GCE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Environmental Science – ESC1
(5441)

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Environmental Science

June 2004 **ESC1**

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

Question 1

(a) Low albedo/dark surfaces/example of dark surface;
atmospheric particles/smoke/smog;
e.g. of source of heat/activity releasing heat;
cars/vehicles/heating/industry;
[**R** pollution without reference to combustion]
building material heat capacity;
turbulence/tall buildings slow winds and heat dissipation; MAX 2

(b) [**R** answers which are based on 'the direct effect of the city' rather than the 'heat island']

(i) Warm air rises/convection;
creates local low pressure;
draws in air from surroundings;
increases wind speed; MAX 2
[**R** ref to funnelling, wind shadows and turbulence]

(ii) Ref to dew point;
more evaporation;
rising air/convection;
more condensation nuclei/dust;
direction/explanation of effect; MAX 2

(iii) Reduced;
increased atmospheric albedo/reflection;
by clouds/particulates/smoke/dust/smog;
light absorption;
by clouds/particulates/smoke/dust; MAX 2

Total marks = 8

Question 2

(a) (i) Screening/sieving/using meshes/filtration;
separation from fluids/smaller objects; 2

(ii) Flocculation/coagulation;
repulsive charges neutralised/allow sedimentation/named flocculant;
e.g. alum/polyelectrolytes/potato starch/feral/Al-Fe salts/floc mat formation/particles stick together; 2

(iii) Steralisation/disinfection/reservoir storage;
chlorine/UV light/ozone/sunlight;
toxic to/kills bacteria;
OR
filtration;
name of filter type/material;
traps due to size;
OR
flocculation;
named flocculant;
stick together and settle; MAX 2

(b) Greater risk of contamination;
reason for greater risk/source of contamination;
example of likely contaminant;
natural purification in reservoir;
example of purification process; MAX 2

Total marks = 8

Question 3

(a) Burial;
anaerobic conditions/anoxic conditions;
pressure/compression;
chemical change;
heat;
up to 2 examples of chemical changes;
[**A** partial decomposition/materials forced out;; MAX 3
e.g. water CO_2/CO/CH_4/H_2S/other hydrocarbons]

(b)

Advantage or disadvantage?	Explanation	
Disadvantage	Reduced flow rate [**R** increased extraction cost]	;
Disadvantage	Reduced storage volume OWTTE [**R** increased extraction cost]	;
Advantage	Increased energy density/content/burns hotter	;
Disadvantage	Increased pollution equipment damage/acid rain/ H_2S is corrosive/releases SO_2 [**R** greenhouse gas]	;

1 mark for 2 correct on same line 4

Total marks = 7

Question 4

(a) Aesthetics;
noise;
radio interference;
wildlife impact/habitat destruction;
designated protected areas;
named land use conflicts;
topography;
damage risk in very high winds;
higher local construction costs/maintenance costs/difficulties;
distance from area of demand; MAX 3

(b) $KE = (0.5 \times 400 \times 7^2) = 9800\,j$

OR

$$KE = \frac{400 \times 7^2}{2} = 9800\,j$$ 1

(c) Lower energy density/large number of aerogenerators needed/(dispersed over) large area of land;
need for storage;
existing vehicles use chemical energy/liquid fuels;
variable supply/unreliable;
public opposition; MAX 2

Total marks = 6

Question 5

(a)

Moderator:	increases chance of fission/allows binding/absorption of neutrons/more likely to react with U;
Secondary coolant:	(water boils) to produce steam/gas;
Biological reactor shield:	worker/human safety; [**R** wildlife]
Cooling pond:	used fuel/rod/U/waste storage;
Control rod:	absorbs neutrons; 5

(b) (i) Nuclear fuel (much) higher; 1

(ii) Coal much larger; 1

Total marks = 7

Question 6

(a) (i) Ultra violet/UV/UVA/UVB/UVC/short wavelength light; 1

(ii) Visible light; 1
[**R** short/long unless qualified]

(iii) Infra red/long wavelength light; 1

(b) CFCs/NOx/(gaseous) Br compounds;
1 example of use/source;
(e.g. aerosols/refrigerators/solvent/plastic blowing/fire extinguishers)
residence time OWTTE;

up to 3 examples of reactions/processes;;;
CFCs - Cl released/Cl free radical
$Cl + O \rightarrow ClO$
$ClO + O \rightarrow ClO_2$
$ClO_2 \rightarrow Cl + O_2$
$CFC + O_3 \rightarrow ClO + O_2$ (partial reaction) 3

(c) More UV reaches surface;
tissue damage/skin cancer/skin damage/mutations/eye damage; 2

(d) Montreal protocol/agreement; 1

Total marks = 9

Question 7

(a) Balancing (chemical) reactions/processes/negative feedback/
self regulation/homeostasis;
up to 2 named examples of reactions/processes;; 3
(photosynthesis/respiration/combustion)

(b) (i) 10000/6 = 1666.7/1667 years; 1

(ii) Replaced by alternative fuels which are:
cheaper;
safer;
more convenient/easier to use;
less polluting;
up to 2 examples of pollutants;;
cause less habitat damage during extraction;
easier to extract;
more efficient;
[**R** environmentally friendly]

Increasing rate of use will reduce lifetime; MAX 2
[**R** run out/exhaustion without qualification]

(c) Descriptions of processes or changed rates of movement of carbon:
deforestation;
afforestation/reforestation;
fuel combustion;
cement manufacture;
soil disturbance/increased soil decomposition;
forest fires/stubble burning;
methanogenic bacteria/anaerobic decay;
up to 2 marks for details of each (named process, specific named C-containing substance)
e.g. carbohydrate not wood/hydrocarbon not fossil fuel

Secondary effects of global climate change:
reduced CO_2 solubility;
increased rate of decomposition;
melting permafrost releasing methane;
methane hydrate liberation; MAX 9

Total marks = 15