

GCE 2005

January Series



Mark Scheme

Environmental Science – ESC1

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Dr Michael Cresswell Director General

Environmental Science

January 2005

ESC1

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

Question 1

- (a) Photosynthesis; 1
 combustion/burning/incineration; 1
 anaerobic digestion/decay/decomposition (of organic matter)/methanogenesis/
 anaerobic bacteria/archaeobacteria/fermentation/action of yeast; 1
 [A respiration instead of digestion/decay]
- (b) Names of two opposing processes/materials involved
 e.g. photosynthesis and respiration;
 processes/rates (counter) balance/equal each other/cancel each other/steady state/
 homeostasis; 2

Total marks = 5

Question 2

- (a) (i) Line starts and ends on forest temperature line, raised in urban area; 1
- (ii) Increased heat generation/source of heat/lowered albedo/less reflection/increased
 absorption/high heat capacity; 1
 [R CO₂ and greenhouse effect]
- (b) (i) and (ii) Named factor: humidity/wind/light levels/fog;
 reason for/explanation of change; 2 × 2 4
- humidity; reduced - less vegetation/reduced evaporation/transpiration;
 fog; effect of changed temperature/humidity;
 light levels; effect of changed albedo/atmospheric particulates/smoke;
 rainfall; effect of more evaporation (less infiltration)/rising warm air/
 increased cloud cover;
 rainfall; effect of less evaporation (faster runoff);
 wind; effect of reduced friction of vegetation;
 wind; effect of increased friction/turbulence of buildings;
 wind; effect of buildings – wind channels;
 wind effect of changed temperature/rising air – replaced by air drawn in;
- (c) (i) and (ii) Named difference: wind speed/sunlight/intensity (diffuse)/sunlight/
 temperature change/rain/frost/snow/wind chill/cloud/fog;
 reason for/explanation of change;
- albedo;
 source of heat;
 source of light
 wind shelter;

wind concentration; katabatic winds; anabatic winds; prevailing wind; thermal stratification; [R (just) higher up] atmospheric condensation nuclei;	2 × 2	4
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Total marks = 10

Question 3

- (a) (i) Sedimentation – settling/removal of suspended solids;
[R large debris/particles] 1
- (ii) Flocculation – coagulation/joining/aggregation of charged/clay/small particles;
[R dissolved solids] 1
- (b) Ozone/UV treatment; 1
- (c) Reduced yield/growth/plant death/reduced soil fertility;
[A pH change if problem stated]
salinisation/increased concentration of salts in soil/water stores;
osmosis/(osmotic) dehydration/damage/physiological drought/water loss/high water
potential in plant/lower in soil; MAX 2
- (d) Reverse osmosis;
high pressure filtration/semi-permeable membrane/molecular filter/water movement
from low to high water potential;
OR
distillation;
high temperature/low pressure boiling/evaporation then condensation;
OR
electrodialysis;
electric charge/ion separation; MAX 2
- (e) Up to two specific industrial uses of water:
boiler water/solvent/washing/coolant/radiation absorption/irrigation/food ingredient;;
up to two specific quality-related issues or problems:
limescale/dissolved minerals/hardness/corrosion/turbidity/gross solids/acidity/
toxins/taste;; MAX 3

Total marks = 10

Question 4

- (a) Description of how wave energy is transferred to air/mechanism; energy transfer/absorbed/potential energy/kinetic energy of waves/kinetic energy of machinery; description of how electricity is produced/turbines/generators; 2
- (b) Sunlight causes winds;
winds cause waves;
[R tides/ocean currents] 2
- (c) Tidal power/estuarine barrage;
HEP/water mill; 2
[A pumped-storage HEP]
- (d) Suitability for wind power:
wind speed (energy); wind damage; wind reliability (climatic); space; topography;

land use conflicts:
aesthetics; noise; light reflection; bird strikes; distance from human population; access;
habitat damage;
- 1 mark to expand each point;; MAX 4

Total marks = 10**Question 5**

- (a) Air temperature - F;
Troposphere – A; 2
- (b) (Absorption of) UV/shortwave;
prevents cancer/mutations/damage to eyes/skin/DNA/melanoma/sunburn; 2
[R ref. to heat retention]
- (c) Photodissociation/photochemical reaction;
chlorine/Br/F/I/free radicals released;
[A Cl in CFCs]
[R just CFCs]
chlorine reacts with ozone/(monatomic) oxygen; MAX 2
[A reactions]

- (d) International agreement/legislation use/ban use;
 Montreal protocol/funds to LEDCs;
 [A Agenda 21]
 use of alternative materials;
 up to two named alternative materials:
 e.g. nitrogen/HCFs/HCs/propane/butane/pentane/HFCs/ammonia;;
 up to two named procedure changes:
 e.g. trigger sprays/collection of leaking CFCs/incineration of waste CFCs instead
 of release/removal from old fridges etc/other alternative procedure;; MAX 4
 [A safe storage]

Total marks = 10

Question 6

- (a) 30 - 33; 1
- (b) Reduced convection;
 warm (room) air not in contact with cold glass;
 air is a poor conductor/good insulator;
 some filled with a poorer conductor/argon/vacuum; MAX 2
- (c) (i) Increased losses/more energy needed/more air in contact; 1
- (ii) Reduced losses/less energy needed/reduced rate of heat flow; 1
- (iii) Increased losses/more energy needed/warmed air removed/cold air
 enters/increased temperature gradient; 1
- (d) Reduced (habitat) damage from extraction of energy resource;
 less transport of resources/equipment;
 less pollution in equipment manufacture;
 less pollution in use;
 CO₂;
 SO_x;
 NO_x;
 CO;
 less waste;
 aesthetics;
 noise;
 equipment siting;
 dust;
 smoke;
 turbid drainage water;
 other valid point;
 [R conservation methods] MAX 9
 up to 2 for expansion of each problem;;

Total marks = 15