

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

NOVEMBER 2002

GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 80

SYLLABUS/COMPONENT :8290 /2

**ENVIRONMENTAL SCIENCE
(Paper 2)**



UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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Section A:

- 1 (a) greater proportion of ocean in southern hemisphere / more land in northern hemisphere;
 more energy needed to heat water than land / land heats more rapidly;
 heat energy used in evaporation;
 water absorbs more heat;
 deeper heat penetration in oceans;
 which act as heat reservoir;
 heat released over longer period / in winter; (ora for n. hemisphere) max 4

(b) high albedo;

heat used in melting snow/ice;
 ref. to Sun's rays travelling through more atmosphere / spread over larger area; 2

(c) ice less dense than liquid water;

ice floats/forms at surface;

insulates water below;

water at deeper levels does not freeze;

life can continue below ice;

max 3

Total 9

2 (a) (i) lines joining points at the same atmospheric pressure;

1

(ii) correct angle to isobars (horizontal / almost horizontal); (A) angle $\approx 20^\circ$

correct direction (left to right);

2

(iii) very rapid drop in pressure;

causing very strong winds;

2

(b) (i) A shown in centre of area of high pressure;

1

(ii) light winds;

clear skies;

settled weather;

lack of rain;

max 2

Total 8

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3 all live in the same habitat / forest is habitat;

if all species eat the same food;

and live in the same parts of the trees;

there is competition / they compete;

for the same niche;

they all occupy a different niche; by eating different foods/

~~are~~ living at different levels in the forest;

so no competition / do not compete;

loga eats mainly vertebrates; and is distributed evenly throughout the vertical space;

jint's diet has high proportion of bark; and occupies mainly lower areas;

soksak's diet is mainly fruit; and is largely ground living;

max 8

Total 8

Total for Section 25

Section B

Option 1

4 (a) (i) watts;

1

(ii) joules;

1

(iii) indication that correct formula is used, either by stating $P=E/t$ or by substitution of numbers in correct places (A if time not shown in seconds);

$$2400 = E/2 \times 60;$$

$$E = 288000 \text{ joules};$$

3

(b) high level reservoir/dam;

water allowed to fall to low level;

drives turbines;

which generate electricity;

max 3

Total 8

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| | |
|---|----------------|
| 5 (a) (i) coal, oil, gas; | 1 |
| (ii) gas; | 1 |
| (b) (i) wood; | 1 |
| (ii) inefficient/low energy production/shortage of supply/lack of versatility in use; | 1 |
| (iii) oil; | 1 |
| (iv) nuclear; | 1 |
| (v) technological problems; | |
| uneconomic; | |
| hazardous waste; | |
| difficulties of storing waste; | |
| problems of reprocessing; | |
| danger to the environment; | |
| health concerns; | |
| impact of accidents/example; | |
| fear of terrorism; | max 2 |
| | Total 8 |
| 6 (a) solar panel/solar cell/solar furnace; | |
| further two marks for details of example given;; | 3 |
| (b) renewable; | |
| non-polluting; | 2 |
| (c) only practical where long hours of sunshine are reliable; | 1 |
| | Total 6 |

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- 7 (a) Sun/solar; 1
- (b) (i) large diameter of turbine;
- positioned where wind speed is constantly high; 2
- (ii) visual impact of large turbines on environment;
- best positions for high wind speed in environmentally sensitive areas such as
- mountains/turbines on high towers so very visible; 2
- danger to birds; noise; interference with radio/TV; OVP;*
- (iii) storage of power generated when no/little wind;
- variability/unreliability of wind;
- large number of turbines needed to generate much power; max 2
- (c) (i) (large) sluice gates;
- open at flood tide;
- close at ebb tide;
- head of water built up;
- turbines; and small sluice gates;
- open at ebb tide;
- need for/advantage of large tidal range; max 5
- (ii) high capital cost/environmental objections; 1
- Total 13**
- 8 (a) rate at which temperature rises with depth in Earth's crust; 1
- (b) areas of igneous activity/high concentration of radio isotopes (or example)/low
- density siliceous rock (or example); 1

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(c) either boreholes in areas of hot springs/geysers;

release high pressure steam;

to drive generator;

or fracturing hot rocks;

cold water injected;

hot water produced;

or geothermal aquifer;

cold water injected;

hot water pumped out;

heat exchanger;

max 3

Total 5

9 (a) toxic fog;

caused by uv radiation;

acting on NO_x;

and hydrocarbons;

from motor traffic/industrial emissions;

ozone produced;

forms in, stable sunny conditions/clear skies and light winds;

over cities/industrial areas;

traps other pollutants/e.g.;

effect intensified by geography/bowl shaped relief;

max 8

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(b) reduction of emissions from industrial processes;

use of scrubbers/other e.g.;

reduction in motor traffic;

use of catalytic converter;

improve public transport;

other schemes/e.g.;

improve engine efficiency;

e.g.;

e.g.;

research and development of cleaner alternatives;

e.g.;

max 7

Total 15

Total for Section 55

Option 2

10 (a) permeable/porous rock that stores/transmits water; 1

(b) (i) confined aquifer shown between layers of impermeable rock; 1

(ii) unconfined aquifer above upper layer of impermeable rock; 1

(iii) perched aquifer above impermeable rock and spring on right of diag.; 1

(c) (i) shorter time lag to reach peak;

higher peak; *(A) figs.* 2

more gradual discharge before development;

(ii) less interception by plants;

less infiltration as more hard surfaces;

quicker drainage over hard surfaces;

angled roofs/cambered roads lead to quicker drainage;

dense network of drains leads to quicker drainage;

max 3

Total 9

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11 (a) (i) water contaminated with faeces;

^{untreated} sewage / faeces may contain, bacteria causing disease / Vibrio cholerae;

^{sewage used as} fertiliser attracts flies which may transmit disease;

(ii) caused by parasitic worm;

passed out in faeces;

pass through secondary host / water snail;

larvae pass into water;

enter body via skin;

max 4 for (i) or (ii) to max 6

(b) cholera – vaccination / OVP;

schistosomiasis – kill snails / end use of untreated sewage as fertiliser / OVP; 2

Total 8

12 (a) (i) difficulties of separating types of plastic;

fewer markets / facilities for using, re-cycled plastics / OVP; 1

~~disposal~~
(ii) produced from oil which is non-renewable resource;

not bio-degradable; 2

(iii) textiles;

steel;

vegetable matter; max 2

(b) air pollution by, oxides of nitrogen or sulphur / CO / dioxins;

leaching of toxic materials from ash left; 2

Total 7

13 (a) (i) movement of minerals down through soil dissolved in drainage water; 1

(ii) sandy; 1

(iii) loss of soil fertility / pollution of groundwater sources; 1

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(b) land may become waterlogged;

ref. salinisation;

evaporation draws salts upwards;

crust of salts forms on surface;

toxic to plants;

max 4

Total 7

14 (a) (i) heavy, metal-rich grains concentrated in sedimentary deposits;

1

(ii) gold heavier than sand/other sedimentary grains;

lag behind in bed load;

2

(b) (i) non metallic raw materials needed in large quantities;

1

(ii) clay – bricks;

limestone – cement/concrete/roadstone/industrial processes;

sand – concrete/roadstone;

gravel – concrete/roadstone; any three, each to have different use **max 3**

(iii) danger of water-filled pits;

visual damage to environment;

destruction of habitats;

subsequent use for landfill may lead to pollution;

dust/noise/traffic;

max 2

Total 9

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15 (a) release of (large amounts of) nitrate/phosphate/organic matter/^{excess nutrients,} into water/^{AW};

excessive algal/plant growth;

decay by bacteria;

lowers oxygen levels in water;

changes fauna that can survive;

reduced species diversity;

caused by sewage input;

from treatment plants;

from animal waste/slurry;

from fish farms;

leaching/run-off from fertiliser application;

water increasingly turbid;

max 8

(b) screening of coarse materials;

sedimentation;

sludge into digester;

anaerobic bacteria;

produce methane;

used to power plant;

digested sludge disposed of;

settled sewage (from sedimentation) to fermentation tank;

micro-organisms oxidise organic matter;

final sedimentation;

effluent discharged;

max 7

Total 15

Total for section 55

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Option 3

16 (a) a species is a group of organisms that normally interbreed in the wild and produce fertile offspring;

a variety is a genetically distinct population within a species/a group within a species with distinctly different characteristics;

2

(b) conditions on each side of the valley differ/e.g.;

genotypes within species show variation;

particular characteristic may confer advantage in conditions on one side of valley;

increases chance of successful breeding;

and passing on advantageous characteristic;

population develops where this characteristic dominates;

max 4

Total 6

17 (a) roots anchor soil;

top grow with leaves act as physical barrier to intercept soil;

act as windbreak;

intercept/reduce force of rain;

max 2

(b) millet grown in rows;

grows less densely than grass;

more bare soil;

max 2

(c) use of grass bunds;

tree belts;

permanent plant cover;

max 2

Total 6

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18 (a) ocean fish stocks decreasing;

means of intensive protein production;

large return on relatively small area;

max 2

(b) advantages – no drain on natural fish resources;

only wanted species killed;

rapid growth;

high value species farmed;

product directly used for human diet/less energy loss; max 3

problems – only suited to fresh water/coastal species;

antibiotics may be needed to control disease/problems with disease;

pollution/eutrophication from discharge of waste;

overcrowding of fish in pens/ethics/factory farming objections;

escape of farmed fish causes problems in wild populations; max 3

destruction of habitats (eg mangroves);

Total 8

19 (a) artificial selection – normal cross-breeding of organisms selected for

particular /favourable characteristic;

to produce offspring with that characteristic;

genetic engineering – transfer of genetic material from one species to

another;

modifying the characteristics of that organism; max 3

(b) e.g.;

advantage;

2

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(c) less research into conventional selection/breeding;

may encourage use of marginal lands leading to loss of habitats;

greater loss of genetic diversity;

herbicide-resistant varieties of crops may give rise to resistant weeds;

disadvantage to poorer areas where GM technology is not available;

ecological disruption by "escaped" GM organisms;

OVP;

max 3

Total 8

20 (a) (i) fuel;

building materials;

fodder;

fruit;

honey;

medicines;

dyes;

OVP;

max 4

(ii) demand for timber as a cash crop;

freeing of land for development;

freeing of land for arable farming/cattle ranching;

increased demand for fuel wood;

max 2

(b) city populations buy wood from rural people;

increased demand on supplies within short range of city;

wood then collected from further away when these supplies are used up;

wood collection strips land of trees;

demand exceeds supply;

max 3

} (A) timber; if these two are not given

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(c) (i) soil erosion;

low fertility of land;

OVP;

max 2

(ii) avoid overstocking/overgrazing/ *OVP associated with grassland maintenance;* 1

Total 12

21 (a) benefit to humans;

economic importance;

tourism;

extinction of one species has knock-on effect/interdependence of species;

may lead to disruption of ecosystems;

untapped food sources;

maintenance of gene pool;

importance in agriculture;

e.g.;

medicine;

e.g.;

industry;

e.g.;

ethical reasons;

max 7

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(b) elephants very abundant in 19th century;

hunted for ivory } tusks;

largest tusks on adults;

breeding animals lost;

over-hunting leads to decline;

ivory export quotas set by CITES;

followed by trade ban by CITES;

ivory is economically important in some countries;

encourages poaching;

effects of poaching/excessive hunting on social behaviour of elephants;

price of (illegal) ivory increases;

difficulties of policing ban;

some areas are overpopulated with elephants/distribution uneven;

may cause damage to environment;

need for culling;

some countries seek management policy rather than ban;

importance of elephant for tourism;

max. 8

Total 15

Total for section 55