



## **General Certificate of Education**

# **Environmental Science 6441**

**ESC4      Biotic Resource Management**

## **Mark Scheme**

*2007 examination – June series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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**Environmental Science**
**June 2007****ESC4****Instructions: ; = 1 mark / = alternative response A = accept R = reject****Question 1**

<b>Statement</b>	<b>True</b>	<b>False</b>
Sensible management of a fishery would involve harvesting at just below the maximum sustainable yield	✓	
Farmers using biological control may try to maintain a small but permanent population of the pest	✓	
Vegetative propagation of potatoes produces potatoes that are physically identical to each other and to the parent		✓
Commercial conifer plantations have a more complex structure than ancient woodlands		✓
Energy ratio = $\frac{\text{output or yield}}{\text{input}}$  If system A has an energy ratio of 0.91 and system B has an energy ratio of 0.89, system A is more efficient.	✓	

5

**Total marks = 5**

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**Question 2**

- (a) Nutrients absorbed from deep areas;  
become part of biomass/leaves/stem;  
ploughed in/ref to green manures;  
increases water holding capacity;  
increases active uptake;  
death/decay releases nutrients;  
increase air/oxygen in soil;  
aids decomposition/decay; MAX 3
- (b) Adds OM/humus;  
improves structure;  
improves water-holding capacity/drainage/reduces leaching;  
[A ref to slow release of nutrients]  
binds/reduce erosion;  
food for microbes;  
ref thermal capacity; MAX 2
- (c) Cover the manure/keep it dry/indoors/cool/use liner/collect drainage/containment/  
leachate/run-off; 1
- (d) (i)  $\text{NO}_x$ ;  
nitrous/nitric acid; 2
- (ii) Leaching/runoff;  
eutrophication/algal bloom/increase BOD; 2

**Total marks = 10**

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**Question 3**

- (a) (i) Herbicide/chemical; 1
- (ii) (Interspecific) competition;  
plant reduces light reaching soil/weeds;  
reduces weed germination/growth/photosynthesis;  
plant reduces nutrients/water available to weed/space for weed roots; MAX 3
- (b) (i) Energy (input);  
[R solar]  
fossil fuels/ref to labour/machinery/fertilisers/Haber process/herbicides/  
pesticides/antibiotics/selective breeding; 2
- (ii) Made from/using fossil fuels;  
[R solar]  
finite;  
causes pollution/habitat damage/biomagnification/bioaccumulation/  
affect non-target species;  
highest energy subsidy; MAX 2
- (c) Combination/more than one;  
ref to 2 of biological/chemical/cultural/biotechnology/named examples; 2

**Total marks = 10**

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**Question 4**

- (a) Number of fish reaching maturity is declining/population will fall below MSY/  
over fished/be unable to maintain itself without management; 1
- (b) (i) Catch reduced so helping stocks to recover; 1  
(ii) Smaller/immature fish escape; 1  
(iii) Safe from catch allows breeding/acts as nursery; 1
- (c) Existing biomass/stock/spawning stock biomass;  
mortality rate;  
birth rate/recruitment;  
migration; MAX 2
- (d) Control species;  
food/nutrition/vitamins;  
water temperature;  
daylight/artificial lighting;  
predators;  
antibiotics/pesticides;  
growth enhancers/regulators/hormones;  
oxygen levels;  
water/current speed;  
pH control/named example;  
pollution control/named example;  
assist spawning/reproduction;  
limit movement/respiration; MAX 4

**Total marks = 10**

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**Question 5**

- (a) (i) Absorb carbon dioxide/photosynthesis;  
carbon sinks/sequestration;  
reduce eghe/climate change/global warming;  
high cost of effects;  
credit max 3 for correct effects;  
examples:  
reduce sea level rise/flooding/salinisation of soils/aquifers;  
reduce named/climatic extremes;  
reduce desertification/soil erosion;  
ref to cancellation of debt for forest; MAX 5
- (ii) Soil is finite/irreplaceable/lost resource;  
interception/soil splash/raindrop impact;  
soil wash/overland flow/runoff/gullying/laterisation/leaching/soil erosion/  
wind blow;  
nutrients/fertility lost;  
very expensive to fertilise;  
flooding;  
economic cost of flooding/damage;  
root binding;  
OM/humus/H<sub>2</sub>O holding capacity; MAX 5
- (b) Soils are low in nutrients/infertile;  
most are in biomass;  
lost when trees removed;  
crops use up the remaining nutrients/cause soil exhaustion;  
soil erosion/laterisation;  
leaching; MAX 3
- (c) Natural resource/raw material;  
needed for construction/building/paper/packaging/railways/boats/fuel/infrastructure;  
developed world demand for timber/hardwood/valuable species;  
can be combined with agriculture/ref agroforestry;  
requires limited capital investment/technology; MAX 2

**Total marks = 15**

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## Essay Question

### Question 6

*Quality of Written Communication is assessed in this answer.*

- (a) Rapid human population growth/exponential/ref population explosion;  
mostly in developing countries  
urbanisation  
deforestation/loss of habitat  
soil exhaustion/erosion  
sedimentation  
intensive/chemical agriculture  
fossil fuel use for (agriculture/industry/travel)  
finite  
named/air pollution  
named/H<sub>2</sub>O pollution  
global climate change/eghe  
demand for water/dams/conflict/flooding  
overfishing/by-catch  
species extinction/trading  
Gaia/correct ref to negative/positive feedback/runaway  
transboundary nature  
humans only species capable of global problem/damage  
other causes unrelated to population growth eg El Niño, volcanoes  
differential ecological footprints/comparative effect of MEDC v LEDC/lifestyle impact

**OR**

- (b) Vegetative propagations/asexual reproduction  
selective breeding  
named/traits  
increase in productivity  
narrow use of species  
artificial insemination  
embryo transplants  
genetically engineered plants/animals  
named traits  
ethics  
identifying and isolating genes difficult  
dangers/gene spread/ecological impacts  
developing countries' dependency on/lack of hi-tech  
food production not problem  
distribution  
distortion of agriculture by trade agreements/tariffs/embargoes  
cash crops for debt relief/MNCs  
population growth still exceeds agriculture productivity  
especially Africa/falling further behind/OWTTE  
other named solutions – irrigation, pesticides, herbicides, fertilisers etc

**Total marks = 20**

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## Essay Questions

The essay questions are marked using the following marking criteria.

### Scientific content

(maximum 14 marks)

Category	Mark	Descriptor
	14	
Good	12	Most of the material of a high standard reflecting a comprehensive understanding of the principles involved and a knowledge of factual detail fully in keeping with a programme of A Level study. Some material, however, may be a little superficial. Material is accurate and free from fundamental errors but there may be minor errors which detract from the overall accuracy.
	10	
	9	
Average	7	A significant amount of the content is of an appropriate depth, reflecting the depth of treatment expected from a programme of A Level study. Generally accurate with few, if any fundamental errors. Shows a sound understanding of most of the principles involved.
	5	
	4	
Poor	2	Material presented is largely superficial and fails to reflect the depth of treatment expected from a programme of A Level study. If greater depth of knowledge is demonstrated, then there are many fundamental errors.
	0	

### Breadth of Knowledge

(maximum 2 marks)

Mark	Descriptor
2	A balanced account making reference to most if not all areas that might realistically be covered by an A Level course of study.
1	A number of aspects covered but a lack of balance. Some topics essential to an understanding at this level not covered.
0	Unbalanced account with all or almost all material based on a single aspect.

**Relevance**

(maximum 2 marks)

Mark	Descriptor
2	All material present is clearly relevant to the title. Allowance should be made for judicious use of introductory material.
1	Material generally selected in support of title but some of the main content of the essay is of only marginal relevance.
0	Some attempt made to relate material to the title but considerable amounts largely irrelevant.

**Quality of Written Communication**

(maximum 2 marks)

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

**Total marks = 20**