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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Environmental Science 5441/6441

ESC4 Biotic Resource Management

Mark Scheme

2005 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.

Environmental Science

June 2005 **ESC4**

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

Statement	True	False
In subsistence farming, surplus production is burned		✓
The purpose of milk quotas is to ensure UK production of cheese and yoghurt is maximised		✓
Genetic variability cannot be introduced by vegetative propagation	✓	
Typically, agroecosystems involve the maintenance of complex food chains		✓
Polyploidy always results in fast-growing plants		✓

5

Total marks = 5

Question 2

(a) (i) 5 (cm); 1

(ii) As OM increases stability increases/positive correlation/OM binds peds; 1

(b) (i) Fertilisers/nitrates/N/ NO_3^- are soluble;
[**R** nutrients]
(less) leaching/percolation/ref. decreased movement/infiltration;
[**R** eutrophication]
ref. organic matter/binding/structure/increase H_2O holding;
less pesticides/herbicides used (because they control weeds);
ref. to (act as a) cover crop/mulches;
reduce intensity/volume of water reaching soil/ref. interception/protection;
releases nutrients slowly/plants use nutrients; MAX 4

(ii) Correct ref. (manufacture uses) fossil fuels;
Haber process;
ref. to CO_2/NO_x/NO/N_2O/NO_2/CH_4/CO;
[**R** SO_2 = neutral]
greenhouse gases;
green manure/crop uses/absorbs CO_2 (in photosynthesis);
less soil erosion;
less (airborne) particulates; MAX 4

Total marks = 10

Question 3

(a) (i) Higher the PSE, the more fertiliser used/positive correlation; 1

(ii) (High PSE leads to high fertiliser use) because farmer doesn't have to pay full cost/
E.U. C.A.P leads to maximised food production; 1
[**A** governments bear part of cost (of fertilisers)]

(iii) Lack of humus/organic matter/poor soil structure;
plough pans/compaction by machinery/poaching (by livestock);
decreased infiltration/increased run-off/gullying/rainsplash;
stubble burning/monoculture/ploughing winter planting/deforestation/ hedgerow removal/overgrazing;
unsuitable areas/marginal land/slopes/ploughed;
irrigation; MAX 3

(b) Named organism;
named characteristics/uniformity;
by mating/ref. progeny/young/offspring/artificial insemination/seeds; 3

(c) Ref. gene for production of vitamin A;
transferred into rice from another plant/species/transgenics; 2

Total marks = 10

Question 4

(a) (i) Light intensity/temperature/CO_2/N limit rate of photosynthesis/production/ productivity/growth/temperature and decomposition;
if named factor increases so does rate/decrease = rate slows;
factor closest to its minimum/shortest supply; MAX 2

(ii) Ref. to positive feedback = MAX 3;
ref to self regulation/negative feedback/dynamic equilibrium;
change, response, return to norm;
CO_2 increase;
temperature increase;
photosynthesis increase;
CO_2 decrease;
temperature decrease; MAX 4

(b) Building/cars/transport/industry/increase rice/intensive farming/livestock;
increasing fossil fuel use;
increasing CO_2/CH_4;
increasing temperature;
increasing decomposition;
reduced N store;
OR
building/cars/transport/industry/increase rice/intensive farming/livestock;
increasing fossil fuel use;
increasing SO_2/NO_x/HCI;
acid rain/acidification (reduces fertility);
reduced decomposition;
correct effect on a (biogeochemical) cycle; MAX 4

Total marks = 10

Question 5

(a) Correct ref. to repeat sampling;
declining catch;
declining average fish size/age;
changes to eggs/larvae;
ref. to (sexual) maturity; MAX 2

(b) Net energy use/unsustainable;
[**A** ref. to figures but not verbatim (from text)]
catching/processing uses fossil fuels;
increased CO_2/NO_x/enhanced greenhouse effect;
correct ref. to effects on food chains/wild stocks; MAX 2

(c) (i) Escape;
breed with wild fish; 2

(ii) Could become predator;
could compete for food;
pollution effects from fish farms/fish may spread disease/faeces/
waste/sea lice; MAX 2

(d) (i) High inputs;
temperature;
named example of inputs – e.g. control of food = pellets/concentrates;
pesticides/antibiotics/growth hormones;
capital;
fossil fuels;
controlled environments;
O_2;
high stocking density;
ref. battery farms/restrict movement; MAX 4

(ii) Yield which can be obtained indefinitely/will not harm future yields;
where growth and replacement (birth) equals/balances mortality and harvesting/catch = birth;
where population structure maintained;
leaves enough for breeding;
can't rely on fossil fuels/finite;
ref. to fishmeal/over-exploitation of wildfish for feed/oil;

MAX 3

Total marks = 15

ESSAY QUESTION

Question 6

(a) Malthus and Boserup
Club of Rome
government policies e.g. one-child
health care/contraception
education/literacy
food distribution problems
distortion of agriculture in developing countries
intensive food production
GM
trade/aid

scientific/technological factors
choice of production systems/crops
breeding
genetic engineering

OR

(b) Systems: subsistence, extensive, intensive, organic
Economic factors – population, food, demand, government support, labour
Environmental factors – climate, topography, edaphic factors, inputs, food miles
Ethical factors – GM, Multinationals, dependency. fossil fuels, resource exhaustion, vegetarianism, self sufficiency

Total marks = 20

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