



A-LEVEL

Environmental Studies

ENVS4: Biological Resources and Sustainability
Mark scheme

2440
June 2016

Version/Stage: 1.0 Final Mark Scheme

Mark schemes are prepared by the Lead Assessment Writer 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 associates 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 associate understands and applies it in the same correct way. As preparation for standardisation each associate 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, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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 2016

ENVS4

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

AO = Assessment Objective

Question	Answers	Mark	AO / Spec. Ref.		
1	<table border="1"> <thead> <tr> <th data-bbox="304 741 628 808">Term</th> <th data-bbox="628 741 1179 808">Definition</th> </tr> </thead> </table>	Term	Definition	5	AO1 3.4.2
	Term	Definition			
	Vegetative propagation	Use of corms, bulbs, or runners to produce offspring that are genetically identical to the parent			
	Selective breeding	Producing offspring with desirable characteristics/alleles/genes (by choosing the parents); [A choosing parents to remove unwanted traits in offspring] [R from different species]			
	Micropropagation/ cloning/cuttings/ tissue culture;	A technique used to produce genetically identical offspring from small pieces of parent plant tissue			
	Monoculture	Growth of a single type of crop/species;			
	Crop rotation	Growing a different crop in a field on a cycle of three, four or five years			
	Tillage/ploughing/ digging/rotavating;	Cultivation by turning over the soil			
Heterotrophic nutrition	Gaining food/energy from other organisms; [A relying on autotrophs for food/energy]				
Total		5			

Question	Answers	Mark	AO / Spec. Ref.
2(a)(i)	temperature – increased photosynthesis/chemical reactions/ longer growing season/reduced frost damage; CO ₂ – increased photosynthesis; light intensity – increased photosynthesis; day length/light duration – longer growing season/ control of flowering; water/humidity control – gaseous exchange/transpiration/ nutrient absorption/turgidity; physical damage – reduced wind/rain impact; pollination – introduced pollinators; nutrients – reduced leaching/more precise supply; pest control – barrier to pests/named more effective method; eg biological control, pheromone traps, pesticides	max 3	AO1 3.4.2
2(a)(ii)	Advantage control of: nutrient levels; pH levels; O ₂ levels; no soil pests; more efficient nutrient uptake/smaller roots; Disadvantage cost of initial set up; named energy inputs; greater degree of technical skill required; water borne disease spread through the system/affect all plants; back up energy supply needed (power cuts); depletion of nutrient solution in long plant run;	max 1 max 1	AO2 3.4.2

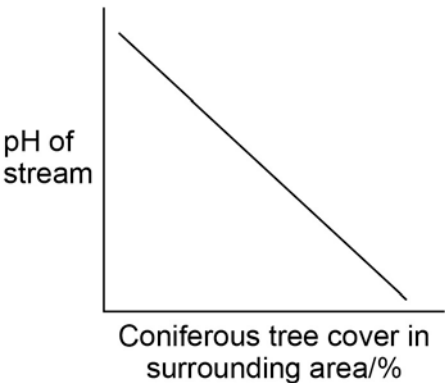
Question	Answers	Mark	AO / Spec. Ref.
<p>2(b)</p>	<p>sustainable;;; eg fix nitrogen/increase soil nitrates/ammonium reduced eutrophication/energy inputs for manufacture/named problem linked to fertilisers reduced food miles for livestock feed/less fossil fuel use due to reduced imports of other crops reduced energy loss/shorter food chain if used as human food reduced impact of soya production</p> <p>unsustainable;;; eg increased susceptibility to pest infestation leading to increased pesticide use reduced wildlife biodiversity fewer pollinators increased food miles for human consumption/more fossil fuel use due to export increased energy loss/longer food chain if fed to livestock first more land needed for growing crops for human consumption</p>	<p>max 5</p>	<p>AO2 3.4.5</p>
<p>Total</p>		<p>10</p>	

Question	Answers		Mark	AO / Spec. Ref.
3(a)(i)	Marine ecosystem	Primary productivity / $\text{g m}^{-2} \text{yr}^{-1}$	1	AO1 3.4.3
	upwelling zone	400 – 1000		
	continental shelf	200 – 400		
	open ocean	2 – 400		
3(a)(ii)	nutrients are a limiting factor/control productivity; nutrient availability controlled by: currents from sea bed; runoff from land; storm disturbance of sea bed; loss to sea bed;		max 2	AO1 3.4.3
3(b)(i)	$\frac{620\,000 - 180\,000}{620\,000} \times 100 = 71 \text{ (to 2 sig fig) ;}$ [R 70.96,71.0]		1	AO2 3.4.3

Question	Answers	Mark	AO / Spec. Ref.
<p>3(b)(ii)</p>	<p>Period 1980 – 1985 impacts of overfishing in (1970s and 80s) not yet evident/fish stocks not yet collapsed;</p> <p>Period 1985 – 2001 stated cause of population decline;;; eg overfishing/fishing at greater than MSY quotas set too high net mesh too small fish removed before they have reproduced/reached sexual maturity increase in trawler numbers/size trawlers at sea for longer/increase use of factory ships poor recruitment due to increase in water temperature/ increased predation disease echo location use of larger/stronger nets sea bed damage to food stocks/nursery grounds reduced food source due to over exploitation/bycatch</p> <p>[A decline in catch due to increasingly strict quotas]</p> <p>Post 2001 stated cause of population increase;;; eg fishing reduced below MSY appropriate quotas set larger mesh size fish allowed to reach sexual maturity reduced fishing effort NTZ closed seasons/temporary fishing bans</p> <p>max 3 if no reference to dates shown by data</p> <p>credit each feature of fishing only once</p>	<p>max 4</p>	<p>AO2 3.4.3</p>
<p>3(c)</p>	<p>more selective due to number/shape of hooks/size of bait; (live)undersized fish thrown back/released; greater proportion of smaller fish survive to grow and reproduce; stated benefits of reduced seabed damage; stated benefits of reduced bycatch;</p>	<p>max 2</p>	<p>AO2 3.4.3</p>
<p>Total</p>		<p>10</p>	

Question	Answers	Mark	AO / Spec. Ref.
4(a)	cheap labour; low taxes; subsidies/grants; guaranteed market/price; cheap land;	max 2	AO1 3.4.4
4(b)(i)	$(80\% \times 50\,000\,000 = 40\,000\,000 \text{ tonnes})$ $101\,172 + 56\,656 = 157\,828 \text{ km}^2$ $\frac{(40\,000\,000)}{(157\,828)} = 253;$ [A 250, 253.4] [R 254, 253.44]	1	AO2 3.4.4
4(b)(ii)	21;	1	AO2 3.4.4
4(c)	(inbreeding) reduces gene pool/genetic diversity; insufficient food supply/territory size too small; loss of pollinators/seed dispersal agents; increased named edge effect (less suitable conditions for survival); increased accessibility for bushmeat hunting/human encroachment;	max 2	AO1 3.4.4

Question	Answers	Mark	AO / Spec. Ref.
<p>4(d)</p>	<p>land selection; eg certification based on sustainable methods legislation restricting areas cleared no burn (policy) for land clearance</p> <p>cultivation methods;;; eg reuse/treatment of waste water reduce (inorganic) fertiliser use by planting legumes/ green manure crops/manure addition of OM/manure to improve soil structure/water retention</p> <p>use of cover crops/intercropping/mulching to reduce soil erosion reduce runoff by vegetation/ buffer strips avoid planting on steep slopes/near rivers</p> <p>mulching to reduce weeds integrated pest control use of GM/pest resistant varieties</p> <p>[A HYV reduce need for plantation expansion] [A crop rotation related to nutrient depletion]</p> <p>wildlife inclusion; eg leave connected forest areas/use of biological corridors multicropping to increase biodiversity avoidance of sensitive habitats for primates/named taxon</p> <p>fair trade/worker conditions/rights; eg fair trade prices for produce fair incomes provision of worker facilities alternative food supplies to reduce dependency on bushmeat involvement of locals in decision making process</p>	<p>max 4</p>	<p>AO2 3.4.5</p>
<p>Total</p>		<p>10</p>	

Question	Answers	Mark	AO / Spec. Ref.
5(a)(i)	 <p>[A any downward trend]</p>	1	AO3 3.4.6
5(a)(ii)	Spearman rank;	1	AO3 3.4.6
5(a)(iii)	with increasing % coniferous tree cover pH decreases; [A negative correlation/directional/null hypothesis]	1	AO3 3.4.6
5(a)(iv)	5% probability that the results were produced by chance/ 95% probability that the results were not produced by chance;	1	AO3 3.4.6
5(b)	acidic pollutants deposited on conifer needles/selective nutrient uptake changes pH; [A decomposition of needles] leaching of acidic solution into nearby streams/acid(water)runoff;	2	AO3 3.4.6
5(c)	low pH – fewer caddis fly larvae; low pH – longer Dipper territory; less food/fewer caddis fly larvae – longer territory length; longer territory length – fewer Dipper breeding pairs; less food/fewer caddis fly larvae – fewer Dipper breeding pairs; fewer Dipper breeding pairs – indicator of low pH; low pH is water quality indicator;	max 4	AO3 3.4.6
Total		10	

Question	Answers	Mark	AO / Spec. Ref.
6(a)	<p>Details related to organic matter;;; eg manure/crop residues increase nutrients/N/P pits prevent organic matter being washed away N needed for amino acids/proteins/nucleic acids/ATP P needed for nucleic acids/DNA/ATP/proteins increased aeration/soil biota crop residue/OM/biota increases in filtration humus/crop residue/OM absorbs/retains water</p> <p>Details related to water;; eg aids nutrient uptake reduced runoff/less leaching pits increase infiltration water a limiting factor/needed in photosynthesis</p> <p>Details related to increased pH; eg increase microbial activity/decomposition of soil OM increased nutrient availability</p> <p>Details related to pest control; eg lower spread of pests/easier pest control weed suppression/easier weeding</p> <p>Details related to soil erosion; eg less soil erosion</p>	max 6	AO2 3.4.2
6(b)	<p>not easily mechanised/labour intensive/more time consuming; large amounts of manure needed/farmers need access to cattle; financial investment required for cattle/manure/crop residue; risk of waterlogging/named anaerobic process; increased risk of disease introduction (in crop residue); increased competition for named resource; increased wind rock (because of funnelling);</p>	max 3	AO2 3.4.2

Question	Answers	Mark	AO / Spec. Ref.
6(c)	<p>Method same watering rate/volume; collect eroded soil/water; method of measuring eroded soil/turbidity;</p> <p>Number of samples equal numbers of pits/maize plants;</p> <p>Size of samples same pit dimensions;</p> <p>Timing same time period/at same time;</p> <p>Standardisation/reliability soil texture/structure/OM content/water content at start; same plant age/size; same wind velocity; same slope angle/compaction; replication for statistical test/reliability/representative/ significant results;</p>	max 6	AO3 3.4.6
Total		15	

Question	Answers	Mark	AO / Spec. Ref.
<p>7(a)</p>	<p>Habitat destruction: forest clearance loss of biodiversity</p> <p>Pollution of water: OM increasing BOD antibiotics/hormones/tannery chemicals fertilisers/pesticides used on feed crops sediments from eroded pastures</p> <p>Global climate change: increased methane production increased use of fossil fuels/energy use for livestock feed processing/intensive rearing/transport</p> <p>Impact on soil: accelerated soil erosion overgrazing/trampling/poaching</p> <p>Habitat creation: upland grazed moorland</p> <p>Reduced need for inputs: part of mixed farming system</p> <p>Pesticide use: worming agents/insecticides loss of dung fauna</p> <p>Introduced pests</p> <p>Increased antibiotic resistance</p> <p>Increased impact on water supply: irrigation for livestock crops</p> <p>Control of invasive weeds: food producing alternatives to herbicides</p> <p>Removal of crop residues inedible to humans: used in conversion of waste materials from other processes into protein</p> <p>For 'good' : candidates need to cover first four topics</p>	<p>20</p>	<p>AO1/AO2 3.4.2/3.4.5</p>

Question	Answers	Mark	AO / Spec. Ref.
7(b)	<p>Maximising yields: selective breeding controlling limiting factors exclusion of competitors/predators control of pests and diseases growing several trophic levels together</p> <p>Minimising environmental impacts: farming herbivorous fish reducing predator control/culling and fish escapees by better cage design rotating sites/locations of cages/enclosures growing several trophic levels together eg seaweeds/shellfish remove waste nutrients and organic matter from finfish rearing units using cleaner fish eg wrasse/lumpsuckers for farmed salmon lice E.I.A. (UK) removing excessive growth of weed and crustaceans by mechanical cleaning of cages optimising stocking density controlling feeding quantities to reduce waste waste treatment plant for organic waste from farms</p> <p>For ‘good’ : both topic areas need to be covered</p>	20	AO1/AO2 3.4.3

Question	Answers	Mark	AO / Spec. Ref.
7(c)	<p>Population pressure greatest population growth in LEDCs increase per capita resource use with development greatest per capita increase in LEDCs concept of ecological footprint concept of carrying capacity/ ability to increase carrying capacity</p> <p>Increase total resource demand food water timber minerals energy land high per capita resource use in MEDCs</p> <p>Environmental impacts of increased resource consumption climate change impacts/air pollution impacts other named pollution impacts of water/soil reduced biodiversity/biological resources deforestation impacts reduced agricultural productivity/soil loss depletion of non-renewable resources</p> <p>For 'good' : all three topic areas need to be covered</p>	20	AO1/AO2 3.4.1
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 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.