



General Certificate of Education

Environmental Science 5441

ESC3 The Biosphere

Mark Scheme

2006 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Environmental Science

June 2006

ESC 3

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

Question 1

- (a) **F** (interspecific competition);
C (biotic potential);
A (environmental resistance); 3
- (b) Decrease or increase a population irrespective of population density;
 eg fire/climatic extreme/hurricanes/abiotic factors/named abiotic factor;
 [**R** deforestation/habitat destruction] 2

Total marks = 5

Question 2

- (a) (i) Oxygen/ O₂; 1
- (ii) Oxygen enables aerobic respiration;
 complete breakdown of glucose/sugar/food (toCO₂ and H₂O);
 [A equation]
 more energy released/ATP produced than without oxygen/anaerobic respiration;
 [A ref to less enzyme damage linked to presence of ozone layer] MAX 2
- (iii) Causes chemical change/mutation/ change in DNA/ genetic material/skin cancer/
 sunburn/radiation blindness/cataracts; 1
 [A reference to reduction in plant productivity/photosynthesis]
 [R damage unqualified]
- (iv) (Liquid) water;
 solvent for all metabolic reactions/habitat for aquatic organisms/metabolite for
 named process/photosynthesis/transport medium;
 [A water as a major component of organisms]
OR
 suitable temperature (range);
 enables enzyme activity/optimum temperature for biological processes/metabolic
 reactions/presence of liquid water;
OR
 presence of gravity;
 holds atmosphere; MAX 2

- (b) (i) Breakdown of dead organisms/organic matter; use of enzymes/reference to saprophytic/saprobiotic nutrition; release of nutrients/named nutrient/increase soil fertility; recycling of nutrients/use by other organisms/plant growth; [A release of CO₂] [R ref to detritivore activity/soil mixing/aeration] MAX 3
- (ii) Insufficient oxygen/air; } mark to be awarded only if clearly
waterlogging/lack of water; } linked to the process of decomposition/ MAX 1
[R lack of space] } respiration

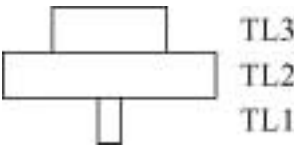
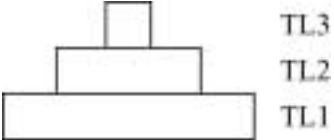
Total marks = 10

Question 3

- (a) Landtake for urbanisation/housing/road building/industry/development qualified; use for agriculture/grazing/cleared for forestry; recreational areas/golf courses/caravan sites; military use; [R trampling/pollution] MAX 2
- (b) (i) Climax (community) 1
- (ii) Deflected succession/plagioclimax/biotic climax/sub climax; 1
- (c) (i) New growth more nutritious/easier to eat/allows grass to grow/woody shrubs/trees harder to eat; 1
- (ii) (Fertile) soil already present; ash provides nutrients; soil contains seeds/spores; roots not damaged; animals can migrate in (from surroundings areas)/survival of burrowing animals; MAX 3
- (d) Protection of habitat/designated as nature reserves/SSSI/SAC/SPA/ESA; [R landscape designations such as National Park/AONB/ Green belt and Country Park] restrict activities/recreation/refuse planning permission/close areas to public; grants/subsidies/compensation qualified; correct reference to control of agricultural practice/burning/sheep grazing; [A education/raising public awareness] [R footpath creation] MAX 2

Total marks = 10

Question 4

- (a) (i) Woodmouse/beetle/caterpillar/aphid/grey squirrel/slug;
[A earthworm] 1
- (ii) Blackbird/woodpecker/owl/hawk/fox; 1
- (b) (i) Sunlight energy fixed by green plants/ref to photosynthesis;
formation of chemical energy/carbohydrates/named carbohydrate/lipids/proteins;
passed to primary consumers/herbivores/omnivores;
carnivores/secondary consumers consume herbivores/primary consumers;
correct reference to decomposers; MAX 3
[A named organisms from a single food chain only for MAX 1 mark]
- (ii) Food chain efficiency approx 10%/approx 10% transferred/2nd law of
thermodynamics;
respiratory/heat losses; } at any trophic level
loss through inedible parts/not all parts eaten; }
loss through faeces/excretion; MAX 3
- (c) (i)  1
- (ii)  1

Max 1 for whole of part (c) if correct shapes but not labelled
[A inverted pyramids if TL's labelled correctly]
If >3 TL's illustrated – mark bottom 3 levels only if concept correct

Total marks = 10

Question 5

- (a) Habitat loss;
competition from greys;
disease/viruses;
predation; MAX 3
[R climate change/persecution by humans]
- (b) Enables exploitation of different food source/ resource/named resource/concept of niche
separation explained;
reduces competition/allows co-existence; 2

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- (c) Breeding in captivity;
 release into wild/repopulation;
 legal protection/banning to prevent killing/hunting/collecting/habitat change;
 trade controls/CITES/international agreements;
 in situ conservation/nature reserves/SPA's/SSSI's/SAC's;
 [R UK National Park]
 [A ref to National Parks/game reserves abroad]
 qualified habitat management (eg nest boxes/supplementary food)/qualified habitat
 creation;
 methods to increase breeding success (sperm banks/artificial insemination/frozen
 embryos);;
 education/raise public awareness;
 remove/cull competitors/predators; MAX 5
- Total marks = 10**
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Question 6

- (a) Food source;
 breeding space/nesting cover/habitat qualified;
 migration corridors;
 shelter; MAX 2
- (b) (i) Environmental gradient present/changes in distribution of vegetation; 1
 [A valid comparison with line transect]
- (ii) Direction/position of transect relative to hedge (N-S **or** parallel to hedge);
 size of quadrat used stated (0.25m² OR 1m²);
 continuous/interrupted sampling used;
 [A sample at regular intervals]
 [R random sampling]
 recording of plant density/% cover/frequency/numbers/use of abundance scale;
MAX 3
-

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

Mark-release-recapture method/Lincoln Index;
 catch sample and mark them;
 release and recapture after time interval;
 formula for calculation/example of calculation/population estimate from proportion of marked to unmarked;
 pitfall trap (for ground level inverts);
 light trap (for night flying insects/moths ;
 mammal trap/Longworth trap;
 sticky trap (for flying insects);
 sweep net(for inverts in long grass);
 beating tray (for inverts in trees/bushes);
 Tüllgren funnel (for soil/litter organisms);
 Baermann funnel (for nematodes in soil);
 quadrats for sessile/slow moving animals;
 pooters (for inverts visible with naked eye);
 aerial photography (eg for birds);
 direct observation (eg birds/mammals)/infra-red cameras;
 observation of tracks/droppings/burrows/nests;
 suitable method for extracting earthworms;
 tagging/radio transmitters for distribution;

Description of purpose of the apparatus needed for mark to awarded.

Credit extra detail eg method of use – MAX 2 for each method

MAX 7

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