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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Environmental Science 5441

ESC1 Energy, Atmosphere and Hydrosphere

Mark Scheme

2007 examination – June series

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Dr Michael Cresswell Director General

Environmental Science

June 2007 **ESC1**

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

Question 1

Gas	Human activity	Global climate change?	Ozone depletion?	
		Yes	No	;;
Chlorofluorocarbons/ CFCs/freon				;
		Yes		;
	Nitrate fertiliser (use)/combustion/ vehicle exhaust emissions			;

Total marks = 5

Question 2

(a) Reduced (downstream);
deposition/trapped in reservoir/static water; 2

(b) Reduced flow fluctuations;
reduced flow due to storage for later use;
increased flow due to deliberate release;
reduced volume due to evaporation;
reduced flow causes river bed friction to cause further flow reduction;
lowered sediment burden reduces friction and increases flow; MAX 2

(c) Effect;
explanation;

eg
increased humidity;
greater surface area for evaporation/increased evaporation;
increased cloud cover/fog/mist;
less insolation;
increased precipitation;

lower temperature range/warmer at night/in winter/cooler in day/in summer;
heat/thermal capacity/heat absorption;
coastal breeze effect;

increased windspeed;
reduced surface friction;

increased albedo reduces temperature;
reduced albedo increases temperature; MAX 2

(d) Sandstone/chalk/limestone; 1

(e) Reduced contamination (risk)/cleaner;
named example of contaminant;;
[**A** two different examples]
reduced treatment costs/fewer processes;
low set-up/construction costs/equipment required/equipment maintenance;
little surface disruption/land-use conflict/lower aesthetic impact;
higher dissolved mineral content;
no evaporation losses; MAX 3

Total marks = 10

Question 3

(a) Photosynthesis;
DOM/dead organic matter; 2

(b) Fossil fuels/carbonate rocks; 1
[**A** lithosphere/sediments]
[**R** underground/in soil]

(c) Change in named process;
change in second named process;
rebalance; 3

(d) Named activity with effect on carbon movement/amount in reservoir/named material;;;
eg fossil fuel combustion;
named activity using fossil fuel;
deforestation;
increased soil decomposition;
marine pollution killing phytoplankton;
global warming increasing rate of named process;
change in vegetation type; MAX 3

(e) Any suitable difficulty;
population size estimates;
DOM estimates;
deep oceans/soil organisms/other hard to find organisms;
area estimates;
different carbon contents of different types/sizes of organism;
speed of change/residence times; MAX 1

Total marks = 10

Question 4

(a) Slows neutrons/absorbs (kinetic) energy of neutrons;
neutron absorption;
worker/people protection/prevention of named effect of radiation on humans; 3
[**R** environmental protection]

(b) **Advantage**
advantageous feature of nuclear power;
comparative/explanatory comment; (no need to mention both resources)

eg
high energy density;
NP higher (energy density);
OR
compact site;
NP more compact site/more local landscape impact;
OR
reliable supply;
NP available when required/more reliable;
OR
controllable supply;
NP more controllable/output can be changed as required; MAX 2
[**A** opposite comments about windpower]

Disadvantage
disadvantageous feature of nuclear power;
comparative/explanatory comment;

eg
non-renewable resource;
reference to depletion of reserves;
OR
pollution risk/waste disposal;
NP has greater risk/produces radioactive waste;
OR
level of technology required;
NP is more complex;
OR
cost;
NP more expensive;
OR
landscape impact;
NP larger (local) impact; MAX 2
[**A** opposite comments about windpower]

(c) Fission uses U/Pu/fusion uses H;
fusion higher/fission lower temperature;
fission splitting/fusion joining (of nuclei);
fission commercial/fusion experimental;
fusion naturally occurring/fission due to human activities;
greater energy potential for fusion/lower for fission;
less radioactive waste from fusion/more from fission;
no high level waste from fusion/amount/high level waste from fission; MAX 1

(d) Sunlight causes pressure/temperature differences/heating of air;
causing air movement/wind/convection current/to balance pressures; 2

Total marks = 10

Question 5

(a) (i) Purpose:
removal of colloids/clay/suspended fine/small particles;

Process:
coagulation/neutralisation of repelling charges/addition of named flocculant/alum/polyelectrolytes; 2

(ii) Purpose:
kills/removal of bacteria/pathogens/named pathogen/microorganisms;

Process:
addition of toxin/chlorine/ozone/UV; 2
[**A** both marks in one part]

(b) Grit trap;
screens;
filtration;
flocculation;
sedimentation; MAX 2

(c) Named industrial water use;;
water quality requirement;;

eg
coolant/heat transfer;
low suspended solids/reactive chemicals;
OR
boiler water;
very high purity to prevent mineral build-up;
OR
textile washing;
soft to reduce scum formation;
OR
brewing;
hardness of water;
OR
food processing;
no pathogens/bad taste/toxic chemicals;
OR
geothermal power;
low dissolved mineral content;
OR
ballast water;
no large solids;
OR
irrigation;
low salinity/no toxins;

OR
named leisure industry;
no pathogens/toxic chemicals; MAX 2 + MAX 2 MAX 4
[**R** use without justification]
[**A** use with wrong justification as long as plausible]

Total marks = 10

Question 6

(a) (i) 570 (±) 20; 1

(ii) 270 (±) 10; 1

(b) (i) Faults/fissures/fractures cause extraction/safety problems;
(overburden) depth/hardness increases mining difficulty/subsidence risk;
low (reservoir rock) permeability/porosity;
increased extraction costs reduce use; MAX 1

(ii) Any cause of increasing costs;
examples;
carbon tax/extraction costs/transport costs;
cheaper alternatives; MAX 1

(iii) Any suitable example;
GCC/acid rain/oil pollution/habitat damage during extraction/
photochemical smogs/smogs/aesthetics/noise/dust;

legislative/public pressure/pressure group activity/mechanism; MAX 1

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

Up to 2 methods from each area (industry, transport systems, domestic users);
1 mark max for detail of how each method reduces energy use
MAX 4 + MAX 4 + MAX 4 up to 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