



## General Certificate of Education

# Environmental Science 5441/6441

*ESC1 Energy, Atmosphere and Hydrosphere*

## Mark Scheme

*2005 examination – June 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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

**Environmental Science**

**June 2005**

**ESCI**

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

**Question 1**

- (a) (Water soaking) into the ground/soil/rock/entering interstitial spaces;  
(evapo) transpiration/diffusion;  
water landing on leaves/vegetation; 3  
[R taken up by plant]
- (b) Porosity: proportion of volume which is space/presence of spaces;  
permeability: (rate of) fluid flow through; 2

**Total marks = 5**

**Question 2**

- (a) Welding/cutting/steel production/iron purification/breathing gases/sewage works/  
disinfection – sterilisation – O<sub>3</sub>/ specified fuel combustion eg rocket fuel/  
specified industrial reaction;  
carbon dioxide;  
anaerobic decay of organic matter/gas with oil/swamps/manure/ruminants/  
gut bacteria/methane hydrate/sediments under the sea/fossil fuel formation; 3
- (b) Cooling towers;  
[R power station cooling]  
irrigation/watering crops;  
combustion of HCs/oil/natural gas/vehicle fuel;  
[R coal/fossil fuels]  
coke drenching;  
reservoir construction;  
[R salt evaporation pans]  
afforestation;  
1 mark for name with brief description/justification. MAX 2
- (c) Temperature change; }  
evaporation/condensation change; } MAX 2  
change in cloud cover;  
leads to albedo/insolation change;  
opposite temperature change/balancing processes/self regulation/homeostasis; 1
- (d) Differential heating;  
different air pressures;  
winds blow (to equalise pressures)/water vapour carried/cloud movement; MAX 2

**Total marks = 10**

**Question 3**

- (a) Reformed over relatively long time period/not within human lifespan/practicable time period; 1
- (b) Burial;  
anaerobic;  
heat;  
[A warm]  
pressure; MAX 2  
[R long time]  
[R decomposers]
- (c) Permeable source of rock to allow migration to reservoir rock;  
(highly) porous reservoir rock to store large volume of oil;  
impermeable cap rock/rock above to prevent escape;  
suitable structure to form reservoir – anticline/fault/salt dome/reef trap;  
rock depth/rock hardness/permeable reservoir rock/  
high flow rate (for exploitation); MAX 2
- (d) High temperature – reduces viscosity/high pressure – forces oil out; 1
- (e) (i) Habitat damage during burial/construction/use;  
aesthetics if overground;  
habitat loss under supports (if overground);  
pollution from energy use for pumping/construction;  
resource use for manufacture of materials;  
pipeline leaks;  
migration barrier;  
specific explanation of any of above effects; MAX 2
- (ii) Habitat damage of pylon foundations/base/construction;  
noise;  
aesthetics/visual pollution;  
heat;  
electromagnetic effects;  
bird deaths/injuries;  
specific explanation of any of the above effects; MAX 2

**Total marks = 10**

**Question 4**

- (a) (i) Positive correlation/as one rises so does the other; 1
- (ii) Ability to afford energy-using devices;  
greater use of materials requiring energy during production;  
energy use in energy industry infrastructure;  
example if device/material/feature of infrastructure; MAX 2
- (iii) Climate difference requiring more energy use;  
climate difference requiring less energy use;  
level of industrialisation;  
type of industry;  
greater distances requiring more transport energy use;  
low cost encouraging waste;  
conservation ethic/efficiency of use;  
indigenous supplies;  
relevant use of country to illustrate; MAX 3
- (b) (Richer/poorer)can/can't afford more expensive/desirable/new technologies; 1
- (c) Relative shortage increases prices;  
inability to afford energy;  
restricted fuel choice;  
example of restricted fuel choice;  
example of environmental impact of fuel choice;  
example of effect on any development activity;  
transfer of money to LEDCs;  
transfer of pollution/GCC/radiation pollution; MAX 3

**Total marks = 10**

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**Question 5**

- (a) (i) Area that collects rainfall/precipitation for a river or reservoir or other water body; 1
- (ii) Evaporation/precipitation/infiltration rate/abstraction above reservoir/effluent inputs/land use/geology re: porous/permeable/amount/type of vegetation; [R position of reservoir] 1
- (iii) Increase potential energy/kinetic energy/flow rate/velocity/force; [R head of water] 1
- (b) 2 examples of land use – agriculture/forestry/industry/housing/recreation/other;; [A activities on the reservoir]
- 2 appropriate different problems caused – fertilisers/pesticides/turbidity/industrial pollutants/sewage/reduced volume/sedimentation;; 4
- (c) Correct relative predictability;  
correct relative output controllability;  
correct relative reliability;  
ability to store;  
comment on fluctuating demand;  
who buys the equipment (public/private/corporate);  
level of technological development; MAX 3

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

- (a) **B**  
**F**  
**D/E**  
**A** 2 correct for 1 mark, 4 correct for 2 marks MAX 2
- (b) CO<sub>2</sub> absorbs/prevents escape of IR/long wave energy;  
[R reflects]  
[R heat]  
CO<sub>2</sub> a greenhouse gas;  
absorption of infra red warms atmosphere;  
warmed atmosphere insulates the Earth's surface/reradiates IR to earth surface; MAX 2
- (c) Daily: named cause of fluctuations in photosynthesis;  
annual: soil respiration/decomposition/uplift/volcanoes/changes in photosynthesis/  
CO<sub>2</sub> solubility; 2

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

Suitable expansion of following points:

- temperature change;
- species' range of tolerance;
- species distribution;
- change in (species) survival/extinction;
- changes in rainfall distribution;
- changes in amount of rainfall;
- sea level rise;
- changes in wind strength;
- changes in wind direction;
- changes in ocean current strength;
- changes in ocean current direction;

Up to 2 marks for expansion of each process/effect/alternative valid point

MAX 7

*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**

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