



## **General Certificate of Education**

# **Environmental Science 5441**

**ESC1      Energy, Atmosphere and  
Hydrosphere**

## **Mark Scheme**

*2008 examination – January series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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**Environmental Science**
**January 2008****ESC1****Instructions: ; = 1 mark / = alternative response A = accept R = reject****Question 1**

Feature	Source of water for public supply		
	Upland reservoir water	Groundwater	Lowland river water
Most likely to be saline		✓	
Least likely to be turbid		✓	
			✗
Least likely to have a high calcium content	✓		
Most likely to contain <i>E. coli</i>			✓
Least likely to have a low dissolved oxygen level	✓		

**Total marks = 5**

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**Question 2**

- (a) (i) Large volume/space for stored oil; 1
- (ii) Traps/prevents escape (upwards) of oil; 1  
[**R** downwards movement]
- (iii) Reduce viscosity/less thick; 1  
[**R** pressure]
- (b) Timescale of reformation renewable quick, non-renewable slow; 2  
crude oil non renewable/solar power renewable/relative timescale;
- (c) Named specific cause for decline in use;;  
Explanation;;  
technical  
geological  
political  
legislative  
economic  
environmental impact/pollution  
environmental protection/designated areas  
social/public preference MAX 3
- (d) Wave – winds/solar energy; 2  
tidal – gravitational attraction of moon/sun;

**Total marks = 10**

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**Question 3**

- (a) Chlorine (monoxide) causes ozone depletion;  
related chemical reaction; 2  
[R descriptions of correlation]
- (b) (From) CFCs/named use (of CFCs);  
chlorine released (from CFCs); 2  
reaction with ozone/monatomic oxygen;
- (c) Increased UV;  
DNA damage/mutations/skin damage/skin cancer/sunburn/cataracts/reduced photosynthesis/  
other named health effect of exposure to UV; 2
- (d) Alternative materials for named use;  
named examples/propane/butane/HCFs/HFCs;;  
named alternative activity/pump action sprays/trigger sprays;  
reduce/ban use of CFCs/HCFs/halons;  
Montreal Protocol;  
CFC destruction/waste disposal/named item containing CFCs;  
description of method/incineration; MAX 4

**Total marks = 10**

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**Question 4**

- (a) (i) Increased temperature;  
increased evaporation;  
increased condensation nuclei/cloud cover; 2  
[R reference to wind (not in table)]
- (ii) (More) cloud cover;  
traps/prevents escape of heat/IR/long wavelength;  
  
reduced humidity;  
lower heat capacity of drier air;  
  
reduced albedo;  
more energy absorbed; 2  
  
[A smog = fog]  
[R holds heat/specific heat capacity (not in table)]
- (b) Energy conservation effect;; Max 2  
eg  
reduced heat release/generation/named energy conservation method;  
less soot/smoke;  
reduced evaporation from hot effluent water;  
  
effect on data;;;  
eg Max 3  
reduced temperature;  
changed frosts/snow/fog/cloud cover;  
fewer condensation nuclei;  
reduced precipitation/fewer days with precipitation MAX 4  
[R GHG effects]
- (c) Frost formation;  
cold air under warm;  
density difference;  
less buoyant;  
reduced wind velocity;  
fog/mist formation;  
increased albedo;  
reduced temperature; MAX 2

**Total marks = 10**

**Question 5**

- (a) (i) Correct area shaded; 1
- (ii) Francis; 1
- (iii) Turgo and Kaplan; 1
- (b) Sunlight absorbed and converted to heat;  
evaporation;  
potential energy;  
pressure differences produce winds; MAX 2  
[R water cycle driven by the sun (need processes)]
- (c) Surplus electricity/low (energy) demand allows water to be pumped up/  
moved from bottom to top reservoir;  
high (energy) demand, water flows down/potential energy transformed; 2
- (d) (i) Lower energy density of named renewable energy resources/  
high energy density of fossil fuels;  
storage/weight/transport difficulties/quantity needed of named  
renewable energy resource; MAX 1
- (ii) Mismatch to demand from named (intermittent) renewable energy resource/  
fossil fuels always available; MAX 1
- (iii) Named required energy type not available from named renewable  
energy resource; MAX 1

**Total marks = 10****Question 6**

- (a) Chlorofluorocarbons/CFCs;  
nitrate fertiliser use/named high temperature combustion process/  
use of named equipment;  
landfill sites/padi fields/coalmine ventilation/natural gas use(leakage)/  
livestock farming; 3
- (b) Increased evaporation (and subsequent precipitation)/changed wind patterns/  
changed ocean current; 1
- (c) Contracts on melting/expands on freezing/displaces liquid volume; 1

(d) *Quality of Written Communication is assessed in this answer.*

Impact of changed factors;;;  
 extinction/changed geographical range  
 migration patterns  
 range of tolerance  
 enzyme inhibition  
 named adaptations/lack of adaptation/speed of adaptation

Max 4

Factors changed by GCC

named abiotic factor;;  
 eg water supply, fires, temperature extremes, increased storm damage,  
 flooding, erosion, melting of ice/permafrost/salinity/nutrients

Max 2

named biotic factors;;  
 changed food supply  
 changed habitat  
 changed breeding sites  
 changed competition  
 changed inter-species relationship  
 eg pollination, seed dispersal, decomposition/nutrient release

Max 2

Taxa;;;;

appropriate named taxonomic examples used to illustrate

Max 4

MAX 8

*Quality of Written Communication*

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.

MAX 2

**Total marks = 15**