A-LEVEL

Environmental Studies

ENVS3: Energy Resources and Environmental Pollution
Mark scheme

2440
June 2015

Version/Stage: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer 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 associates 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 associate understands and applies it in the same correct way. As preparation for standardisation each associate 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, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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 2015 **ENVS3**

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

AO = Assessment Objective

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>1</td><td>
<table>
<tr><th rowspan="2">Abbreviation / technical term</th><th colspan="6">Pollution issue</th></tr>
<tr><th>Noise</th><th>Sulfur dioxide</th><th>Photo-chemical smog</th><th>Smoke</th><th>Ionising radiation</th><th>Oil</th></tr>
<tr><td>Dry FGD</td><td></td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Critical Pathway Analysis (CPA)</td><td></td><td></td><td></td><td></td><td>✓;</td><td></td></tr>
<tr><td>PANs</td><td></td><td></td><td>✓;</td><td></td><td></td><td></td></tr>
<tr><td>NNI</td><td>✓;</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SPM</td><td></td><td></td><td></td><td>✓;</td><td></td><td></td></tr>
<tr><td>Bacterial Bioremediation</td><td></td><td></td><td></td><td></td><td></td><td>✓;</td></tr>
</table>
</td><td>5</td><td>AO1
3.3.2</td></tr>
<tr><td>Total</td><td></td><td>5</td><td></td></tr>
</table>

Question	Answers	Mark	AO / Spec. Ref.
2(a)	22 (cm)**;**	1	AO3 3.3.1
2(b)	thicker insulation will be economic if energy prices rise**;** other named benefit**;;** eg named pollutant/pollution issue caused by fuel combustion/ extraction/processing reduced thermal pollution less money spent on boiler/heating system maintain optimal thickness/compensate for compaction grants/free insulation materials longer term payback	max 2	AO2+AO3 3.3.1
2(c)	named feature of house that is south-facing/named direction related to insolation**;** eg windows long walls conservatory increased window area/sunpipe/skylight/ named light transmitting surface/trombe wall/ named heat absorbing surface**;** use of named high absorption/named low emissivity material**;**	max 2	AO2 3.3.1
Total		**5**	

Question	Answers	Mark	AO / Spec. Ref.
3(a)	both increase**;** both stepped**;** lithium-ion batteries continued increase, nickel-metal hydride reaches limit/plateau(in 1999)**;** [**R** positive correlation] [**R** if date/year quoted is incorrect]	max 2	AO2 3.3.1
3(b)	no improvements since/research stopped (in 1994)**;** shortage of resources**;** concern of metal pollution**;** [**A** maximum energy density reached (in 1994)] [**R** if date/year quoted is incorrect] [**R** better alternatives]	max 1	AO2 3.3.1
3(c)	(increased usefulness as) batteries are smaller/lighter/higher energy store for given volume/mass/size**;** more energy stored/longer life (for given size)/ less frequent recharge**;**	max 1	AO2 3.3.1
3(d)	chemical energy**;**	1	AO1 3.3.1
3(e)	renewable (energy source)**;** instant refuelling possible**;** lower embodied energy**;** less named resource extraction damage/more abundant**;** biodegradable**;** named environmental problem associated with use of metal**;;** eg no neurotoxins no bioaccumulation no biomagnification no synergism named lower cost feature**;** eg resource extraction waste disposal recycling	max 3	AO2 3.3.1

3(f)	water sprays/air filter/respirator/gloves/cover exposed skin/remote operation/reduced time of exposure/regular blood tests**;** [**R** unqualified protective clothing]	1	AO1 3.3.2
3(g)	(organic) more toxic/more completely absorbed/transferred across cell membrane/(more) liposoluble/(more) volatile**;**	1	AO1 3.3.1
Total		**10**	

Question	Answers	Mark	AO / Spec. Ref.
4(a)	named bedrock that is more or less radioactive/granite/limestone**;** named source of radon**;** faults/fissures**;** named occupation/activity that affects exposure**;;** eg radiologist/radiographer/miner/nuclear power worker/frequent flying/caving/pot holing [**R** two examples of same source] medical exposure**;** eg X-ray (photography)/CT scans/radiotherapy/ isotope investigations pollution by radioisotopes released from nuclear/metal industry**;** weapons fallout**;** isotopes in food/water/fertiliser**/**or named food**;** [**A** amount of radon contained by different soils/rocks varies] [**R** naturally occurring radon in the ground, unless qualified by containment] [**R** living near nuclear power station]	max 3	AO2 3.3.2
4(b)	exposure – absorption of radiation**;** contamination – contact with/carrying of the (radioactive) source**;**	2	AO1 3.3.2
Total		**5**	

Question	Answers	Mark	AO / Spec. Ref.
5(a)	1**;**	1	AO2 3.3.1
5(b)	Kaplan (turbines)**;**	1	AO2 3.3.1
5(c)	5 **and** 200**;**	1	AO2 3.3.1
5(d)	lack of high enough head/fall in height**;** lack of narrow exits(for dam construction)**;** permeable geology**;** unstable geology**;** catchment areas too small/low rainfall/small water volume**;** named land use conflict**;** [**R** seismic activity] [**R** isolated from grid, too far from consumers]	max 3	AO2 3.3.1
5(e)	no use of carbon fuel/no CO_2 released during generation**;** intermittent use reduces fossil fuel use to meet demand peaks**;** (embodied energy of) cement/metals/named material**;** (fossil fuel use in) extraction/transport/construction**;** (fossil fuels used in) vehicles for maintenance**;** methane from DOM in reservoir**;** (CO_2 released by) deforestation of reservoir site**;** for pumped storage HEP: CO_2 released by primary electricity resource**;**	max 4	AO2 3.3.1
Total		**10**	

Question	Answers	Mark	AO / Spec. Ref.
6(a)	named pesticide groups**;;** eg organochlorines or one named eg DDT, dieldrin, aldrin organophosphates or one named eg parathion, malathion pyrethroids or one named eg pyrethrum, permethrin neonicotinoids carbamates one of Roundup, paraquat, 2,4-D, 2,4,5-T, Agent Orange one of mercury, copper named properties**;;;** eg persistence/degradability liposolubility specificity solubility in water volatility bioaccumulation biomagnification synergism mutagenicity carcinogenicity teratogenicity [any link between property and named pesticide group must be correct] environmental impact caused by named property**;;;** eg thin eggshell breeding failure/sterility death neurological effects birth abnormalities cancer named affected taxon (max 1 per property) [link between impact and named property must be correct]	max 5	AO2 3.3.2

6(b)	range of nutrient concentrations/application rate (min 3)**;** named nutrient(s)**;** mass/number of seeds/plants/algae per test**;** same species/variety/genetically uniform**;** 3+ replicates per test to increase reliability**;** timing/frequency/duration of observations**;** measurement of named factor**;** eg leaf area/plant height/number of cells/number of leaves/ biomass/dry mass/light transmission/light colour control of other factors**;;** eg light temperature water/humidity soil/growth medium preliminary study to establish named aspect of study**;** use of statistical test to assess significance /named appropriate statistical test**;** [**R** inappropriate statistical test]	max 5	AO3 3.3.3

Total		**10**

Question	Answers	Mark	AO / Spec. Ref.
7(a)	logarithmic (scale)/doubles (noise) volume**;**	1	AO1 3.3.2
7(b)(i)	747-400s 2295 flights**;** (9180/4) 757-200s 5800 flights**;** (= max no of flights - not noisy enough to be restricted. 9180/0.5 > 5800)	2	AO2 3.3.2
7(b)(ii)	fewer flight restrictions/more flights**;**	1	AO2 3.3.2
7(c)	named design change**;** effect on noise emissions**;** eg high bypass ratio engines/engine chevrons/hush kits smooth mixing of exhaust gases and surrounding air **or** better brakes no need to use reverse thrusters **or** more aerodynamic surfaces/winglet/blended wing/undercarriage fairing less turbulence/vibration/thrust/power needed **or** lighter (materials) smaller engines/less thrust/power needed	2	AO1 3.3.2
7(d)(i)	movements increase **and** population (affected) reduces**;** [**R** negative correlation] [**R** if data/values quoted are incorrect] [**A** correct values from graph but thousands omitted]	1	AO1 3.3.2
7(d)(ii)	flightpath changes**;** steeper take-off**;** continuous descent angle**;** change in landing gear deployment**;** engine tests location away from residential areas**;** taxi areas away from residential areas**;** acoustic walls/baffle mounds**;** population movements/changes in residential areas**;** ban noisy aircraft**;** [**R** night flight restrictions, double glazing, airport location]	max 2	AO1 3.3.2

7(e)	transect over 500m-10000m**;** 8-20 sampling sites**;** appropriate intervals (25-1000m)**;** avoidance of objects affecting noise transmission**;** avoidance of other noise sources**;** reference to wind**;** timing of data collection related to flight operations**;** repetition/interval between readings/peak level readings to obtain mean sound levels/representative results**;** calibrated/standardised sound level meter**;** ref to stats test to assess significance/Spearman's rank (correlation coefficient)**;** reference to safety**;** eg ear protection	max 6	AO3 3.3.3

Total		**15**

Question	Answers	Mark	AO / Spec. Ref.
8(a)	intermittence storage unreliability storage low energy density improved technology storage difficulty named technologies land area needed site selection/public education energy form named new technology geographical limitations transport system setup/research/development costs subsidies/grants public acceptance education/information/community grants named environmental impact named method of reducing impact	20	AO1+AO2 3.3.1

Question	Answers	Mark	AO / Spec. Ref.
8(b)	adequate coverage of all **three** areas needed for Scientific content 'good' **Choices made in 1st country** amount resource imported/home produced pollution development of new resources **Impacts in 2nd country** supply/demand – costs shortage of supplies inability to access own resources impact of resource extraction availability of technology cheaper/R&D paid in other countries pollution impact **Impact of energy supplies on quality of life** transport to import desired goods water purification operate appliances time spent on work operation of infrastructure eg education, health care	20	AO1+AO2 3.3.1

Question	Answers	Mark	AO / Spec. Ref.
8(c)	**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 **Specialist techniques**: stated problems of not treating wastes/mixing with general wastes costs/technological difficulties of methods	20	AO1+AO2 3.3.2
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, 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.