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General Certificate of Education (A-level)
June 2012

Environmental Studies ENVS4

(Specification 2440)

Unit 4: Biological Resources and Sustainability

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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 students' 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 Studies

June 2012 **ENVS4**

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

Question 1

<table>
<tr><th></th><th>Answers</th><th>Mark</th></tr>
<tr><td>1</td><td>
<table>
<tr><th>Term</th><th>Letter</th></tr>
<tr><td>Limiting factor</td><td>F</td></tr>
<tr><td>Gross Growth Efficiency</td><td>D</td></tr>
<tr><td>Growth Rate</td><td>A</td></tr>
<tr><td>Productivity</td><td>C</td></tr>
<tr><td>Abiotic factor</td><td>B</td></tr>
<tr><td>Intensive agriculture</td><td>H</td></tr>
<tr><td>Extensive agriculture</td><td>E</td></tr>
<tr><td>Efficiency</td><td>I</td></tr>
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; ; ; ; ;
</td><td>5</td></tr>
<tr><td>Total</td><td></td><td>5</td></tr>
</table>

Question 2

	Answers	Mark
2(a)	correct identification of 120, 0.22, 0.25**;** 3.465 / 3.47 / 3.5**;** [**R** 3.46 and 3.50] **2 marks** for correct answer allow correct calculation based on one error for **1 mark**	2
2(b)(i)	3.5475 / 3.548 / 3.55 / 3.5**;** [**R** 3.54, 3.50]	1
2(b)(ii)	1.3514 / 1.351 / 1.35 / 1.4**;** [**R** 1.40, 1.350, 1.3]	1
2(c)	Root binding**;** [**R** roots increase stability] more DOM/humus**;** (foliage/trees) protect against rain(splash)/interception**;** (foliage/trees) protect against wind/reduce wind speeds**;** leaf litter/mulch protects against rain(splash)/interception**;** leaf litter/mulch protects against wind/reduce wind speeds**;** long term crops/reduced tillage/soil disturbance**;**	2
2(d)	Lower stock density**;** prevent overgrazing/supplementary feeding to reduce grazing**;** restrict/rotate grazing areas**;** remove from pasture in wet/very dry weather**;** prevent trampling/poaching (of soil)/compaction**;** siting/moving/protecting feeding/drinking/congregation areas**;** choice of livestock species**;** why species reduces erosion**;** eg not close-grazing hooves that dislodge soil less [**R** reference to manure increasing OM content]	MAX 4
Total		**10**

Question 3

	Answers	Mark
3(a)	Advantages**;;;** eg all have the same/predictable characteristics same nutrient requirements same pollination time same pest management requirements same growth rate/ripening/harvest time (for mechanised harvesting) same height/size/shape for harvesting uniform marketability max 3 [**R** timing of agrochemical application] Disadvantages**;;;** eg all susceptible to same pests/diseases same ripening/harvest time (for manual harvesting) all have same range of tolerance eg of environmental change that could not be survived reduced crop gene pool/reduced <u>crop</u> biodiversity hybrid seeds expensive/progeny not true breeding max 3 [**R** general reduction in biodiversity]	MAX 4
3(b)	Stimulation of ovulation/use of FSH/(multiple) ovulation/(more) eggs/ <u>more</u> embryos/fertilisation/IVF**;** (implantation in) surrogate/other female/multiple females/donor female spends less time pregnant**;**	2
3(c)	(Artificial transfer of) genes from another species/variety**;** (pollination) only uses genes from one gene pool**;** inserted/spliced into (recipient) DNA/chromosome**;** transgenics/horizontal gene transfer**;** example of GM variety**;** eg Bt crops, Roundup-ready crops, golden rice	MAX 2
3(d)(i)	163**;**	1
3(d)(ii)	5% (or lower) probability that results were produced by random chance/ 95% (or greater) probability that results were not produced by random chance**;**	1
Total		**10**

Question 4

	Answers	Mark
4(a)(i)	Fast growth**;** suitability for climate conditions**;** suitability for soil conditions**;** even annual growth**;** straight trunks**;** less pest/disease susceptibility**;** market demand**;**	MAX 2
4(a)(ii)	Competition for light**;** weed suppression**;** straight trunks**;** tall trunks**;** fewer knots/side branches**;** [**R** reference to high yield]	MAX 2
4(b)(i)	Transect**;** 1 regular/systematic spacing of readings**;** readings all taken at the same time**;** readings all taken at the same height above ground**;** repeats at each site to compensate for wind variability**;** replicates for statistical test/confidence level**;** anemometer/meter/device for measuring wind velocity**;** max 4 [**A** reference to repetition in different seasons if clearly linked to deciduous forests/leaf cover]	MAX 5
4(b)(ii)	Spearman rank**;** [**A** t-test if method in **4(b)(i)** measures wind speed in/out of plantation]	1
Total		**10**

Question 5

	Answers	Mark
5(a)	Concerns over/awareness of environmental impact/sustainability**;** concerns over/awareness of public/human health/personal choice**;** concerns over/awareness of livestock welfare**;** max 1 named environmental impact/sustainability issue**;;;** eg fertilisers causing eutrophication pesticides harming biodiversity fossil fuel use in agrochemical manufacture causing global climate change/named pollutant released avoidance of GM named public/human health/personal choice issue**;;** eg pesticide/fertiliser residues in food/toxicity blue baby syndrome/methaemoglobinaemia flavour, appearance or other stated aesthetic impact response to advertising/education/media increasing affluence named livestock welfare issue**;** max 4 eg free-range/battery lack of natural behaviour veterinary medicines only credit same example more than once if linked to specific different issues	MAX 4
5(b)(i)	Method of maintaining nutrients linked description of how method works manure/compost/fishmeal/dried blood/named organic waste**;** recycling of biological materials/slow release of nutrients**;** green manures (ploughed back in)**;** manure crop retains nutrients reducing leaching**;** legumes/named legume**;** (root) nodule bacteria/*Rhizobium*/nitrogen fixation**;** mixed farming**;** food for livestock and manure for crops**;** crop rotation**;** prevents continuous use of same nutrients**;** [**R** mulching]	MAX 3

Question 5 continued

	Answers	Mark
5(b)(ii)	Natural predators/parasites/diseases**;** named conserved habitat**;** eg hedges/unsprayed field margins/beetle banks crops with natural pest/disease resistance**;** crop rotation to prevent pest build up**;** do not use monoculture/use polyculture to hamper pest colonisation**;** high crop density to suppress weeds**;** lower crop density to reduce pest/disease susceptibility**;** sow seeds later (to accelerate germination and early growth)**;** raise seedlings to protect young plants then transplant**;** soil moisture control to reduce decay/maintain optimum growth**;** control soil pH so unsuitable for pests**;** attractant/sacrificial crop**;** repellent/barrier crops**;** mulching to suppress weeds**;** introduced predators/parasites/diseases**;** pheromone traps**;** sterile male techniques**;** culling of animal pests/removal of weeds**;** physical barriers**;** eg fences, nets use of animal growth hormones (to disrupt pest life cycles)**;**	MAX 3
Total		**10**

Question 6

	Answers	Mark
6(a)	Some juveniles die as lack of space in adult population**;** spaces created by fishing increase juvenile survival**/**caught adults replaced**;**	2
6(b)(i)	Reduced cohort/total population size**;** accurate reference to values eg 70 million to 8 million at age 5**;** lower mean (modal) age**;** modal age reduced from 5 to 4**;** shorter life expectancy**;** no fish over 8 in fished population/greatest age in non-fished population 10 (or over)**;** **or** greatest age reduced from 10 (or over)**;** to 8**;**	MAX 4
6(b)(ii)	Fish becoming larger**;** survive <u>to breed</u>**;**	MAX 1
6(b)(iii)	(Minimum population size) that can sustain itself**;**	1
6(c)(i)	Breed late**;** low fecundity/fewer eggs**;** more caught before breeding age**;** mixed shoals – impact on juvenile fish**;** killed by pressure drop/fished from great depth, discards do not survive**;** [**A** high by-catch rate]	MAX 3
6(c)(ii)	Removal of non-target species**;** less food**;** other named inter-species relationship (on which Orange Roughy rely)**;**	MAX 2
6(d)	Protected breeding population/spawning habitat**;** colonisation of/migration to surrounding area**;**	2
Total		**15**

Question 7

	Answers	Mark
7(a)	Design Pollution control catalytic converters reduce NO_x, CO, HCs urea/ammonia to reduce NO_x Energy use aerodynamics increased efficiency fuel changes hybrid/fuel cell/battery materials weight reduction fibre glass/carbon fibre/aluminium energy recovery braking energy storage (cars)/return to grid (trains) design for end of use ease of recycling Use mass transport lower energy per passenger mile speed control optimum speed acceleration/brakings reduced energy loss	20
7(b)	Habitat damage in construction wetlands/mangroves energy inputs heating/cooling/aeration/water pumping catching breeding stock/young stock fish reduction of wild population catching food fish overfishing by-catch/environmental damage of catching eg bottom trawling/drift nets organic nutrient pollution faeces/waste food inorganic nutrient pollution from breakdown of faeces/waste food pesticide pollution eg for control of weed growth antibiotic use disease control pests spread to wild fish eg lice escapees	20

Question 7 continued

	Answers	Mark
7(c)	Increase consumer goods domestic appliances cars disposable goods travel/transport car usage/vehicle choice long-distance holidays food miles energy use heating/air conditioning lighting water use Decrease more expensive low-impact choices low-energy appliances expensive new technologies photovoltaics LED lights hybrid cars organic food fairtrade products	20
		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 is 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, 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. Spelling, punctuation and grammar are almost always correct. Technical terminology has been used effectively and accurately throughout. At least one page of material is presented.
1	Account is logical and generally presented in clear, scientific English and continuous prose. Minor errors occur in spelling, punctuation and grammar. Technical terminology has been used effectively, but may contain minor errors. At least one page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas. Continuous prose is not used. Spelling, punctuation and grammar contain a range of errors. Little technical terminology is used. Less than one page of material is presented.

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