



**General Certificate of Education
June 2010**

Environmental Studies 2441

ENVS4

**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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting 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 the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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ENV54

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

Question 1

	Answers		Mark
1	Vegetative propagation	Asexual reproduction/production of offspring that are genetically identical to parent/clone from named/plant tissue/micropropagation (eg corms, bulbs/runners/rhizomes/cuttings)	5
	Limiting factors in food production	The factor in <u>shortest supply/minimum</u> (which controls the process)	
	Agricultural diversification	Increase in the variety of activities on farms	
	Energy subsidy	The (artificial/additional) named/energy inputs/fossil fuels/machinery/fertilisers/pesticide/antibiotics (into production systems)	
	By-catch	Non-target/unintended/accidental/species caught by fishing/over quota	
	Sustainability	Maintaining adequate output/living standards without depleting resources/environmental damage/Brundtland definition (meeting demands of present without compromising needs of future)	
Total			5

Question 2

	Answers	Mark
2(a)	Same crop/cultivation techniques; same soil type/pH; same amount/type of fertiliser; same (micro)climate; same field topography/size; same field boundaries; simultaneous sampling; same method of invertebrate sampling; same pesticide; same volume of pesticide added/application technique ref calibration of equipment; 0/1 = 0 marks 2/3 = 1 mark 4 = 2 marks	MAX 2
2(b)(i)	Increased pesticide concentration kills more pests/invertebrates so crop yields increase; but highest concentration toxic to crop/kills pollinators/soil biota so crop yield decreases;	2
2(b)(ii)	Better measure of environmental impact (of pesticide)/includes population numbers;	1
2(c)	(line) transect; systematic sampling; pitfall traps/pooters/sweep nets/beating trays/soil auger; species identification/count; repetitions/large sample number; increases data reliability/remove anomalies/calculate mean; for statistical test; named diversity/statistical test;	MAX 5
Total		10

Question 3

	Answers	Mark
3(a)	If steeper: more kinetic energy; more H ₂ O run off/less infiltration; shallower soil; more soil creep/mass movement/sheet wash; less vegetation cover/root binding;	MAX 2
3(b)	Less run off (as mixing)/improves infiltration/drainage; incorporated OM/humus improves structure; (mixing improves) root penetration/binding; increased nutrients = increased plant cover; increased interception;	MAX 3
3(c)	Slope angle selected; (belt) transect; ref systematic/stratified sampling (down slope); (expanded) quadrat; <u>%</u> veg cover/ref abundance/domin/DAFOR scale; min 5 % sample of slope; clinometer/levelling/ref spirit level/protractor/theodolite;	MAX 5
Total		10

Question 4

	Answers	Mark
4(a)	High nutrients inputs (from rivers/estuaries/upwelling/sediment disturbance); (shallow water so) more light penetration/higher temperatures/ref photic zone; (more turbulent so) higher CO ₂ ;	MAX 2
4(b)	Migration (in/out); based on sample data; to generate estimates; time lag between sampling and enforcement of catch limits; pollution/disease incidents/ref change in named ocean current/El Niño/La Niña;	MAX 3
4(c)	Inefficient/low technology application; tropical rain washes away chemicals; more vigorous weeds; more marginal land used; less use of organic/cultural/integrated techniques (than MEDCs)/more GM pest resistant crops in MEDCs; pesticides applied over a larger area; more prolific pest reproduction in tropics; cold winters in MEDCs kill overwintering adult pests; (more use in LEDCs =) increased resistance likely; LEDCs use cheaper/less effective pesticides; faster biodegradation/photodegradation (in tropics); ref resurgence;	MAX 5
Total		10

Question 5

	Answers	Mark
5(a)	Increased light levels; reduced (relative) humidity; increased wind; increased temperatures; increased (diurnal) temperature range; decreased precipitation; decreased cloud cover; increased airborne particulates; 0/1 = 0 marks 2/3 = 1 mark 4 = 2 marks	MAX 2
5(b)	Use native species; grow locally/less imports; selective extraction/not clear fell; named selective extraction techniques; eg helilogging, skidders, heavy horses replace felled trees/reforestation; afforestation; exploit forest edge only; trees only removed if healthy seed trees nearby; re-use/keep access pathways/narrow; large/heavy machinery not used; riverside/wet soil areas not exploited; pathways avoid rare/important trees (to avoid root damage); smaller branches given to local craftsmen/furniture makers/use cut offs; exploit plantations to preserve virgin forests; forests managed for mixed species/age structure; harvest below MSY/ref quotas; faster growing/high yield varieties use less land; coppicing/pollarding; organic not agrochemical;	MAX 5
5(c)	Ethanol/biofuels less energy dense than fossil fuels/low energy ratio; requires new/expensive technology; genes may transfer into wild plants; still produces GHG/named; more land required; competes for land with food crops;	MAX 3
Total		10

Question 6

	Answers	Mark
6(a)	Fewer food plants/species/named; less biological pest control; reduced gene pool for engineering; (fewer trees for) climate control/of water cycle; less OM/nutrient input/aeration into soil; more soil erosion; less pollination/seed dispersal; other named interspecies relationships; eg mycorrhizal fungi OWTTE;	MAX 3
6(b)	Positive correlation; most MEDCs above world average/most LEDCs below/MEDCs > LEDCs; scatter around trend/ref; exponential increase/in gradient; Argentina/anomalies;	MAX 2
6(c)	Global ecological footprint increases; soil erosion/desertification/GCC/named pollution; extinctions (increase); its economic development is unsustainable; competition for resources = price increases; reduced resource availability to LEDW; increase in mining/habitat destruction;	MAX 5
6(d)	Control population; increase domestic productivity; reduce trade/food miles; strategies for sustainable food production/MSY/quotas/IR8/GM/ stewardship; operate at lower trophic level; [A. refs to vegetarianism] ref sustainable water use; reforestation; recycle/four Rs; renewable fuels; energy conservation strategies/examples of; carbon sequestration/examples of; named inter/national protocols/agreements;; eg Rio, Kyoto, Agenda 21, land fill tax, aggregates tax named pollution control; eg carbon capture coal-fired power stations reduce planned obsolescence/design for end of life;	MAX 5
Total		15

Question 7

	Answers	Mark
EITHER		
7(a)	Glasshouses: 1 ch/thermostatic temperature controls 2 rate of photosynthesis 3 and growing season 4 automatic shades control photosynthesis 5 ch return pipes supply CO₂ control photosynthesis 6 automatic sprinklers control water 7 relative humidity 8 plant turgidity 9 nutrient uptake 10 biocontrols 11 named examples 12 reduces crop pests 13 hydroponics 14 soil less/rock wool laboratory farming Field crops: 15 drainage/irrigation 16 controls nutrient uptake 17 liming 18 alters pH (and nutrient uptake) 19 deep ploughing 20 breaks plough pan 21 lifts subsoil nutrients into root zone 22 alters soil structure 23 agricultural fleece 24 increases light levels 25 affects rates of photosynthesis 26 shelter belts/hedgerows 27 reduce wind damage 28 frosts 29 transpiration 30 maintains soil temperature 31 reduces soil erosion 32 headlands/beetle banks 33 companion/intercropping 34 attracts biocontrol 35 ref polytunnels	14 2 2 2 20

OR 7(b)	Effects of soil erosion: 1 reduced productivity 2 sedimentation of rivers/reservoirs 3 flooding downstream 4 coastal sedimentation 5 increased atmospheric particulates 6 desertification 7 land slides 8 famine 9 refugee movements 10 ref case studies/example – Sahel/Dust Bowl Conservation techniques: 11 cultivation of long-term crops 12 contour ploughing 13 contour bunding/tied ridges 14 terraces 15 windbreaks 16 multi/companion cropping 17 cover crops 18 strip cropping 19 mulching 20 increased OM 21 ref case studies/examples – water harvesting in Sahel, dry farming in Dust Bowl/Prairies	14 2 2 2 20
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OR 7(c)	1 Organic wastes 2 causes deoxygenation 3 nutrient enrichment 4 increased turbidity 5 escapes 6 affects wild gene pool 7 non-native species affect food webs 8 lice/spread of disease 9 pesticide pollution 10 dichlorvos/hydrogen peroxide/cypermethrin 11 loss of habitat/biodiversity 12 impact on tourism 13 coastal erosion due to mangrove loss 14 effects of harvesting wild fish populations to provide food pellets 15 bird/seals caught in nets 16 ref case studies/examples;; 17 ref ER = O/I 18 comparison of commercial fishing and aquaculture ERs 19 fish farming is unsustainable 20 ref food miles/imports from Asia 21 fish farming = consumption at 4 th trophic level Sustainability of fish farming includes: 22 rearing vegetarian carp 23 sea urchins litter detritus in Scottish salmon farms 24 equipment treated with antifouling paints 25 algae brushed off cages 26 new, lower stocking densities 27 sites of cages rotated 28 goldsinny wrasse in salmon coops eat sea lice	14 2 2 2
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. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.