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General Certificate of Education
June 2010

Environmental Studies 2441

ENVS3

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 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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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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Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

	Answers	Mark
1	Coal; wind; hydrogen; coal; wind + tidal; [0 if too many ticks on any row] [ignore ticks in first two rows]	5
Total		**5**

Question 2

	Answers	Mark
2(a)(i)	Oxidises SO_2 to SO_3/sulfurous acid to sulfuric acid/synergism/toxic to leaves-cuticles/denatures proteins - cell membranes/chlorosis**;**	1
2(a)(ii)	Absorbs UV/prevents skin cancer/named health problem**;** [**A** reduces UV reaching Earth]	1
2(a)(iii)	Interaction with NO_x/HCs/production of PANs**;** [**A** interaction with sunlight]	1
2(a)(iv)	Eye/respiratory/asthma/leaf-cuticle damage**;** [**R** protection from UV]	1
2(b)	Only short-term/local effects effects/reduced mobility**;**	1
Total		**5**

Question 3

	Answers	Mark
3(a)	30 ± 2;	1
3(b)	39 ± 2;	1

3(c)(i)	Arguments for**;;;** max 3 eg abundant fuel high energy density/small amount of fuel needed low fuel transport requirement named pollutant not released small waste quantity <u>Qualified</u> comments that can be used for or against eg mining damage uranium, sand, gravel, other materials site suitability limited number/planning permission problems lower access problems than fossil fuel P Stns development/installation/construction cost power station operation cost high cost compared with others high cost but high return type of energy produced – suitability for public/industrial/transport use level of technology well developed too complex for LEDCs level of CO_2 emissions none from power stations lots from support industries power station aesthetics ugly power stations local impact worker safety good safety record public safety named health risk environmental contamination low contamination rate need for evacuation/changed land use stated damage caused level of public support perceived risks NIMBY employment	

	Arguments against;;; max 3 eg non-renewable fuel decommissioning cost (reactor) accidents/Chernobyl/Windscale/Three Mile Island radioactive waste - lack of long-term disposal method radioactive waste - persistence/(long) half life radioactive waste - high cost of disposal weapons link/terrorism risk Additional explanatory comments	MAX 4
3(c)(ii)	Arguments for;;; max 3 renewable energy (relatively) simple technology no fuel requirement no pollution (in use) usable in isolated areas suitable for mobile uses few aesthetic problems Qualified comments that can be used for or against level of public support level of CO_2 emissions none in use released during manufacture type of energy produced – suitability for public/industrial/transport use raw material usage installation/set-up costs maintenance costs Argument against;;; max 3 intermittent/day-night/seasonal Unreliable/affected by cloud cover Low efficiency (energy conversion by panels) Additional explanatory comments	MAX 4
Total		**10**

Question 4

	Answers	Mark
4(a)	Daily rise and fall/daytime peaks, night time lows; fluctuations during daytime peak (during day, meals, breaks); higher during week than at weekend; reduced/changed time of peaks Sat/Sun; differences between weekdays; eg Mon-Thu ref to values at stated time;	MAX 3
4(b)	baseload activity (all the time); eg industry: Al smelting, sewage treatment, water treatment, hospitals domestic: fridges, appliances on standby weekday/weekend differences;; eg less industry at weekend different meal times use of electricity for transport - elec trains/underground/trams [**A** impact of weather change]	MAX 2
4(c)	Pumped storage HEP; (surplus electricity used to) pump water up; two reservoirs; (gravitational) potential energy; water released during periods of demand; rapid response; HEP dam kept closed; (gravitational) potential energy (stored); electricity generated when required; Hydrogen economy; (surplus electricity used for) electrolysis of water; storage of hydrogen (from electrolysis); use of (stored) hydrogen when needed; named method of using (stored) hydrogen; Fuel cell; electricity used to make fuel/converted to chemical energy; named fuel/hydrogen/methanol; electricity generated when required; named use of fuel cell;	MAX 5
Total		**10**

Question 5

	Answers	Mark
5(a)(i)	Catalytic converter; platinum/palladium; reduction; oxygen + nitrogen produced; lean burn engine; control of oxygen supply; urea/ammonia treatment; named product/N_2 (+ H_2O CO_2); named legislation; eg MOT emission controls UN Convention on Long Range Transboundary Pollution European Pollutant Emission Register (EPER) reporting requirements named alternative method/alternative fuel/energy conservation; [**A** two methods or one method + detail] [Cancel right and wrong answers if a list is given]	MAX 2
5(a)(ii)	Wet/dry flue gas desulfurisation/FGD/fluidised bed; lime/calcium carbonate/calcium oxide; slurry/wet spray/scrubber; calcium sulfate/gypsum; Wellman Lord; scrubber; sodium sulfite; sulphuric acid; coal desulfurisation; crush and wash/stream; hydrodesulfurisation; (conversion to) H_2S; amine solution; biodesulfurisation; named taxon; eg Rhodococcus named legislation; eg UN Convention on Long Range Transboundary Pollution European Pollutant Emission Register (EPER) reporting requirements Clean Air Act (1956) UK's Air Quality Strategy Protocol on the Reduction of Sulphur Emissions named alternative method/ alternative fuel/energy conservation; [**A** two methods or one method + detail] [Cancel right and wrong answers if a list is given]	MAX 2

5(b)	Smoke/particles; charge difference**/(**particles) attracted; ash collected/falls/removed;	MAX 2
5(c)	Range/type/number of species; named species; (differing) sensitivities/named acidic pollutant; presence/absence/abundance; colour; size/state of health; reproductive structures; location of study sites; eg urban/rural transect, gravestones number of samples (for reliable results); estimate of past pollutant levels;	MAX 4
Total		**10**

Question 6

	Answers	Mark
6(a)(i)	**×** 8;	1
6(a)(ii)	**×** 4;	1
6(b)	Named human conflicts;; eg aesthetics, noise, flicker, radio interference named wildlife conflicts;; eg bird strike/migration route, bat deaths, habitat damage designated areas access difficulty; distance to consumers; named construction problem; eg poor foundations/deep water	MAX 2
6(c)	NFFO/Non Fossil Fuel Obligation; price control; eg increase fossil fuel price tax relief; carbon tax; (set-up) grants/discounts/subsidies/loans/research funding; make planning process/construction easier; sell surplus electricity to the grid;	MAX 3
6(d)	Habitat damage during material extraction/processing; habitat loss/damage for installation of aerogenerators; habitat loss/damage for access roads/transformers/cables/infrastructure; aesthetic damage to natural environment; bird strike; bat deaths; noise disturbance of wildlife/named taxa; eg of cetaceans	MAX 3
Total		**10**

Question 7

	Answers	Mark
7	Clear hypothesis; (large) number of samples/repeats; avoid anomalous results/gain reliable results; allow statistical assessment of significance; need to control/measure impact of other variables; age; state of health; gender; occupation; other activities; other causes of health change; exposure to other chemicals; synergistic effects; toxic metabolites; critical group; Critical Pathway Analysis/route into body; accuracy of dose/concentration/exposure measurements; lack of knowledge of previous exposure; (equipment) calibration; need for range of doses/concentrations; timescale of study/chronic, acute effects; difficulty with controlled experiment; ethics of human testing/deliberate exposure; untestable hypotheses eg lethal human dose; transferability of results from animal testing; subjective measurement of symptoms/self-reporting; use of placebo/double blind tests; lack of comparison with other studies; need for peer assessment/objectivity; safety precautions;	MAX 10
Total		**10**

Question 8

	Answers	Mark
EITHER		
8 (a)	Vehicle design: Aerodynamics wheel design ignition cooling appliances eg AC weight manufacture materials regenerative braking/hybrid engines Vehicle use: speed control/acceleration encouragement of bicycle/public transport use/car share financial incentives/disincentives Industry: thermal insulation volume control heat recovery 14 2 2 2	20
OR		
8 (b)	Landfill: relatively cheap no processing land use methane release leachate Incineration: reduced solid waste atmospheric pollutants heat recovery equipment costs named wastes named processes Recycling: reduced resource use reduced processing cost reduced wastes transport costs labour costs named wastes named processes 14 2 2 2	20

OR **8 (c)**	Water flow/currents water velocity current direction depth enclosed water bodies/water volume air flow/wind wind strength wind direction precipitation (precipitation) patterns/intermittency/amount geology porosity topography permeability pH wildlife named sensitive taxa 14 2 2 2	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, 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.