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General Certificate of Education (A-level)
June 2011

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 candidates' 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 candidates' 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 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 Studies

June 2011 **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>Definition</th></tr>
<tr><td>Maximum sustainable yield</td><td>The maximum allowable harvest that will not change the ability of the resource to supply that harvest indefinitely</td></tr>
<tr><td>Pollution</td><td>Energy/matter/chemicals
(released into the environment with the potential to cause)
adverse changes/damage to an ecosystem/environment ;</td></tr>
<tr><td>Overpopulation</td><td>Excess of population over resources/ carrying capacity ;</td></tr>
<tr><td>Agroecosystem</td><td>The living organisms/biota and physical processes/abiota and their interactions/which are (human) controlled in a (artificial) farming/agricultural ecosystem ;</td></tr>
<tr><td>Monoculture</td><td>(repeated) growth of a single crop (over a large area/long time) ;</td></tr>
<tr><td>Cross breeding</td><td>Mating (parents of two) different breeds/varieties to produce (offspring with desired/different) combinations/characteristics ;
[R species]</td></tr>
</table>
5</td></tr>
<tr><td>Total</td><td></td><td>5</td></tr>
</table>

Question 2

	Answers	Mark
2(a)(i)	0.1%;	1
2(a)(ii)	1%;	1
2(b)	Nutrients – fertilisers/root nodule/nitrifying bacteria; soil pH – lime; H_2O – irrigation/drainage; pests – pesticides/bio control; temperature – heating/ventilation; CO_2 – burn fuel/return flue pipes from central heating; soil O_2 – aeration/ploughing/drainage; light – lamps/shades; reduce movement/respiration of livestock; (plant/animal) hormones; genetic manipulation/selective breeding;	MAX 2
2(c)	On marginal land (where crops cannot grow)/land too dry/shallow soil/ steep topography/low nutrients/rocky/cold/acidic; ruminants/ livestock can utilise (endemic) plants unsuitable for humans;	2
2(d)	Choice of season (for ease of plant identification); use of quadrats; random numbers/sampling; [**A** systematic or stratified sampling] grid and/or co-ordinates; weeds identified; number of individuals counted/frequency/density/% cover; <u>large</u> number of quadrats; [**A** large number along transects] repeat investigation on different dates; to assess significance of data/obtain representative sample; description of distribution; eg random = variation in number of plants in quadrats/variation in number of quadrats with plants clustered = only some quadrats show plants uniform = similar/same number in every quadrat avoid trampling/crop damage; ref nearest neighbour index;	MAX 4
Total		**10**

Question 3

	Answers	Mark
3(a)(i)	Nigeria: higher energy intake/not lowest % cash crop/not negative correlation**;**	1
3(a)(ii)	Malnutrition/famine/reduced food supplies**;** volatile world market for (luxury) crops**;** (subsistence) farmers become landless/unemployed/urban drift**;** reliance on mechanisation/agrochemicals is unsustainable**;** reliance on single/few crops**;** new export cash crops not as suited to local environment/pests/climate**;** lack of (subsistence) farmers' knowledge of growing new crop**;** profits go to TNCs/abroad**;**	MAX 3
3(b)	Economies of scale**;** ease of pest control/fertiliser/machinery use**;** low labour inputs**;**	3
3(c)	Decreased tourism**;** less seed dispersal/pollination (for forest regeneration)**;** less crop pest predation**;** specific food chain impact**;** decline of bush meat species**;** impact on non-target species**;** habitat destruction <u>for hunting</u>**;** eg burning/clearings ref species interdependence**;** eg elephant water holes	MAX 3
Total		**10**

Question 4

	Answers	Mark
4(a)	River inflow has decreased**;** river inflow has decreased faster/more (than evaporation rates)**/** (ratio) evaporation : river inflow has increased**;**	2
4(b)	Increased salinity**;** pollution concentration**;** decreased fish stocks**;** lower crop yields/food supply**;** [**A** famine] local climate change/named example of**;** [**R** drought] dust/salinisation/salt storms/soil erosion/desertification**;** respiratory problems**;** migration**;** consequence of settlements 'high and dry'**;**	MAX 4
4(c)	Windbreaks**;** increase interception/infiltration/reduce rain splash/runoff**;** reduce evaporation/drying of soil**;** root binding**;** add organic matter/improves soil structure**;**	MAX 4
Total		**10**

Question 5

	Answers	Mark
5(a)(i)	Output or yield divided by input**;**	1
5(a)(ii)	No inputs of hormones/antibiotics/food/nutrients**;** no <u>energy</u> inputs for temperature control/aeration/water flow**;** short (travel) distances to fishing grounds**;** shorter food chain**;** shellfish are sessile/move less**;**	MAX 2
5(b)	Sea bed/benthos not damaged**;** less by-catch/more species specific**;** less food web effects**;** less ghost fishing**;**	MAX 3
5(c)	0 – 1 assumptions = 0 marks 2 – 3 assumptions = 1 mark**;** 4 assumptions = 2 marks**;;** eg individuals are mobile and can be caught births/deaths do not (significantly) affect the population being caught/marked does not affect mortality population not significantly affected by migration population mixes freely/not territorial all members of population equally likely to be caught mark/tag is not lost	2
5(d)	More line fishing/less use of nets/trawling**;** exclusion zones to protect <u>named</u> by-catch taxon**;** escape panel/Turtle Escape Device**;** line sinkers**;** night fishing**;** decoy lures**;** hook design**;** dolphin discs**;** justified smaller net size**;** eg dolphins cannot escape huge pair trawls whales etc cannot swim around very long drift nets by-catch proportion monitoring**;** increased mesh size/change mesh shape**;**	MAX 2
Total		**10**

Question 6

	Answers	Mark
6(a)(i)	Based on sample data/estimates/accuracy uncertain/5% chance results are outside these extremes/indicates degree of reliability/variability of data**;** [**R** range of data]	1
6(a)(ii)	Temperate region previously damaged/before 1970**;** more conservation effort/legal protection in MEDC/temperate region**;** (more) fragile ecosystem/species/food webs in tropics**;** greater (recent) human population expansion in tropics**;** (affluence in) MEDCs increases demand for tropical products**;**	MAX 3
6(b)	Problems related to: tropical forest as a carbon sink/atmospheric regulation**;** water cycle**;** loss of named forest products**;** loss of medicines/cures**;** loss of genetic resources/reduction in gene pool**;** unsustainable development only lifts LEDCs out of poverty temporarily**;** soil erosion**;** resulting overexploitation of other areas**;**	MAX 4

Question 6 continued

6(c)	Reduce human population**;** shorten food chain/ref vegetarianism**;** promote organic/less intensive farming**;** use named renewable energy resource**;** reduce imports/food miles/buy local goods**;** tree planting**;** named energy conservation method**;** named water conservation method**;** education**;** named economic strategies**;** eg landfill tax carbon tax congestion charges/toll road Environmental Stewardship Scheme named legislation**;** eg Clean Air Act Environmental Protection Act named protocol/summit**;** eg Rio de Janeiro Kyoto Copenhagen CITES named pollution control technology**;** eg carbon sequestration method flue gas desulphurisation catalytic converters [**A** use of hydrogen/fuel cells] waste reduction**;;** eg 5 Rs design for end of life reference planned obsolescence 'bag for life' reduced packaging	MAX 7
Total		**15**

Question 7

	Answers	Mark
7(a)	*Discuss the environmental and social impacts of agriculture* Habitat impacts: eg forest clearance drainage of wetlands ploughing of grasslands reduction of biodiversity GM contamination New habitats: pond creation stonewalls/buildings succession/prevention open grassland landscape variety conservation farming: eg corncrake farming, beetle banks, skylark scrapes ref designations eg stewardship, FWS Pollution impacts: caused by pesticides – bioaccumulation, biomagnification, non-target species nutrients – eutrophication methane/nitrous oxide – global climate change increased river turbidity increased mechanisation/intensification/carbon dioxide Changes to water cycle: increased surface runoff caused by soil compaction changes in evapotranspiration compared to previous vegetation aquifer depletion salination surface water dries up less flooding Accelerated soil erosion: rain splash wind blow surface runoff Effects of soil erosion: reduced productivity sedimentation of rivers/reservoirs flooding downstream coastal sedimentation increased atmospheric particulates desertification landslides	

	Social impacts: supports increased human population (food) tourism and employment uneven distribution of food malnutrition animal welfare issues, battery farming trade trap (misuse of land/pollution =) loss of natural productivity famine refugee movements influence of TNCs – encourage replacement of subsistence farming with cash crops subsistence farmers become landless or cultivate marginal/unsuitable land credit relevant, named examples	20
OR 7(b)	*Discuss the role of forests as a resource for the human population* building construction ref/examples hardwoods/softwoods furniture tools fibres – paper, jute fuelwood food – coffee, nuts, papayas pharmaceuticals/medicines – vincristine, diosgenin, quinine carbon sink/sequestration – limit gcc release oxygen maintenance of ozone layer moderates climate extremes – evapotranspiration, low albedo alters rainfall down wind regulates water cycle – evaporation, transpiration interception reduces run off/flooding reduces soil erosion helps maintain/form soils provides habitat for wildlife living laboratory/scientific investigation recreation/ecotourism amenity use/psychological oases education	20

OR 7(c)	*Discuss the manipulation of species for human consumption in food production systems* optimum livestock/crop densities GM domestication selective breeding/out breeding/cross breeding – to improve gross growth efficiency, taste, nutrient content, pest/disease resistance, uniformity of appearance, timing of growth, docility artificial insemination and embryo transfer pedigree books rare breeds as DNA source vegetative propagation and micropropagation plant hormones animal hormones – BST, steroids named food production systems as egs	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, 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. 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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