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General Certificate of Education (A-level)
June 2013

Environmental Studies ENVS4

(Specification 2440)

Unit 4: Biological Resources and Sustainability

Final

Mark Scheme

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Environmental Studies

June 2013 **ENVS4**

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

Question 1

	Answers	Mark
1		5

Technical Term	Definition	
Carrying capacity	**The maximum population that can be sustained/supported sustainably**	;
Transgenics/ genetic engineering	*Genetic modification by the transfer of genes into a different species*	;
Heterotrophic nutrition	*Gaining food energy from other living organisms*	
Mulch(ing)	*The control of weeds by adding shredded vegetable matter to the soil surface*	;
Polyculture	**The growth/cultivation of more than one crop/species grown in an area (together)**	;
Steroid hormones	*Agrochemicals used to increase the Gross Growth efficiency of livestock*	
Productivity	*Yield per unit area*	
Sustainable development/ sustainability	*Changes in society that meet the needs of the current generation without reducing the ability of future generations to meet their needs*	;
Efficiency	*Yield per unit input*	

Total		**5**

Question 2

	Answers	Mark
2(a)	Shorter food chain/higher energy efficiency/fish at lower trophic level; lower food inputs/do not need to be fed meat/fishmeal; higher productivity per unit area; use plant food inedible to humans; lower named fishing impact;	MAX 2
2(b)	Temperature - heating/cooling/thermostat/geographical location/shading; oxygen - (air) pumping/water agitation/spray/weirs; water flow rate - pumping/location in area of current; pH control - lime/buffers/neutralisers; light levels - artificial lighting/shading/turbidity reduction; turbidity - sedimentation/filtration/reduce flow; (mineral) salts/nutrients - addition of/removal of; ammonia - removal using bacteria;	MAX 4
2(c)	Pathogens/named pathogen/parasites/disease; increased BOD; increased turbidity/suspended solids/sedimentation; decomposition/bacterial action; deoxygenation; death of aerobic/clean water organisms; nitrate/phosphate/inorganic nutrient release; eutrophication; algal bloom; toxins (released by blue-green algae/cyanobacteria); shading; death of macrophytes/aquatic plants;	MAX 4
Total		**10**

Question 3

	Answers	Mark
3(a)	Standardised/controlled (more easily) in laboratory**;** named feature controllable in laboratory**;;;** eg soil depth soil type/named soil feature gradient water addition/loss wind (velocity) vegetation easier collection/measurement of runoff/soil water easier collection/measurement of eroded soil named practical advantage**;** eg travel to site/labour cost environmental/wildlife damage easier repetition qualified health and safety comment	MAX 4
3(b)	<u>Measure/control/range</u> of plant spacing/number/density/cover**;** controlled variables**;;** eg same plant type same plant size/height/leaf cover same watering rate/wind velocity water drop size/height same slope/compaction same time period same soil type same mass/volume/depth/amount of soil collection of soil/water**;** measure eroded soil/turbidity**;** replication for (statistical) significance/statistics test**;**	MAX 4
3(c)(i)	22**;**	1
3(c)(ii)	(Significant at) 0.01/1%/confident at 99%**;** [**A** correct statement for wrong degrees of freedom calculated in **(c)(i)**]	1
Total		**10**

Question 4

	Answers	Mark
4(a)(i)	More <u>varied</u> named abiotic factor**;;** eg light levels temperature nutrients water availability humidity texture, eg bark More <u>varied</u> named biotic factors**;;** eg habitats/niches food (types) disease pollinators seed dispersal species other interdependent relationships ease of colonisation (by already adapted) indigenous species	MAX 2
4(a)(ii)	Different growth rates**;** different nutrient requirements**;** different/more pest control requirements/no single pest treatment**;** varied timing of operations**;** lack of economies of scale/selective logging not clear fell/ more labour intensive**;**	MAX 2
4(b)	Systematic/random sampling**;** [**R** stratified sampling] quadrats**;** of suitable/stated size**;** representative number of samples/proportion of area**;** identify (different species)/species richness/number of different species**;** abundance/count (individuals of each species)**;** percentage cover/biomass**;** diversity index**;** statistical test**;**	MAX 6
Total		**10**

Question 5

	Answers	Mark
5(a)(i)	4 200 000 000/4.2 x 10^9/42 x 10^8 or any other correct standard form**;**	1
5(a)(ii)	200 000 x 7.6 x 375 = 570 x 10^6 570 x 10^6 ÷ 1.5 = 380 x 10^6 (380 x 10^6 ÷ 28 x 10^9) x 100 = 1.36 200 000 x 7.6 x 375 **OR** 570 x 10^6 **OR** 570 000 000 **OR** ÷ 1.5 and ÷ 28 x 10^9**;** 1.36 **or** 1.357**;** [**A** 1.4] award both marks for correct final answer	2
5(b)	Named method that involves energy inputs to increase crop yields**;;;;** eg machinery use/named machine manual/animal labour manufacture of fertilisers manufacture of pesticides transport (not post-harvest) irrigation drainage heating/cooling lighting burning fuel to generate CO_2 embodied energy/manufacture of materials	MAX 4

Question 5 continues on the next page . . .

Question 5 continued . . .

	Answers	Mark
5(c)	**Advantage;;;** one linked example/feature per advantage**;;;** for example: transfer of genes between species introduce new characteristics (impossible within crop species)/ no unwanted genes introduced increased yield/growth rate eg GM corn, GM soya, GM cotton pest control eg Bt corn, Bt cotton nutritional content eg Vitamin A/Golden rice pesticide resistance eg Roundup ready-soya disease resistance eg papaya ringspot virus potato late blight zucchini viruses drought resistance eg corn, gene from bacteria storability eg apples slower browning non-softening tomatoes better marketability eg taste, colour, appearance **Disadvantage;;;** one linked example/feature per disadvantage**;;;** for example: genetic contamination eg pollen from GM crop transferred to organic crop/wild species public health issue concern eg allergies environmental impact eg toxic pollen, Bt corn – monarch butterflies horizontal gene transfer eg possible transfer from crops to weeds/bacteria cost of buying new seed each year eg terminator genes increased insect resistance to GM toxins eg spread of Bt resistance	MAX 8
Total		**15**

Question 6

	Answers	Mark
6(a)	Increased rents/land prices**;** loss of land**;** loss of other foods**;** lower income/loss of employment**;** rural depopulation**;** cannot afford expensive inputs**;** reliance on bought seed (F1 hybrids)**;** pesticide poisoning**;**	MAX 2
6(b)(i)	Named (uniform) input**;** named (uniform) cultivation/harvesting/processing method/marketability/ feature**;**	MAX 1
6(b)(ii)	Equal susceptibility to disease/pests/named factor**;**	1
6(c)	Pesticide resistance**;** pesticide pollution**;** fertiliser pollution**;** energy inputs from fossil fuels/unsustainable sources**;** named impact of fossil fuel use**;** over exploitation of water source**;** salinisation**;** habitat loss (due to agricultural expansion)**;** loss of agricultural gene pool/biodiversity**;** extinctions/loss of wild biodiversity**;** loss of carbon store**;** increased soil compaction/erosion**;** poor choices made by/opportunities for economically disadvantaged**;** extraction damage for materials**;**	MAX 6
Total		**10**

Question 7

	Answers	Mark
7(a)	Ecotourism, recreation, aesthetics hydrological cycle soil erosion atmosphere – carbon dioxide/oxygen temperature regulation resources – eg timber, oils, fibres, food, medicines genetic resource indigenous peoples	20
7(b)	Catch quotas size limits fishing effort control NTZ closed seasons protected individuals population seeding by-catch control ghost fishing control control of other damaging activities – fishing, dredging advantages and disadvantages in terms of: (long-term) sustainability production cost income/employment	20
7(c)	Credit for strategies for sustainable development accept strategies for general environmental protection named summits/agreements Stockholm 1972 Brundtland Commission 1983 Rio 1992 Agenda 21 Johannesburg 2002 Aid commitments named legislation waste management – recycling, landfill renewable energy – premium prices, subsidies pollutant emissions – carbon, SO_x, NO_x, catalytic converters transport – congestion charges mining – aggregates tax planning controls habitat/species protection	20
Total		**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, 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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