Version 1.0

General Certificate of Education (A-level)
June 2012

Environmental Studies ENVS2

(Specification 2440)

Unit 2: The Physical Environment

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 **ENVS2**

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>Definition</th><th>Letter</th><th></th></tr>
<tr><td>An underground rock structure from which water is abstracted</td><td>G</td><td></td></tr>
<tr><td>The average duration that a molecule remains in a reservoir</td><td>D</td><td>;</td></tr>
<tr><td>The volume of material transferred from one reservoir to another per unit time</td><td>H</td><td>;</td></tr>
<tr><td>Precipitation that is caught on vegetation</td><td>A</td><td>;</td></tr>
<tr><td>The flow of water into the ground</td><td>F</td><td>;</td></tr>
<tr><td>The movement of water between the particles of soil or rock</td><td>C</td><td>;</td></tr>
</table>
</td><td>5</td></tr>
<tr><td>Total</td><td></td><td>5</td></tr>
</table>

Question 2

	Answers	Mark
2(a)(i)	Reduced/less CO_2 (now)**;** [**A** reduced greenhouse effect now] [**A** higher albedo] [**R** lists of differences from the table]	1
2(a)(ii)	Higher atmospheric pressure**;** [**A** more CO_2 in the Earth's atmosphere] [**R** factors not from table eg distance from the sun]	1
2(b)	Photosynthesis/uptake of CO_2 by plants/carbon sequestration by plants**;** stored as fossil fuels/carbonate rocks/limestone/chalk/ named material containing C**;** [**A** biomass]	2
2(c)	Nuclear/nuclei**;** fusion/joining**;** plasma**;** small atoms/nuclei**;** hydrogen/deuterium/tritium/helium**;**	MAX 3
2(d)	Absorbed by ozone/O_3/converted to chemical energy**;**	1
2(e)	Human activity and effect on albedo**;;** eg afforestation - reduced (albedo)/increased light absorption deforestation - increased (albedo)/decreased light absorption more tarmac - reduced (albedo)/increased light absorption melting ice due to global climate change - reduced (albedo)/increased light absorption more cloud due to global climate change - increased (albedo)/decreased light absorption smoke/PM10 (from fuel)/aerosols (eg from combustion, not spray cans) - increased (albedo)/decreased light absorption (more) condensation nuclei (producing more) cloud - increased (albedo)/decreased light absorption	2
Total		**10**

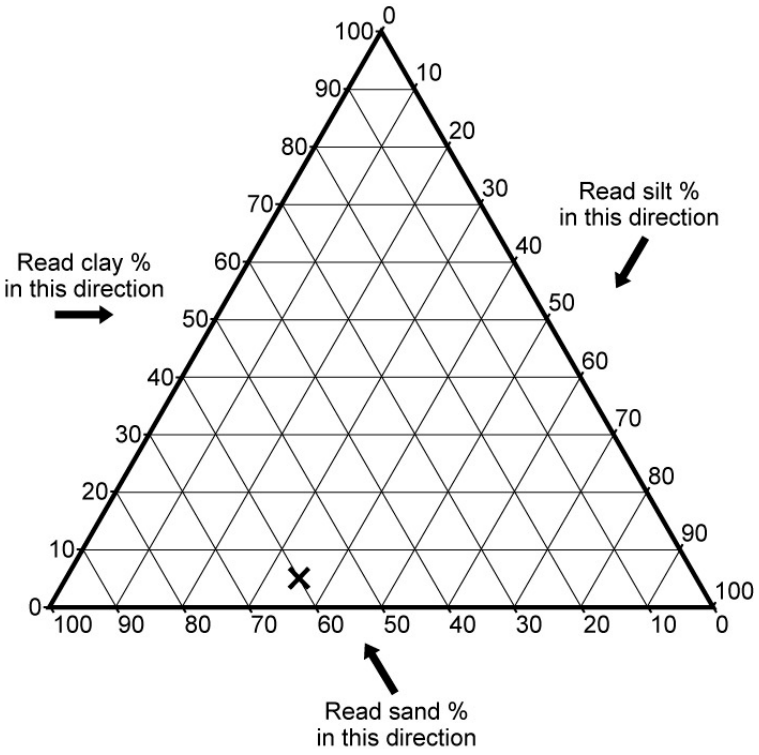
Question 3

	Answers	Mark
3(a)	Annual/seasonal peaks/troughs/cycle**;** ref to ozone/O_3 value/Dobson Units**;** rapid decline to/lowest value 1994/1993 to 1995**;** little overall change/fluctuating stable 1995 to 2010**;** [**A** long term decline/ozone/O_3 depletion for **1 mark**]	MAX 3
3(b)	If frequency is too low: may miss (seasonal) fluctuations**;** fluctuations may mask trend**;**	MAX 1
3(c)	CFCs/chlorofluorocarbons/halogens**;** [**A** chlorine]	1
3(d)	CFCs/named ODS absorb/broken down by UV**;** chlorine/named free radical (released)**;** reaction with ozone/monatomic oxygen**;** chemical reaction equation**;;** eg Cl + O > ClO ClO + O > ClO_2 Cl + O_3 > ClO + O_2 [**A** ozone depletion caused by other gases eg NO_x, bromine/Br]	MAX 2
3(e)	Montreal Protocol**;** ban/reduce use/emissions of CFCs/ODSs**;** named alternative process**;** eg pump action sprays named alternative material**;** eg alcohols, HCFCs, HCs safe disposal of named waste**;** eg old refrigerators	MAX 3
Total		**10**

Question 4

	Answers	Mark
4(a)(i)	(Increased) decomposition/aerobic respiration**;** more carbon (from land) to atmosphere/CO_2**;** **OR** use of machinery/fossil fuels**;** release of carbon to atmosphere/CO_2**;**	2
4(a)(ii)	(More) photosynthesis/plants take up CO_2**;** CO_2/carbon removed from atmosphere/carbon sequestration**;** **OR** more photosynthesis/plants take up CO_2**;** CO_2/carbon into biomass/dead organic matter/carbon sequestration/less CO_2 in atmosphere**;**	2
4(a)(iii)	(Increased) energy use/burning fossil fuels/biomass**;** carbon from fuels/land to atmosphere/more CO_2**;**	2
4(b)	Reduce overall change/re-establish equilibrium/ (description of other) named processes that create balance**;** temperature increase**;** CO_2 is limiting factor/controls rate**;** photosynthesis**;** C stored**;** in wood/biomass/dead organic matter**;**	MAX 4
Total		**10**

Question 5

	Answers	Mark
5(a)	3 correct readings of data figures from diagram**;** 40, 25, 15 3 correct percentage calculations**;** 50, 31.25 (31/31.3), 18.75 (19/18.8) put in correct boxes in table**;** sand, silt, clay award 3 marks for correct percentages in correct boxes with no working award 2 marks for correct percentages in incorrect boxes with no working award 2 marks for correct values (40, 25, 15) in correct boxes	3
5(b)(i)	**B**/soil with most sand**;**	1
5(b)(ii)	**A**/soil with most clay**;**	1
5(c)		1

Question 5 continued

	Answers	Mark
5(d)	Plant vegetation/hydroseeding**;** roots hold spoil/soil together/reduce raindrop impact**;** add manure/nutrients**;** increased humus level**;** addition of top soil**;** root growth medium**;** reduce slope angle/terracing**;** [**A** landscaping] reduce runoff rate**;** drainage**;** reduce risk of waterlogging**;** soil retention walls/steel mesh**;** reduce landslip**;** compaction**;** reduced soil particle mobility**;**	MAX 4
Total		**10**

Question 6

	Answers	Mark
6(a)	One suitable method**;** detail of how it works**;** eg leachate collection/recycling electrolysis *Thiobacillus*/bacteria oxidise sulfur/produce acid/acidic solution dissolves metal/copper large scale mechanisation/named improvement in technology economies of scale/cheaper per tonne of material phytoremediation/hyperaccumulators/brassicas absorption of metal	2
6(b)	Increased energy requirement**;** more difficult extraction/processing/time-consuming/more material mined**;**	2

Question 6 continued

	Answers	Mark
6(c)	Feature**;;** impact of feature on viability**;;** eg of features: amount of deposit economies of scale ore purity more ore extracted (if purity is low) chemical form of ore affects ease if extraction of mineral depth of deposit more overburden removed (if deep)/(depth of) drilling shape/dispersal of deposit more non-ore material/larger area (if irregular shape/dispersed) mine drainage pumping cost (if drainage is poor) overburden hardness more difficult if hard overburden stability more removed if unstable/loose seismic stability landslide/collapse risk distance to/accessibility to market transport cost availability of workforce lack of local skills – inhibit development/increase costs availability of water needed for processing/washing/purification availability of energy needed for processing/transport/lack of local supplies increase costs named land use conflict detail of conflict	MAX 4
6(d)	Named factor**;** correct direction of change**;** eg more market demand COOG goes down increased sales price COOG goes down	2
Total		**10**

Question 7

	Answers	Mark
7(a)	Maintain balance**;** replaced what is taken up by crop/removed with harvested crop/leached/ denitrified**;**	2
7(b)	Eutrophication**;** algal bloom**;** [**A** increased (water) plant growth] shading/death of macrophytes**;** decomposition**;** deoxygenation**;**	MAX 2
7(c)	Lower solubility/bound to soil particles**;** [**R** insoluble]	1

Question 7 continued

	Answers	Mark
7(d)	Farming activity**;;** eg drainage ploughing irrigation adding fertilisers planting legumes adding green manures adding manure adding compost crop rotation harvesting grazing machinery use/fossil fuel consumption flooding/padi Linked effect on process**;;** eg less/more: denitrification nitrogen fixation (rapid) nutrient release/decomposition ammonification/nitrification dissolved nutrients Reason**;;** eg increased aeration/more aerobic compaction/poaching (of soil)/less aeration release of oxides of nitrogen leaching more soil biota named bacteria taxa linked to process eg *Azotobacter* (linked to fixation in soil/conversion of gas to ammonium) root nodule bacteria*/Rhizobium* (linked to fixation in root nodules/legumes) *Nitrobacter/Nitrosomonas* (linked to nitrification/oxidation/ammonium to nitrite/nitrite to nitrate) *Pseudomonas* (linked to dentrification/reduction) detritivores/decomposers (linked to breakdown of DOM) credit each effect/reason once only	MAX 5
Total		**10**

Question 8

	Answers	Mark
8(a)	pH/electronic meter/probe**;** calibration (of meter)**;** **OR** universal indicator solution/paper**;** colour comparison**;** [**R** litmus]	2
8(b)(i)	Prevent evaporation/water loss**;** prevent absorption of water/water gain**;** (allow **1** mark for maintain water content) reduce decomposition/soil respiration/bacterial action/enzyme action**;**	MAX 2
8(b)(ii)	Ensure destruction of organic matter**;** [**R** humus] avoid breakdown of minerals/carbonates**;** [**A** calcium minerals]	2
8(b)(iii)	(26.7 – 21.2 = 5.5 5.5/26.7 x 100) = 20.599**;** [**A** 20.6, 20.60]	1
8(b)(iv)	(6.35 – 5.55 = 0.8 0.8/6.35 x 100) = 12.598**;** [**A** 12.6,12.60]	1
8(b)(v)	Consistency within a study/between samples/sites/times**;** comparability between studies/researchers**;** control of other variables**;** similar accuracy/precision**;**	MAX 2
Total		**10**

Question 9

	Answers	Mark
9(a)	Problems**;;;** eg low volume available/availability limited by cost accessibility unreliable supply fluctuating supply storage difficulties quality issue dirty pathogens disease vectors toxic pollutants natural toxins hardness turbidity pH salinity competition for supplies Social impacts**;;;** eg named health issues disease diarrhoea dysentery cholera typhoid polio bilharzia hygiene problems time spent collecting water time not spent on other activities restricted choice of uses/named restricted activity eg irrigation impact on named lifestyle issue eg food supply Economic impacts**;;;** eg treatment cost named (expensive) treatment process named restricted industrial activity eg textiles, heating, food processing, irrigation, farming	MAX 5

Question 9 continued

	Answers	Mark
9(b)	Named source**;;;** advantages**;;;** disadvantages**;;;** eg aquifers naturally filtered low turbidity low pathogen content no surface land use conflicts low treatment costs predictable supply salinity of aquifer water dissolved minerals need for suitable geology danger of over-exploitation/impact on surface water features subsidence risk of salinization/salt water incursion high volume may hide low recharge rate high cost of borehole drilling reservoirs low turbidity (due to sedimentation) low treatment costs reliable supply high turbidity (due to erosion) silting up need for river suitable topography suitable geology land use conflicts pollution risk cost of dam construction rivers no expensive structures/development costs flow fluctuations pollution risk competition for river use high treatment costs sea huge volume geographical restrictions salinity high energy use high treatment cost	MAX 8

Question 9 continued

effluent/grey water

supplement supplies when other sources are limited
contaminant content
not potable
high treatment costs

rainwater harvesting

low collection cost
low treatment cost
unreliable supply

credit cost of collection/treatment/construction mark once only as advantage
credit cost of collection/treatment/construction mark once only as disadvantage

Quality of Written Communication

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 half a 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, and is usually accurate. 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. Spelling, punctuation and grammar contain many errors.

2

Total		**15**

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