of concentrating on a single product *[1 mark]*/
  - economic arguments *e.g.* increased risk of crop loss *[1 mark]*
  - reasonable alternative *[1 mark]*

*max [2 marks]*

- (c) (i) *Any two of:*  
 low inputs of fertiliser *[1 mark]*/
- lower yielding varieties *[1 mark]*/
- but increased disease/pest resistance *[1 mark]*/
- require less/no additional fertiliser to yield something *[1 mark]*/
- farmers may not be able to afford new varieties *[1 mark]*
- preserves biodiversity *[1 mark]*

*max [2 marks]*

- (ii) *Accept any reasonable answers, e.g.:*  
 different inputs *[1 mark]*/
- varying soil fertility *[1 mark]*/
- more fertiliser/pesticides in developed countries *[1 mark]*/
- less loss to disease/pests *[1 mark]*
- different climates *[1 mark]*
- different technical levels *[1 mark]*

*max [2 marks]*

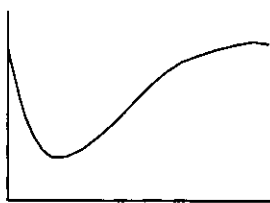
- (d) (i) graph A – world grain production has increased steadily [1 mark];  
graph B – world grain production *per capita* has increased slightly but is now falling [1 mark];  
implications – less grain/food per person as population continues to rise [1 mark];  
food shortages [1 mark];  
A tripled in 50 years [1 mark] – both fluctuate max [3 marks]
- (ii) area of land available for growth of crops [1 mark];  
reducing extra returns from increased amounts of fertilisers [1 mark];  
water shortages for irrigation [1 mark];  
government restrictions – set aside land [1 mark];  
lack of technology in LDCs [1 mark];  
human impact leading to floods or droughts [1 mark] max [2 marks]
- (e) (i) Grain equivalents take into account how much meat is eaten in a diet [1 mark];  
an Indian diet has little or no meat, an American diet has far more [1 mark];  
grain equivalent accounts for the energy loss in turning grain to meat for consumption [1 mark];  
US has more money for food [1 mark] max [2 marks]
- (ii) 1 American-style diet consumes 800 kg = 0.8 tonnes  
800 kg = 0.8 tonnes provides for 1 American-style diet  
1 tonne for  $1/0.8 = 1.2$  people  
2000 million tonnes for 2500 million [1 mark]; max [1 mark]

**Total [15 marks]**

3. (a) biodiversity = measure of the species richness of an area [1 mark];  
number of different species of plants and animals in an area [1 mark];  
diversity in terms of numbers of ecosystems or habitats [1 mark] max [1 mark]
- (b) (i) lower the latitude, more biodiversity there is [1 mark];  
or higher the latitude, the lower the biodiversity [1 mark];  
nearer the equator, more species diversity [1 mark];  
negative correlation between species numbers and latitude [1 mark] max [1 mark]
- (ii) *Accept any reasonable answer up to 2 marks, e.g:*  
more ecological niches for species nearer equator [1 mark];  
higher insolation, temperature and rainfall near equator so greater productivity so more food [1 mark];  
structural complexity of TRF [1 mark];  
easier to survive in less extreme environments [1 mark] max [2 marks]
- (iii) *Any reasonable answer, e.g:*  
size of countries vary [1 mark];  
level of human interference varies [1 mark];  
migration of birds [1 mark] max [1 mark]

- (c) *Again, any reasonable answer, up to 2 marks, e.g:*  
genetic resource [1 mark]/  
commercial exploitation [1 mark]/  
stability of the ecosphere [1 mark]/  
tourism [1 mark]/  
moral/ethical/religious [1 mark]/  
aesthetic [1 mark]  
*max [2 marks]*
- (d) (i) *e.g. restoration of degraded areas [1 mark];*  
conservation outside protected areas [1 mark]/  
education to increase awareness [1 mark]/  
international agreement [1 mark]  
*max [1 mark]*
- (ii) *perceived needs of human society for finite natural resources [1 mark];*  
remaining land already designated for other purposes [1 mark];  
for a named area – success depends on size of area, where it is and  
the management of it [1 mark]/  
larger areas often more successful [1 mark]  
*max [3 marks]*
- (e) *Award marks for example;*  
consideration of effect of CITES and non-governmental organisations  
(WWFN) [1 mark];  
effectiveness of captive-breeding / zoo programmes and reintroduction of  
animals to the wild [1 mark];  
pointless just to preserve one species, also need the habitat in which it lives  
[1 mark];  
success/failure of the programme for the named species [1 mark]  
Example: named species *e.g.* orang-utan in Sumatra/Sabah  
further detail about named species [1 mark]/  
strength – public made aware of need to take orphans to authorities, not  
keep as pets [1 mark];  
good rehabilitation programme to teach young to find food, climb reserve  
area managed [1 mark];  
weaknesses – little follow-up on released animals [1 mark];  
animals can escape from reserve and be in danger from logging/collectors  
[1 mark]/  
life-long dependence on humans to provide food/company [1 mark]  
*max [4 marks]*

*Total [15 marks]*

4. (a) point source is emitted from single, identifiable locations *e.g.* sewage effluent from a pipe [1 mark];  
non-point source from multiple dispersed origins *e.g.* vehicle exhausts [1 mark] max [2 marks]
- (b) (i) Any two reasonable answers, *e.g.*:  
sewage outfall [1 mark]/ slurry drainage from farm [1 mark]/ silage effluent leakage [1 mark] max [2 marks]
- (ii) BOD = Biochemical/Biological\Oxygen Demand [1 mark]/ is the ability of organic effluent to deoxygenate water [1 mark]/ is a measure of the amount of dissolved oxygen utilised by microorganisms when organic pollution enters a body of water [1 mark];  
Gives an indication of how much oxygen is needed by bacteria to remove organic material from the water [1 mark]/ shows how polluted the water is [1 mark]  
Award [1 mark] for:  
line which is mirror image of BOD line (approximately)/  
line which falls and then rises again appropriately max [2 marks]
- (iii)  max [1 mark]
- (iv) ammonium converted to nitrate by bacteria [1 mark] max [1 mark]
- (v) *e.g.* are biotic/biological indicator species [1 mark]/  
can tolerate high levels of pollution so, if found may indicate pollution [1 mark]  
can tolerate low oxygen levels [1 mark] max [1 mark]
- (c) Use an EIA (Environmental Impact Assessment) [1 mark];  
baseline study before any changes made [1 mark];  
record species present, habitats, ecosystems [1 mark]; max [3 marks]
- Pollutants from farm enterprise:  
slurry from cows [1 mark]/  
methane from cows [1 mark]/  
pesticides on land for wheat [1 mark]/  
increased fertiliser run-off to watercourses [1 mark];  
vehicle traffic – exhaust gases/noise [1 mark]/  
road construction – noise and rubbish/soil compaction [1 mark];  
tourists – sewage [1 mark]/ waste water [1 mark]/ organic and non-degradable rubbish [1 mark]/ disturbance of wildlife/habitats [1 mark] max [3 marks]

Total [15 marks]