



ASSESSMENT and  
QUALIFICATIONS  
ALLIANCE

# Mark scheme

# June 2003

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## GCE

# Environmental Science

## Unit ESC1

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

**Question 1**

- (a) (i) More Ultra Violet/wider wavelength range; 1
- (ii) Shorter wavelength(s); 1
  
- (b) Reflectivity/proportion/amount of light reflected/reflection of light; 1
  
- (c) (i) Negative feedback/homeostasis/balance/equilibrium/self regulation; 1
- (ii) Temperature regulation;  
(temperature) reduced;  
increased albedo/light reflection/reduced light reaching surface;  
**OR**  
reduced insolation (at surface);  
reduced evaporation/transpiration;  
reduced condensation/cloud formation; 1

MAX 2

**Total marks = 6**

**Question 2**

(a)

	(Waste)spent fuel rods/ nuclear/uranium rods/ plutonium;	Vitrification/solid glass;
	Used fuel rod cladding/filters from waste treatment;	
	Clothing/general contaminated equipment/fuel manufacture;	

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- (b) (i) Nuclear power: relatively small/coal larger; 1
- (ii) Nuclear problem for longer/justified reference to life span of waste;  
must have comparative statements 1

**Total marks = 6**

### Question 3

- (a) (i) High population/high level of industry/lower rainfall/lack of source with justification e.g. lack of reservoirs + topography/land use/  
lack of aquifers + geology/contamination; 1
- (ii) Population decrease/reduced industry/change in type of industry; 1
- (iii) Increase in population/per-capita consumption/tourism/industry/irrigation as climate changes; 1
- (b) Suggestion of possible source:  
new aquifers/aquifer recharge/river abstraction/desalination/inter-basin transfer/transport/reservoirs/reuse/repair leaky pipes; 1
- (c) (i) Reference to time period when availability is lower than demand/April to October demand is high, availability is low; 1
- (ii) Storage during winter months/times of surplus water/low demand/high availability;  
for later use; 2
- Total marks = 7**
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### Question 4

- (a) Potential energy (of raised tide);  
kinetic energy (of turbines)/mechanical energy; 2
- (b) Any of the following:  
Bay/estuary/high tidal range/low shipping use/low environmental impact/low economic damage;  
1 mark for description or justified example  
e.g.  
Bay;  
large volume of water/low construction cost/not too deep (for construction)/narrow entrance to increase velocity;  
**OR**  
Large tidal range;  
increased volume of water/increased potential energy/  
greater water velocity; MAX 2
- (c) No energy conversion is 100% efficient/ref. to Laws of Thermodynamics/  
water would stop moving if all energy harnessed/correct e.g. of “waste”  
energy produced; 1  
[A when too slow to harness KE/turn turbines]  
[R ref to intermittency]
- Total marks = 5**
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**Question 5**

- (a) X on 'Gases from industrial process' in heat exchanger; 1  
Y on 'Fresh air' on pipe; 1
- (b) Heat transfer/conduction;  
from (outgoing) wastes to (incoming) air (for use);  
recycling/reuse of heat energy;  
reduced demand for 'new' energy/fuel use; MAX 2
- (c) Any method  
e.g.  
Increased length/long pipes;  
increase surface area;  
**OR**  
Thinner pipes;  
increased rate of conduction;  
**OR**  
Thermal insulation;  
reduce heat losses (to surroundings);  
[R if around pipe]  
**OR**  
Pipes made of better thermal conductor/example;  
more efficient/rapid heat transfer;  
**OR**  
Counter – current flow;  
increased temperature gradient;  
increased rate of heat transfer; MAX 2

- (d) Any suitable example:  
 1 mark for method, 1 mark for expansion  
 e.g.  
 Aerodynamics;  
 reduced friction/drag;  
**OR**  
 Better engine temperature control;  
 more efficient fuel combustion;  
**OR**  
 Ignition control/electronic ignition/fuel injection;  
 more efficient combustion;  
**OR**  
 Optimum size of engine;  
 [R smaller]  
 correct power : weight ratio/avoid unnecessary fuel use;  
**OR**  
 No use of unnecessary energy-using equipment;  
 Air conditioning/4WD/other suitable e.g.;;  
**OR**  
 Lower weight/lighter construction materials;  
 less fuel/energy required; MAX 2  
 [A “more efficient engine” for 1 mark only]

**Total marks = 8**

**Question 6**

- (a) Higher pressure and temperature;  
 [only allow if explanation provided]  
 (pressure) forces out oil;  
 (temp) oil less viscous/flow more easily/comes out faster/more liquid; 3
- (b) Porous;  
 permeable;  
 impermeable/cap rock;  
 route from source rock; MAX 2  
 [R features of source rock]

**Total marks = 5**

### Question 7

- (a) UV absorbed;  
energy converted to chemical energy;  
breaks up/splitting of diatomic oxygen;  
splitting/destruction of ozone;  
reversible reaction/dynamic equilibrium/cycle repeated; MAX 3
- (b) Less/no UV reaches Earth's surface/absorbs UV/barrier to UV/UV filtered out;  
prevents all/tissue damage/example of effect;  
DNA damage/(skin) cancer/eye problems; 2
- (c) CFCs absorb UV/short W/L radiation;  
chlorine released;  
chlorine reacts with monatomic oxygen;  
chlorine released again;  
reduced levels of O/increased levels of O<sub>2</sub>;  
ozone level reduced/less ozone formed/ozone hole/thinner ozone layer; MAX 3  
[R radiation on own]  
[R CFCs break down ozone]  
[R properties of CFCs e.g. persistence]

**Total marks = 8**

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## Question 8

(a)

(i) Gas;	(ii) Activity;;	(iii) Emission reduction;;;
Carbon dioxide;	Combustion of fossil fuels/first example; second example of fossil fuel use; (only one example from each of industrial or domestic or transport use of fossil fuels) combustion of wood/biomass; increased decomposition; (reduced photosynthesis with cause) e.g. deforestation;	Appropriate processes and descriptions; non FF use/use of renewables; increased efficiency of use/better combustion efficiency/energy conversion efficiency; reduced unnecessary use;
Ozone;	Use of ozone in water treatment; NO <sub>x</sub> breakdown;	Use of Cl <sub>2</sub> ; control of hydrocarbons; control of NO <sub>x</sub> ; catalytic converters; e.g. of reaction in catalytic converter;
Oxides of nitrogen;	Combustion of fuel/in vehicle engines; use of nitrate fertilisers; deforestation by burning/stubble burning;	Organic fertilizers; slow release inorganic fertilizer; catalytic converters; e.g. of reaction in catalytic converter; low temperature combustion;
Methane;	Landfill sites; paddy fields fossil fuel extraction; herbivores/ruminants/ livestock;	Name of alternative disposal technique; description of process; ref to organic matter; alternative crops; collection of methane; reduced livestock rearing;
CFCs;	Aerosol cans; expanded plastics; solvents; refrigerants/air conditioning;	Alternative propellants; alternative gases for expanded plastics; alternative solvents; alternative refrigerants;
Water vapour;	Named process increasing evaporation; named process increasing transpiration;	Process/activity to control temperature; details of mechanism; control of vegetation;
1	MAX 2	MAX 3

6

(b) Changes in:

temperature;  
humidity;  
wind direction;  
wind strength;  
ocean currents;  
temperature extremes;  
vegetation distribution;  
rainfall patterns;  
cloud cover;  
insolation/albedo/scattering;

species distribution/dominance;  
C3 & C4 plant dominance;  
growth rates;

sea-level rise;  
flooding of low-lying land;  
more evaporation;  
increased rainfall;  
increased erosion;  
changed distribution of agriculture;  
extinctions/reduced biodiversity;  
soil composition/processes;  
vegetation fire frequency;  
change to biogeochemical cycles;  
    e.g. CO<sub>2</sub> dissolved in oceans  
        decomposition releasing CO<sub>2</sub>  
        ice melting

MAX 9

[A corresponding opposite statements – global warming/cooling]  
Up to 5 points with up to 1 for expansion of each

**Total marks = 15**