



General Certificate of Education

Environmental Science 5441

**ESC1 Energy, Atmosphere and
Hydrosphere**

Mark Scheme

2008 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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

Copyright © 2008 AQA and its licensors. All rights reserved.

COPYRIGHT

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

Environmental Science

June 2008

ESC1

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

Question 1

1 D;
 K;
 F;
 J;
 G;

Total marks = 5

Question 2

- 2 (a) Carbon dioxide in atmosphere;
respiration/combustion;
(dead) organic matter;
[R lithosphere] 3
- 2 (b) Balanced processes/maintained concentration/inputs = outputs;
photosynthesis – respiration/identified balancing processes; 2
- 2 (c) **Named human activity;**
process that changes carbon in dead organic matter;

eg deforestation/harvesting
increased litter/OM removal
OR
ploughing
increased loss in decomposition
OR
use of organic manures
increased DOM
OR
drainage
increased aerobic decay 2
- 0 for activity with no explanation
1 for activity with wrong explanation
- 2 (d) **Named effect (of CO₂ release by human activities);;**
named change/process;;
description of change/process;;;

increased temperature

increased carbon dioxide/hydrogen carbonate in water
increased carbonate sedimentation
increased photosynthesis
increased rate of decay/respiration
increased rates of growth
increased methane releases

change in carbon in named reservoir
[R change in DOM]

ref to equilibrium
ref to residence times MAX 3

Total marks = 10

Question 3

- 3 (a) Less energy to force air apart/push car through the air;
friction;
conversion to heat;
reduced drag/air resistance/turbulence; MAX 2
- 3 (b) **Any suitable example;
detail;**
- eg detail of engine design that increases combustion efficiency
valve control
temperature control
choke control
fuel injection
ignition control
- energy recovery
hybrid fuels/energy recovery/recovered energy stored in batteries
- more efficient fuel choice/energy density
eg diesel instead of petrol
- vehicle weight
aluminium/thinner steel/fibre glass/better power to weight ratio MAX 2
- [R answers related to car usage]
- 3 (c) Increased;
accurate use of data to show fuel used per unit distance; 2
- eg $3320/6880 = 0.48$
 $3970/10800 = 0.37$
 $0.37 < 0.48$
- 3 (d) Negative correlation; 1
- 3 (e) Increasing thickness of insulation increases cost;

(increasing thickness) reduces heat loss/heating cost;

ref to (concept of) declining benefit of increasing thickness/
increasing payback time/
law of diminishing returns/
money better spent on other energy-saving procedures; 3

Total marks = 10

Question 4

- 4 (a) Harnessing does no damage/no pollution;
equipment extraction/manufacture/installation/habitat loss;
named damaging process/material required;
aesthetics; MAX 2
- 4 (b) Carbon dioxide released on combustion;
balanced by that absorbed during growth;
agricultural methods may release greenhouse gases/named method;
[A change of previous land use with impact on carbon dioxide] MAX 2
- 4 (c) Tidal power is intermittent;
flow/times can be predicted/regular lunar cycles;
energy only harnessed when water flows;
changing daily times;
spring and neap tides/varying tidal range; MAX 2
- 4 (d) Low energy density/yield;
too much land required/demand too great;
competition with food crops;
some vehicles can't use biofuels; MAX 2
- 4 (e) Supply reduced if use exceeds replacement;
Maximum Sustainable Yield;
overexploitation of wood/poor catchment management/geothermal power; MAX 2

Total marks = 10

Question 5

- 5 (a) Oxides of nitrogen/ozone/water (vapour);
[A formulae] 1
- 5 (b) (i) **Named process/activity;;
how activity increases atmospheric levels;**
- eg landfill sites
rice padi fields/waterlogged fields
anaerobic respiration/anaerobic bacteria
- livestock farming
anaerobic bacteria
- coal mine ventilation
methane from coalification
- use of (natural) gas
leaks/releases from drilling/pipelines
- melting ice (by human activity)
methane release from permafrost MAX 2
- 5 (b) (ii) **Named process/activity/use;;**
- eg aerosol propellants
solvents/de-greasing
refrigerant
expanded plastic
- how it increases atmospheric levels /change of state/escape on waste disposal; MAX 2
- 5 (c) Melting land ice/ice caps/named location of ice(on land);
thermal expansion; 2
- 5 (d) (i) Not combustible;
lacking technology to exploit / technology too expensive;
can't be stored/unreliability (to match demand); MAX 1
- 5 (d) (ii) **Named method;;
detail;**
cables/power lines/grid
- high voltage/
low current/
overhead/underground/
cooling/insulation
- hydrogen production/electrolysis of water/conversion to chemical energy
- storage method (eg pressurised/metal hydride)/
transport method (eg pipeline/cylinders/metal hydride)/
named method of use at destination MAX 2

Total marks = 10

Question 6

6	(a)	Seawater	C		
		Groundwater	D		
		river water	A		
		upland reservoir water	B		
				1 correct – 1 mark	
				2/3 correct – 2 marks	
				4 correct – 3 marks	3

6	(b)	(i)	Sterilisation/kill bacteria/kill pathogens;	1
---	-----	-----	---	---

6	(b)	(ii)	Dental health;	1
---	-----	------	----------------	---

6	(c)	<i>Quality of Written Communication is assessed in this answer</i>		
---	-----	--	--	--

Up to 4 named processes;;;;
1 each for specific purposes;;;;
1 each for details of process;;;;

screens

remove large floating objects/paper/plastics
 mesh/grill/filter

grit traps

remove road grit/stones
 slower flow

primary treatment

remove/separate organic solids/faeces
 sedimentation/slow flow

secondary treatment

removal of remaining organic matter
 aeration tank/oxidation pond / trickling filter bed
 secondary sedimentation
 action of aerobic bacteria

tertiary treatment

microscreens / phosphate removal / chlorination/UV
 collect bacteria / precipitation / kill pathogens
 filtration / iron sulphate / toxic

sludge treatment

reduce volume/destroy odours/kill pathogens
 anaerobic digestion/bacterial action/heat

sludge disposal

reduce quantity / simple disposal / beneficial use/food production
 incineration / landfill / agricultural fertiliser use

MAX 8

[R water treatment processes: sand filter/flocculation/coagulation/carbon filter/fluoridation]

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
