

GCE 2004
June Series



Mark Scheme

Environmental Science – ESC4 (6441)

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Dr Michael Cresswell Director General

Environmental Science

June 2004

ESC4

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

Question 1

Process/Technique	Description
Vegetative propagation/asexual reproduction/cloning; [R division or propagation alone]	Use of corms, bulbs or runners to produce offspring that are genetically identical to parent plant
Organic agriculture/OWTTE;	Cultivation of food without using artificial fertilisers, synthetic pesticides or genetically-modified organisms
Transgenics	Transfer/insertion of genes/DNA from one species/plant/organism/animal into another; [R a genetically modified organism]

3

Total marks = 3

Question 2

- (a) Combination/variety of methods;

Any 2 or named examples:

biological: e.g. natural predators;

chemical: e.g. fungicides/pesticides/herbicides;

cultural: e.g. crop rotation/multicrop/companion cropping;

biotechnological: e.g. pest resistance/add a gene;

[R just pesticides]

[R organic and inorganic]

chem or bio = no mark

2

- (b) (i) Reduced effectiveness OWTTE/increased resistance/negative correlation/pesticide increases, mortality decreases;

1

- (ii) Some insects resistant/tolerant/adapted to pesticide;

[R immune/genetically immune]

survived to reproduce/OWTTE/ref to next generation;

resistance inherited/ selected for/genes passed on/ref to genes;

[A genetically changed]

higher level/dosage of insecticide needed;

MAX 3

Total marks = 6

Question 3

- (a) Ref to demand/economic viability/imports/sales;
deforestation;
root binding/interception/organic matter;
rainsplash/gullyng/overland flow/soil erosion/wash/run-off; MAX 3
[R soil exposed to...]
- (b) Reduced N/nitrate fertiliser use;
reduced leaching/less nitrate or N in water/less washing off/run-off;
less need to remove nitrate/less need for dilution/treatment; 3
[R N or nitrate is soluble]

Total marks = 6

Question 4

- (a) EU; 1
- (b) Increased intensification/increased crops/increased field size/increased
mechanisation/overproduction = destruction of hedgerows/ponds/woods/draining; 1
[A marginal land becomes profitable]
- (c) Set aside;
land taken out of production/fallow;
OR
(milk) quota;
maximum volume allowed/production limits;
OR
grants;
diversification or named examples rare breeds/petting farms/campaigning/paint balling;
OR
grants;
organics;
OR
removal of intervention prices;
decreased incentive to grow; 2

Total marks = 4

Question 7

- (a) South Asia; 1
- (b) (i) Carbon dioxide absorbed in photosynthesis (whole statement required);
stored as carbohydrate/fat/protein/cellulose/sugar/glucose/starch/wood/
biomass/organic products; 2
- (ii) Change of microclimate;
loss of vegetation/overgrazing/deforestation/root binding/less organic
matter/humus;
increased soil compaction/trampling/churning up;
increased soil erosion/wash/desertification/gullying/wind;
decreased infiltration/increased overland flow/run-off/increased
flooding/sedimentation of rivers; MAX 3
- (iii) Water table rises/ref to evaporation/salts brought/pulled up to surface;
leave salts behind;
salt water incursion; 2
- (c) (i) Subsidy means fossil fuels/or named;
finite; 2
- (ii) No OM added;
structure weakened;
erosion;
siltation/sedimentation;
reduced capacity;
dredging = costs
OR
leaching;
nitrate or phosphate;
eutrophication of reservoir (correct reference e.g. algal bloom);
(increased) costs of H₂O treatment; MAX 4
- (d) (i) Deforestation/slash and burn/vegetation burning ;
fossil fuels used in fertiliser manufacture/transport/machinery/used in
glasshouses;
ploughing/increased cultivation;
oxidation of carbon compounds; MAX 2
- (ii) Rice production/padi;
anaerobic decomposition/respiration;
ruminants/cows/cattle/livestock;
biomass burning; MAX 2

- (iii) Soil cultivation/ploughing;
oxidation of nitrogen compounds;
N-containing fertilisers;
biomass burning;
denitrification;
machinery (exhaust fumes)/production of fertilisers emits N_2O ; MAX 2

Total marks = 20

Question 8

- (a) Agriculture uses simple food chains
uses few genotypes/species
forests often monocultures
easier management
fishing is simple exploitation
little attempt to manage
little knowledge of food chains/webs
problems of calculating MSY;
exotic species in forestry
eradicates pests/parasites and biological control
reduces decomposition
removal of crop removes nutrients
complete harvest/clearfelling leaves soil bare
erosion
dependent upon external inputs
fertilisers
pesticides
inputs all based on fossil fuels
polluting
finite
energy ratio may be < 1

OR

- (b) Types of system
subsistence
commercial
organic
artificial
inputs and outputs
soil factors
climate factors
topography
economic factors

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	Material is logically presented in clear, scientific English. Technical terminology has been used effectively and accurately throughout.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors.
0	The essay is generally poorly constructed and often fails to use an appropriate scientific style and terminology to express ideas.

Total marks = 20