



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 – Secci 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]

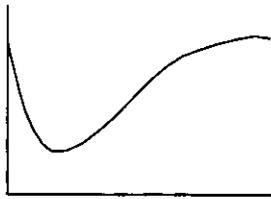
- (c) *Again, any reasonable answer, up to 2 marks, e.g:*
genetic resource [1 mark]/
commercial exploitation [1 mark]/
stability of the ecosphere [1 mark]/
tourism [1 mark]/
moral/ethical/religious [1 mark]/
aesthetic [1 mark] *max [2 marks]*
- (d) (i) *e.g. restoration of degraded areas [1 mark];*
conservation 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]