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General Certificate of Education (A-level)
June 2011

Environmental Studies ENVS3

(Specification 2440)

Unit 3: Energy Resources and Environmental Pollution

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.

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Environmental Studies

June 2011 **ENVS3**

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

Question 1

	Answers	Mark
1	Nuclear (power/fuel)/uranium/plutonium/thorium/hydrogen**;** biofuel/biomass/named biofuel**;** [**R** coal/oil] wind/solar/wave**;** tidal**;** HEP/tidal/pumped storage/water/reservoir**;** [**R** dam]	5
Total		**5**

Question 2

	Answers	Mark
2	Measurement of: noise/sound/loudness/example of noise pollution**;** acid rain/acid mine drainage**/**named acidic waste/soil/water/toxin solubility/basic slag/lime**;** [**R** acid/alkaline unless qualified] aircraft/airport noise**;** suspended [**A** solid] particulate matter/dust/smoke/PM10/ (suspended) particles in atmosphere/water**;** photochemical smogs/vehicle exhaust pollution/description of interaction of pollutants**;**	5
Total		**5**

Question 3

	Answers	Mark
3(a)	Lower fuel consumption**;** all pollutants (relatively) low**;** change in levels of correctly named pollutant**;** eg NO_x higher at lower ratios [**A** subsequent removal of pollutant by catalytic converter]	3
3(b)	Photochemical <u>reaction</u>**/**photodissociation/action of light/UV**;** NO_2 breakdown (to NO and O)**;** monatomic oxygen (produced)**;** ozone (produced from O_2 and O)**;** PANs**;** **OR** NO_x dissolves in water**;** nitric acid (produced)**;** toxic ion/heavy metal solubility**;**	MAX 2
3(c)	Random/systematic/stratified sampling/transect**;** sample location justification**;** eg pollution gradient/areas with different pollution concentrations/city centres – suburban/distance from road spacing/number of sample sites**;** [**R** repetitions on one site] same substrate type/named substrate**;** effect of substrate**;** eg pH old sites where lichens have had time to colonise**;** similar aspect/light intensity**;** similar precipitation pattern**;** similar wind direction**;** [**A** Health and Safety comment]	MAX 5
Total		**10**

Question 4

	Answers	Mark
4(a)	Method**;;** 2+2 linked descriptive point**;;** **eg** double hull reduced risk of tank damage tank washing/bilge water storage tank waste not dumped overboard/discharged at oil terminal twin rudders/engines/fuel tanks less chance of total manoeuvrability failure ballast water**;** not held in oil tanks**;** advanced navigation**;** avoid collisions**;** inert gas system**;** reduce fire/explosion risk**;** [**A** larger number of tanks] [**A** smaller volume spilt]	4
4(b)	Change in biotic factors change in food supply/prey population**;** change in predation (population/behaviour)**;** change in competitor population**;** reduced feeding by parents – food collection difficulties**;** reduced feeding by parents – spend more time cleaning/feeding/ incubating/protecting**;** pheromone/chemolocation/odour problems**;** eg cannot find mate/ food change in abiotic factors O_2 cannot dissolve**;** deoxygenation by decay/high BOD**;** light does not pass through oil for plants to photosynthesise/birds cannot see food**;** (affected by) cleanup/chemicals used/detergents/dispersants/ steam**;** loss of named habitat feature**;** linked named taxon/example**;**	MAX 4

Question 4 continued

4(c)	As temperature increases/suitable temperature: faster decomposition/biodegradation**;** faster bacterial action**;** increased kinetic energy (of reactants)**;** faster enzyme action**;** [**R** enzymes denatured] reduced viscosity increases surface area (for bioremediation)**;** [**A** converse]	MAX 2
Total		**10**

Question 5

	Answers	Mark
5(a)	Resources with high energy density more useful because: higher power output/less fuel needed**;** greater ease of transport**;** less space for storage**;** higher achievable temperature**;** higher achievable pressure**;** higher achievable light intensity**;** named use requiring high energy density, eg vehicle fuel**;** [**A** converse]	MAX 2
5(b)	Removes unreliability/intermittency**;** higher energy density**;** electrolysis <u>of water</u> (to produce hydrogen)**;** more useful chemical energy**;** application to vehicles/named use/high intensity use**;** many primary fuels harnessed to give one fuel for consumers**;** storability of hydrogen**;** surplus for later use/peak shaving/back up supplies**;**	MAX 3
Total		**5**

Question 6

	Answers	Mark
6(a)	Ore concentration/named quality issue**;** eg chemical form of ore**;** named extraction issue**;** eg overburden hardness, drainage, faults, depth location/transport distance/method**;** different raw materials/processing methods/efficiency**;** different products made from same material**;**	MAX 2
6(b)(i)	Reduce mass/lighter**;** reduced energy/fuel use (for propulsion)**;**	2
6(b)(ii)	Choice/amount of materials that can be recycled**;** reuseable parts**;** lower energy use (in recycling)**;** easier separation/dismantling**;** identifiable materials**;** less waste produced**;** fewer toxins/pollutants**;** alloys (harder to recycle)**;** biodegradable materials**;** named material with high embodied energy used because easily recycled**;** [**A** converse]	MAX 2
6(c)	Recyclable goods**;** recycled goods**;** fair-trade/ethical goods**;** organic products**;** local goods**/**food miles**;** air miles/travel distance choice**;** choice of transport type**;** eg bicycle, car, bus, train low energy goods/energy conservation products/renewable energy**;** low water use products**;** (avoidance of) packaging**;** planned obsolescence/disposable items/fashions**;** trivia**;** high embodied energy products**;** linked specific example per choice**;;** eg appliance, how impact is reduced	MAX 4
Total		**10**

Question 7

	Answers	Mark
7(a)	Less fuel/energy use**;** named pollutant/named environmental impact**;** eg noise pollution [**R** climate change, carbon footprint]	2
7(b)	Feature of named material**;** how feature reduces named pollutant emissions**;** eg compressed earth has low conductivity named pollutant not released (by heating) power station ash named atmospheric pollutant from cement manufacture eg CO_2/SO_2/dust/noise worktops/recycled paper reduced litter/waste to landfill/named atmospheric pollutant from incineration named energy conservation method named pollutant not released by fuel use (no longer required) wool named pollutant produced in manufacture of alternative insulator (not produced by wool) plastics/paints/heavy metals (not used) named pollutants that could have been produced, eg lead, mercury, calcium, chlorinated compounds, smoke, PM10 [**A** choice not to use named materials]	2
7(c)	Example of how other energy inputs would have been used**;;** eg space heating water heating lighting electrical appliances example of use of solar power**;;;** eg passive solar gain photothermal panel large windows south facing windows high thermal mass materials [**A** photovoltaics]	MAX 3

Question 7 continued

7(d)	Reduced air contact/separation of cold air from warm air**;** reduced heat conduction**;** reduced convection/static air**;** low conductivity gas/argon/named gas/vacuum**;** low emissivity glass (reflects IR radiation)**;** (optimal) gap size (eg 16mm)**;** lower temperature gradient**;** [**R** insulation]	MAX 3
7(e)	Rainwater use/collection/storage**;** reduced abstraction from named source**;** reduced impact of water infrastructure/construction/maintenance/ abstraction/water treatment**;;** storm surge reduction**;** less waste disposal infrastructure/waste dealt with on site**;** fewer waste treatment processes/use of natural processes/solids composted**;** nutrient sinks/trees absorb nutrients**;** named pollution/disposal problem not caused**;** aquifer recharge**;** named use of water**;**	MAX 5
Total		**15**

Question 8

	Answers	Mark
8(a)	Descriptions of each comparison of similarities and differences inorganic nitrates phosphates way in which nitrates/phosphates enter water nitrates cause Blue Baby Syndrome/methaemoglobinaemia eutrophication algal bloom macrophytes shaded macrophytes die decomposition deoxygenation deaths of aerobic organisms food chain effects timescale organic sewage/abbatoir/food processing/paper mill wastes bacterial decay bacteria deoxygenation death of aerobic organisms increased turbidity reduced light penetration pathogens named pathogens release of inorganic nutrients eutrophication	20
8(b)	Pollutant properties state of matter density point/diffuse sources persistence/degradability toxicity chemical reactivity solubility in water/lipids synergism mobility bio-accumulation bio-magnification mutagenic action carcinogenic action teratogenic action examples to illustrate	20

Question 8 Continued

	Answers	Mark
8(c)	Non renewables fuel extraction fuel processing emissions solid wastes equipment manufacture renewables equipment manufacture aesthetics HEP – flooding, river changes tidal – barrages biofuels	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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