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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Environmental Science 5441

ESC1 Energy, Atmosphere and Hydrosphere

Mark Scheme

2008 examination – June series

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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; 3
[**R** lithosphere]

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 CO_2 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; MAX 2
[**A** change of previous land use with impact on carbon dioxide]

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); 1
[**A** formulae]

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) *Quality of Written Communication is assessed in this answer*

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