



**General Certificate of Education  
June 2010**

**Environmental Studies 2441**

**ENVS3**

**Unit 3 Energy Resources and Environmental  
Pollution**

***Mark Scheme***

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**June 2010****ENVS3****Instructions: ; = 1 mark / = alternative response A = accept R = reject****Question 1**

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

**Question 2**

	<b>Answers</b>	<b>Mark</b>
<b>2(a)(i)</b>	Oxidises SO <sub>2</sub> to SO <sub>3</sub> /sulfurous acid to sulfuric acid/synergism/toxic to leaves-cuticles/denatures proteins - cell membranes/chlorosis;	1
<b>2(a)(ii)</b>	<u>Absorbs</u> UV/prevents skin cancer/named health problem; [A reduces UV reaching <u>Earth</u> ]	1
<b>2(a)(iii)</b>	Interaction with NO <sub>x</sub> /HCs/production of PANs; [A interaction with sunlight]	1
<b>2(a)(iv)</b>	Eye/respiratory/asthma/leaf-cuticle damage; [R protection from UV]	1
<b>2(b)</b>	Only short-term/local effects effects/reduced mobility;	1
<b>Total</b>		<b>5</b>

**Question 3**

	<b>Answers</b>	<b>Mark</b>
<b>3(a)</b>	30 $\pm$ 2;	1
<b>3(b)</b>	39 $\pm$ 2;	1

<p><b>3(c)(i)</b></p>	<p>Arguments for;;; <span style="float: right;">max 3</span>  eg  abundant fuel  high energy density/small amount of fuel needed  low fuel transport requirement  named pollutant not released  small waste quantity</p> <p><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<sub>2</sub> 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</p>	
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	<p>Arguments against;;; max 3</p> <p>eg</p> <ul style="list-style-type: none"> <li>non-renewable fuel</li> <li>decommissioning cost</li> <li>(reactor) accidents/Chernobyl/Windscale/Three Mile Island</li> <li>radioactive waste - lack of long-term disposal method</li> <li>radioactive waste - persistence/(long) half life</li> <li>radioactive waste - high cost of disposal</li> <li>weapons link/terrorism risk</li> </ul> <p>Additional explanatory comments</p>	MAX 4
<b>3(c)(ii)</b>	<p>Arguments for;;; max 3</p> <ul style="list-style-type: none"> <li>renewable energy</li> <li>(relatively) simple technology</li> <li>no fuel requirement</li> <li>no pollution (in use)</li> <li>usable in isolated areas</li> <li>suitable for mobile uses</li> <li>few aesthetic problems</li> </ul> <p>Qualified comments that can be used for or against</p> <ul style="list-style-type: none"> <li>level of public support</li> <li>level of CO2 emissions <ul style="list-style-type: none"> <li>none in use</li> <li>released during manufacture</li> </ul> </li> <li>type of energy produced – suitability for public/industrial/transport use</li> <li>raw material usage</li> <li>installation/set-up costs</li> <li>maintenance costs</li> </ul> <p>Argument against;;; max 3</p> <ul style="list-style-type: none"> <li>intermittent/day-night/seasonal</li> <li>Unreliable/affected by cloud cover</li> <li>Low efficiency (energy conversion by panels)</li> </ul> <p>Additional explanatory comments</p>	MAX 4
<b>Total</b>		<b>10</b>

**Question 4**

	<b>Answers</b>	<b>Mark</b>
<b>4(a)</b>	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
<b>4(b)</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
<b>4(c)</b>	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
<b>Total</b>		<b>10</b>



**Question 5**

	<b>Answers</b>	<b>Mark</b>
<b>5(a)(i)</b>	<p>Catalytic converter;  platinum/palladium;  reduction;  oxygen + nitrogen produced;    lean burn engine;  control of oxygen supply;    urea/ammonia treatment;  named product/N<sub>2</sub> (+ H<sub>2</sub>O CO<sub>2</sub>);    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;  <b>[A two methods or one method + detail]</b>  <b>[Cancel right and wrong answers if a list is given]</b></p>	MAX 2
<b>5(a)(ii)</b>	<p>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<sub>2</sub>S;  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;  <b>[A two methods or one method + detail]</b>  <b>[Cancel right and wrong answers if a list is given]</b></p>	MAX 2

<b>5(b)</b>	Smoke/particles; charge difference/(particles) attracted; ash collected/falls/removed;	MAX 2
<b>5(c)</b>	Range/type/number of species; named species; (differing) sensitivities/named <u>acidic</u> 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
<b>Total</b>		<b>10</b>

**Question 6**

	<b>Answers</b>	<b>Mark</b>
<b>6(a)(i)</b>	× 8;	1
<b>6(a)(ii)</b>	× 4;	1
<b>6(b)</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
<b>6(c)</b>	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
<b>6(d)</b>	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
<b>Total</b>		<b>10</b>

**Question 7**

	<b>Answers</b>	<b>Mark</b>
<b>7</b>	<p>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;</p>	MAX 10
<b>Total</b>		<b>10</b>

**Question 8**

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

<b>OR</b> <b>8 (c)</b>	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
<b>Total</b>		<b>20</b>

## 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.