

MARK SCHEME for the November 2004 question paper

8290 ENVIRONMENTAL SCIENCE

8290/02

Paper 2, maximum mark 80

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

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Grade thresholds taken for Syllabus 8290 (Environmental Science) in the November 2004 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 2	80	53	44	24

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.



November 2004

GCE AS LEVEL

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 8290/02

ENVIRONMENTAL SCIENCE

Paper 2



Page 1	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

Section A

1 (a) (i) place where organism lives/physical/non-biological/geographical, factors in an environment; **1**

(ii) rainforest/appropriate named habitat within rainforest; **1**

(b) (i) how and where an organism lives/its role in the habitat;

food;

breeding/nesting site;

part of habitat occupied; **max. 2**

(ii) occupy different niches;

able to use different size branches;

eat different sizes of fruit;

large birds cannot perch on thin branches;

leaves smaller fruit for smaller species; **max. 4**

Total 8

2 (a) (i) 0° - little temperature variation between winter and summer;

angle of Sun's rays through atmosphere shows little change;

cover smaller area (than at 60°);

so warmer;

(accept reverse of these two points in **(ii)** if not given here)

(ii) 60° - rays travel shorter distance through atmosphere in summer;

angle of rays through atmosphere, more acute in winter/different in summer and winter;

rays fall on smaller area in summer (or converse);

so heat is more intense (or converse)/temperature higher in summer than in winter;

Max. 4 for either (i) or (ii) to max. for (a) 6

Page 2	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

(b) prevailing winds/movement of air masses;

proximity to (warm/cold) ocean currents;

proximity to large bodies of water;

proximity to large areas of forest;

altitude;

max. 2

Total 8

3 (a) (i) A - reflection/re-radiation/emission, from Earth's surface;

B - absorption and re-radiation/trapping of radiation by atmosphere; **2**

(ii) C - absorption; **1**

(b) maintains sufficient temperature on Earth;

needed for support of life; **2**

(c) (i) additional CO₂/CO₂ released into atmosphere from burning;

increases/enhances greenhouse effect;

(ii) removes carbon sinks/CO₂ not used in photosynthesis/less plants to take in/use CO₂;

CO₂ builds up/increases/enhances greenhouse effect;

(iii) water vapour is greenhouse gas;

increased evaporation increases amount of water vapour/enhances greenhouse effect;

min. 1 mark for each of (i), (ii) and (iii) plus one in any **max. 4**

Total 9

Total for Section A 25

Option 1

4 (a) 1 1st law of thermodynamics;

energy can neither be created nor destroyed/AW;

but can be converted from one form to another;

2 2nd law of themodynamics;

no single conversion of energy can be 100% efficient/AW; **max. 3**

Page 3	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

(b) (i) complex hydrocarbons;
 formed from organic matter;
 changed by high temperatures;
 from burial; **max. 2**

(ii) (deeper burial) raises temperatures further/higher temp/pressure,
 (converts kerogens); **max. 1**

(iii) used faster than produced;
 finite reserves;
 formed over very long time scales;
 conditions for formation no longer exist; **max. 2**

(c) oxides of sulphur (and nitrogen);
 released when fossil fuels are burnt;
 dissolve in precipitation;
 form acids;
 increase acidity of rain; **max. 3**

Total 11

5 (a) nuclear waste remains radioactive for a very long time;
 small amounts of waste release large amounts of radiation;
 may escape into sea/ground water;
 may pollute large area; **max. 3**

(b) any appropriate method; with detail; x 2
 e.g. deep burial; after encasing in concrete/steel;
 low level waste; dumped at sea; **4**

(c) low CO₂ emissions;
 long lifetime of fuel resource;
 OVP; **max. 2**

Total 9

Page 4	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

- 6 (a) (i)** the Sun; **1**
- (ii)** transmission of power generated to land;
- high capital cost;
- dangers/difficulties for shipping;
- OVP; **max. 2**
- (b) (i)** 8; **1**
- (ii)** spacing of turbines/land available/height of turbine/visual impact/likely max.
- windspeed/strength of material used for blade; **1**
- Total 5**
- 7 (a)** gravitational pull;
- of Moon (and Sun);
- ref. to Coriolis force/geomorphology of ocean basins; **max. 2**
- (b)** problem; explanation; x 3 **6**
- e.g. increased localised erosion;
- as wave action is concentrated on smaller area;
- poor water quality/greater pollution;
- due to lack of flushing of estuarial water;
- destruction of estuary habitats such as salt marsh;
- which depend on rise and fall of tide;
- effects on fish migration;
- barrage prevents passage; **Total 8**
- 8 (a)** larva/molten rock;
- close to/within 10km, of Earth's surface;
- provides source of heat; **max. 2**
- (b)** cold water pumped down to hot rock;
- hot water/steam extracted;
- used to power turbines; **3**

Page 5	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

(c) only possible where hot rock is close to surface;

few areas suitable;

economic constraints;

max. 2

Total 7

9 (a) used for drying fish/crops;

e.g;

photo-thermal system/solar panels;

heats water (in pipes);

black surface for heat absorption; ® traps heat;

cover to prevent heat escape;

photo-voltaic cells;

convert solar energy to electrical energy;

via chemical energy;

large banks of cells incorporated into building structure;

solar furnace;

use of concave mirror to concentrate rays;

ref. to aspects of house construction w.r.t. passive use of solar energy;

OVP;

max. 10

(b) low running cost;

relatively low capital cost;

no infrastructure required;

no distribution problems;

so useful for isolated dwellings;

low maintenance;

low environmental impact;

max. 5

Total 15

Total for Option 1 55

Page 6	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

Option 2

- 10 (a) (i)** smaller/AW;
by approximately $\frac{1}{2}$ **2**
- (ii)** increased; **1**
- (iii)** wind blows dry, salty soil; **1**
- (b)** existing species cannot thrive in increased salinity;
smaller area supports less fish;
smaller area has led to overfishing; **3**
- Total 7**
- 11 (i)** coagulation - very fine particles/colloidal solids;
do not settle out of suspension;
coagulating agent aggregates/coagulates particles;
to flocs;
named coagulant; **max. 3**
- (ii)** sand filtration - micro-organisms;
in top layer;
decompose organic matter;
remove nitrates/phosphates;
release O₂;
non-pathogenic bacteria;
in lower layer;
continue removal of organic matter;
filtered water contains few pathogens; **max. 5**
- (iii)** chlorination - kills remaining pathogens; **1**
- Total 9**
- 12 (a)** precipitation;
from hot water solutions;
in-filling fissures in rock; **max. 2**
- (b)** heavy metal-rich grains, concentrated in sedimentary deposits/concentrated in sediment; **1**

Page 7	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

(c) (i)	(non-metallic raw) materials mined/quarried/used in very large quantities;	1
(ii)	suitable different use for each; x 3	3
(iii)	land degradation/habitat destruction;	
	noise;	
	dust;	
	OVP;	max. 2
		Total 9
13 (a) (i)	acidic;	1
(ii)	raises pH;	1
(b)	major nutrients most available at pH between 6.0 and 8.0;	
	minerals more available/uptake increased as pH is raised;	
	effect of nutrients on crop production;	3
(c)	bacterial/rhizobium sp.;	
	in root nodules of legume;	
	fix atmospheric nitrogen;	
	increases nitrogen/nitrate content of soil;	max. 3
		Total 8
14 (a) (i)	increased concentration of (soluble) salts in the soil;	1

Page 8	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

(ii) high evaporation rate in high temperatures;

water with dissolved salts drawn up through the soil;

or

irrigation water may be slightly saline;

salts build up in the soil as it evaporates;

2

(iii) prevents uptake of water by plant;

concentration of salts greater than in plant cells/lowers water potential of soil; ref. to osmosis;

2

(b) water seeping from irrigation channels/uncontrolled irrigation;

raises level of water table;

2

Total 7

15 (a) very long period before danger from radiation is gone;

high level waste may need monitoring for 250,000 years;

difficulty of ensuring long-term surveillance;

burial means danger of seepage into surrounding land;

contamination of ground water;

movement of wastes to suitable sites;

danger of accident;

security risks/e.g;

difficulty of finding suitable sites;

details;

objections by local inhabitants;

max. 6

Page 9	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

(b) reduces pressure on finite resources;

such as metal ores/minerals;

reduces environmental impact;

e.g;

reduces need for landfill;

reduces incineration;

reduces pollution;

e.g.

job creation;

may not be energy-efficient;

may increase pollution;

difficulty of storing materials;

max. 9

Total 15

Total for Option 2 55

Option 3

16 (a) (i) DNA; **1**

(ii) advantage – reduces herbicide use/OVP;

disadvantage – herbicide resistant weeds may arise/ more,

damaging/dangerous/persistent/herbicides may be used; OVP;

2

(b) (i) artificial selection/selective breeding; **1**

(ii) selection of animals/plants with desired characteristics;

which are able to cross-breed;

no removal of parts of genetic material;

or use of vector;

max. 3

Total 7

Page 10	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

- 17 (a)** advantage - minimises soil damage from heavy machinery//AW/
minimum tillage reduces water loss from soil;
- Ⓐ OVP e.g. time/labour costs
- disadvantage - use of herbicide may leave residues on crop/in soil;
- other valid for either **2**
- (b) (i)** crop increases; **1**
- (ii)** no competition (for nutrients/water); **1**
- (iii)** crop almost as good;
- less bare soil;
- reduces erosion;
- less herbicide used reduces cost; **max. 3**
- Total 7**
- 18 (a) (i)** renewable/less environmental impact than mining or drilling/act as carbon
sinks while in growth; **1**
- (ii)** very large areas of land needed/problems of monocropping/unpleasant
smells of exhaust gases from biofuel; **1**
- (b)** deforestation;
- soil erosion;
- OVP; **2**
- (c) (i)** less manure for agricultural land;
- reduces replenishment of nutrients;
- soil more easily leached as less organic matter; **max. 2**
- (ii)** less organic matter added to soil so soil structure deteriorates;
- organic matter binds soil particles;
- aids percolation;
- more easily eroded by wind/rain; **max. 2**
- Total 8**

Page 11	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

- 19 (a)** milk/wool; **1**
- (b)** less energy/effort used;
- more reliable food supply;
- settled existence possible;
- arable farming can also be practised;
- OVP; **max. 3**
- (c) (i)** overstocked - North West, Chobe, Ghanzi, Kgagaladi;;
- 3 for 1 mark, all for 2**
- understocked - Central, North East, Kgatleng, South East, Ngwatketse;;
- 4 for 1 mark or if Kweneng is included all for 2**
- (ii)** overgrazing;
- degradation of grassland/increase in weeds;
- bare soil;
- erosion;
- lower production;
- cattle deteriorate; **max. 2**
- Total 10**
- 20 (a) (i)** amount of fish removed that does not cause a decline in stocks; **1**
- (ii)** yield increases with fishing effort;
- until maximum sustainable yield is reached;
- after this yield declines as effort increases; **3**
- (b)** restrict number of fishing days/trips/restrict mesh size/catch quotas; **1**
- (c) (i)** produces cheap/large amounts of, protein/reduces depletion of wild stocks; **1**
- (ii)** pollution/eutrophication of water;
- contamination from drugs/antibiotics used;
- escape of farmed fish into wild compete with/cross-breed with wild types;
- damage to habitats/e.g;
- OVP; **max. 2**

Page 12	Mark Scheme	Syllabus	Paper
	AS LEVEL – NOVEMBER 2004	8290	2

Total 8

21 (a) loss of habitat;

e.g;

pollution;

e.g. of source such as pesticides;

effects of agriculture/other activities such as logging;

climate change;

hunting/paching/collection;

trade in animal/plant products;

loss of diversity;

effects on food chains/webs;

reduced gene pool;

max. 7

(b) captive breeding;

role of zoos/botanic gardens;

gene banks/seed banks;

reintroduction;

role of conservation organisations;

habitat protection;

nature reserves/game parks;

national/international legislation;

bans/control of, hunting/poaching/trade;

max. 8

Total 15

Total for Option 3 55