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General Certificate of Education (A-level)
June 2013

Environmental Studies ENVS3

(Specification 2440)

Unit 3: Energy Resources and Environmental Pollution

Final

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 2013 **ENVS3**

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

Question 1

	Answers	Mark
1		

Law/procedure	Details	
Kyoto Protocol	**Control of greenhouse gases/named greenhouse gas/carbon/climate change**	;
Critical Group Monitoring (CGM)	**Study of group of (public) most at risk (because of their lifestyle)** [**R** source-related occupational workers]	;
Montreal Protocol	**Ban/control/reduction of ozone depletion/release of ODSs/named ODS eg CFCs**	;
Critical Pathway Analysis (CPA)	*Predicting the movements of pollutants by studying environmental features such as winds, water currents and geology*	
Landfill <u>Tax</u>	*Financial charges made for the disposal of waste in landfill sites*	;
Clean Air Act (1956)	**Control of smoke pollution/smog/smokeless fuels/smokeless zones/smoke control areas**	;

		5
Total		**5**

Question 2

	Answers	Mark
2(a)	Less energy use/pollution/habitat damage/material used**;** reason**;** eg extraction processing (raw materials) manufacture transport installation disposal at end of life [**R** less noise, fewer bird strikes]	2
2(b)	Small scale generation/simple installation possible**;** (small enough for) easy transport**;** no fuel inputs**;** low maintenance**;** energy transport infrastructure not present**;** less energy loss in long distance transport**;** fewer people that may object/affected**;** less interference with radio/radar/microwave links**;** [**R** remote areas windier]	MAX 2
2(c)	Factors**;;;;** linked detail**;;;** eg affluence named energy using device/items that require energy in manufacture eg cars, washing machine, jacuzzi, metals/plastics level of industry more industry for named reason eg mineral resources, water availability, workforce type of industry $1^o/2^o/3^o/4^o$/metal processing/chemicals/agriculture/manufacturing/services climate heating in cold (climates)/cooling in hot (climates) environmental awareness (high) encouraging conservation/(low) encouraging waste indigenous energy resources/supply infrastructure/cheaper supplies allows greater use/named energy expensive use	MAX 6
Total		**10**

Question 3

	Answers	Mark
3(a)	Method**;;** linked detail**;;** 2 + 2 eg flight paths/no fly zones/airport location/buffer zone/aircraft activities noise away from residential areas flight timing avoid sensitive times/not at night (continuous) descent angle/CDA avoid increase in power named aerodynamic feature/fairings/moulded surfaces reduced turbulence high bypass ratio jet engines/wide diameter jet lower velocity exhaust gases engine hush kits mix exhaust gases with surrounding air lighter aircraft less powerful engines acoustic walls/baffle mounds/embankments/trees absorb/deflect sound [**R** blocks] double glazing noise absorbed [**R** blocks] ban/restrict noisy aircraft Concorde/named noisy aircraft/low bypass ratio jets	4
3(b)(i)	Spearman's Rank (Correlation Coefficient)**;**	1
3(b)(ii)	5% probability that the results were produced by chance/95% probability that the results were **not** produced by chance**;**	1

Question 3 continues on next page . . .

Question 3 continued . . .

3(b)(iii)	Any other variables affecting whole groups**;;;;** eg other pollutants eg lead range of educational abilities quality of teaching class resources effect of peers socio-economic circumstances learning environment gender length of previous study temperature state of health time of day	4
Total		**10**

Question 4

	Answers	Mark
4(a)(i)	More energy/radiation released/absorbed/ionising events/free radicals per unit time**;**	1
4(a)(ii)	Distance of travel from source**;** alpha shorter/gamma longer**;** **OR** ease of penetration/absorption**;** correct reference to alpha/gamma**;** **OR** effect of ingestion of source on health risk**;** greater increase for alpha radiation**;** **OR** ionising power**;** alpha high/gamma low**;**	2
4(b)	10**;**	1
4(c)(i)	Gonadic – sex/reproductive organs/ovaries/testes/egg/sperm/may affect future generations**;** somatic – general/any body cells/cancer/affects current organism**;**	2
4(c)(ii)	Timescale**;** acute – short**;** chronic – long**;**	MAX 2
4(d)	Named method**;** detail of method**;;** eg vitrification/encapsulation cooling pond/water (dried) powder (solid) glass stainless steel container concrete/other absorbing material air/gas cooling (of separated high level waste) deep burial geologically/seismically stable area hydrological isolation/impermeable rock/salt caverns	MAX 2
Total		**10**

Question 5

	Answers	Mark
5		

Process	Purpose	Principle of Operation	
Screening	**Removal of gross/large solids/paper/plastic** [**R** grit]	*Effluents flow through metal grills or mesh*	;
Primary Sedimentation	**Separation/removal of (suspended) solids/organic matter (from fluids)** [**R** grit]	*Effluents remain static or move very slowly for several hours*	;
Aeration	**Breakdown/digestion of organic matter/activation of (aerobic) bacteria** [**R** water treatment]	*Pumping of air or oxygen into fluid effluent*	;
Tertiary Treatment	**Removal of phosphates/production of iron phosphate**	*Addition of iron sulfate*	;
Anaerobic digestion	**Breakdown of organic matter or sludge/ volume reduction/ odour removal/ bacteria/pathogen removal**	*Action of anaerobic bacteria*	;

		5
Total		**5**

Question 6

	Answers	Mark
6(a)(i)	23 and 221 **OR** 15+1+7 and 94+30+15+1+7+74**;** (23/221 x 100) = 10.4/10.41/10.407**;** [**A** 10] correct final answer = **2** marks	2
6(a)(ii)	62.5/63**;**	1
6(b)	Method**;** description**;** eg Fluidised bed combustion/pulverised fuel more efficient combustion Steam condenser reduce pressure to speed up steam flow (over turbines) Increasing turbine blade size absorb energy from low pressure steam Combined Heat and Power use of waste heat/district heating Combined Cycle Gas Turbines use of both kinetic energy and heat Peak shaving storage as potential energy/hydrogen [**R** cooling towers, heat exchangers]	2
6(c)	Named unsuitable feature of coal**;** eg solid, flow problems [**A** lower energy density] **OR** named use of petroleum/necessary feature of petroleum**;** eg vehicle fuel, petrochemicals, fluid, ease of flow, wider range of chemical raw materials	1

Question 6 continues on the next page . . .

Question 6 continued . . .

	Answers	Mark
6(d)(i)	Wind – public objection/unreliable/intermittent/low wind velocity**/** named ecological land use conflict**;** [**A** named technological development]	1
6(d)(ii)	HEP – few suitable sites/habitat loss/small catchment areas/ permeable rocks/unsuitable topography/land use conflict**;** [**A** named technological development]	1
6(d)(iii)	Landfill gas – amount of landfill waste production/low setup costs/ competition with recycling/landfill tax/ financial disincentive**;** [**A** named technological development]	1
6(d)(iv)	Biomass – land availability/competition (with food)/habitat loss**;** [**A** named technological development]	1
Total		**10**

Question 7

	Answers	Mark
7(a)	(energy used in) resource mining; chemical extraction/processing; manufacture/assembly; transport; installation/construction;	MAX 2
7(b)	Gas/liquid/fluid flow/movement; heat transfer; counter-current flow; large surface area/long pipes; thin conductor/thin pipe wall; good (thermal) conductor/copper/named material; insulation around chamber;	MAX 3
7(c)	Reflected onto ceiling for room lighting; avoid excessive brightness/blinds down-lights on/no extra lighting needed; **OR** Non-opening/triple glazed/low emissivity coated windows; prevent draughts/convection losses/re-radiative loss (of passive solar energy gains); **OR** Heating of chimneys; aids ventilation/convection currents;	2
7(d)	Prevents/reduces convection currents (with a bigger total gap);	1
7(e)	Energy absorbed, released later; prevents overheating/less energy needed for cooling; reduces heat loss (from building)/less energy needed for heating;	MAX 2
Total		**10**

Question 8

	Answers	Mark
8(a)	Details of: carbon sequestration 'clean coal' catalytic converters fuel desulfurisation wet/dry desulfurisation low temperature combustion urea sprays fluidised bed combustion pH adjustment/liming smoke scrubbers/cyclone separators/electrostatic precipitators turbo chargers computer combustion control	20
8(b)	Details of: energy density low fuel use carbon emissions low atmospheric pollutant emissions ionising radiation pollution high output of localised power stations technical complexity waste categories: high/intermediate/low solid/liquid/gas half lives biological effects absorbing materials distance exposure time waste disposal method Critical Group Monitoring Critical Pathway Analysis Need balance of advantages, disadvantages and safety methods for Breadth Mark of **2**	20
8(c)	Details of: renewability energy density resource size technological difficulties of extraction level of technological development environmental impacts political/social/economic issues reliability intermittency ease of storage locational factors correct use of named examples	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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