AQA

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme January 2003

GCE

Environmental Science

Unit ESC1

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Unit 1: Energy, the Atmosphere and Hydrosphere

General instructions

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

Question 1

(a) Reference to shaded from light/sheltered from wind/wind tunnel/heat emission/ heat absorption/reflection/albedo/standing water/ground permeability/evaporation; effect of change on microclimate: temperature/windspeed/humidity/condensation/cloud cover/light level/turbulence; [**R** Photosynthesis] 2×2 MAX 4

(b) Windspeed: positive correlation/initial small negative, then positive correlation; 1
humidity: negative correlation; 1

Total marks = 6

Question 2

(a) m = mass of matter destroyed
[**R** mass]
c = speed/velocity of light/ 300×10^6m s^{-1}; 1

(b) **Critical mass**:
minimum (mass);
self-sustaining (chain) reaction/process; 2
[**R** mass required]
[**A** 'exact mass' if justified]

Fissile:
atoms/nuclei can be split;
neutron bombardment;
neutrons/energy released;
e.g. U/Pu; MAX 2

Total marks = 5

Question 3

(a) Ozone/O_3;
UV absorbed/filtered;
[**R** Reflection]
description of chemical reactions: $O_3 \rightarrow O_2 + O$ /$O_2 + O \rightarrow O_3$ /word equation; 3

(b) (i) Chlorofluorocarbons/CFCs/HCFCs/halogenated hydrocarbons;
mobility/persistence/insolubility;
details of chemical reaction:
chemical breakdown due to UV/chlorine released/chemical reactions between C1 and O/O_3;
less ozone formed/ozone destroyed/damage to ozone layer;

OR

oxides of nitrogen released in stratosphere/by aircraft;
details of reactions producing NO_x;
reaction between NO_x and O/O_3;
less ozone formed/ozone destroyed/damage to ozone layer; MAX 3

(ii) Montreal Protocol/agreement/treaty/convention (for CFCs in (b)(i)); 1

(c) Disinfection/sterilisation/killing microbes/setting epoxy resins/identifying fluorescing agents;
1

Total marks = 8

Question 4

	Removal of large solids/debris/e.g.s of;	
		Left to stand/settle/no kinetic energy of movement;
		Neutralisation of repelling/electrical charges/coagulant/flocculant/ ions/named e.g. – Al/Fe compounds/polyelectrolytes allow particles to stick together;
Ozonation/chlorination/ sterilisation/disinfection;		
	Prevention of tooth decay/improved dental health;	

Total marks = 5

Question 5

(a) **D – E** turbine/generator operating at optimum/maximum output; 1
E – F braked/stopped (to prevent damage); 1

(b) (i) × 4; 1
[**R** Increases]
(ii) × 8; 1

(c) Tidal power;
HEP;
wave power;
ocean currents;
[**R** solar/geothermal/biofuels/wind] MAX 2

Total marks = 6

Question 6

(a) **A, D, B, C, H, F, G, E** 1 mark for each two correct MAX 4

(b) **Porous**:
presence/percentage/proportion of volume which is space;
which can hold fluid/water/oil/gas/air; 2

Permeable:
(rate/ease of) fluid flow;
interconnected spaces/pores/fissures/cracks; 2

(c) (i) Salinization/salt water incursion;
contamination of drinking water/reduced quality;
crop damage/osmotic dehydration;
OR Subsidence/collapse/sinking;
lack of support from water;
damage to surface land uses/specified locations;
OR Lowered water table;
drying of surface water feature/example of problem caused:
ecological/agricultural/socio-economic; 2 × 2 MAX 4

(ii) Reduced treatment costs;
less contamination/natural filtration/e.g. of contaminant;
OR Reduced construction costs;
e.g. of equipment needed/not needed;
OR Reduced losses;
reduced evaporation;
OR No surface land use conflicts/flooding/relocation/loss of farmland;
detail of conflict: economic/social/ecological;
OR Presence of specified beneficial mineral;
detail of benefit; 2 × 2 MAX 4

(d) **Reverse osmosis;** 1
pressure/pumping;
membranes;
pore size/partially permeable/ion/salt size too large;
only water passes through; MAX 3
OR
Distillation; 1
heat/sunlight/source of heat;
reduced pressure;
water evaporate/boils;
salt left behind;
water condensed/collected; MAX 3

Total marks = 20

Question 7

(a) Deep
Worse undermining/subsidence;
more buildings/surface equipment;
more spoil;
both require drainage;
land use/habitat loss less;
[**R** economic issues]
[**R** Health and Safety issues]

Open cast
More noise;
more dust;
more spoil before reclamation;
changed use after restoration;
more disturbance due to air blast/vibration; MAX 4

[**A** converse statements – must include comparative comment e.g. more …, less….]

(b) High viscosity;
small quantity;
low reservoir permeability;
isolated location/transport costs/lack of industrial infrastructure/wars/political problems/local taxes/strategic supplies;
high sulphur content/other pollution problem/low purity;
difficulty/high cost of extraction with reason: overburden/quality/depth;
harsh physical environment with reason;
local environmental issues/opposition/designated area protection; MAX 2

(c) Secondary recovery;
artificial/maintenance of pressure;
pumps down natural gas/water;
injection well; MAX 2

Tertiary recovery;
use of solvents/steam/bacteria/detergents;
reduced viscosity;
pumping;
reduce oil pressure at surface/maintain pressure difference; MAX 2

(d) **Geographical/economic features**:
Up to 5 for appropriate, different site features: geological, topographical, infrastructure, coast shape, climatological, exposure, other named feature.
+1 for each justification

Land use issues:
Up to 5 for justified examples: agriculture, habitat damage, aesthetics, noise, urban land, forestry, other named impact.
Each used once only MAX 10

Total marks = 20