



General Certificate of Education

Environmental Science 5441

ESC3 The Biosphere

Mark Scheme

2009 examination – January 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.

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Environmental Science

January 2009

ESC3

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

Question 1

Special Area of Conservation/SAC;
area containing rare species/flora/fauna/geology/physiographic feature;
Ramsar site;
important areas for rare and migratory birds/designated under EU Birds
Directive;
National Nature Reserve/NNR;

5

Total marks = 5

Question 2

- | | | | |
|---|-----|--|-------|
| 2 | (a) | All the living organisms/populations/species in an ecosystem/
habitat/specific area; | 1 |
| 2 | (b) | Number of different species present/species richness;
number of individuals/number in population of each species; | 2 |
| 2 | (c) | Woodland A; (1) | |
| | | Low index of diversity;
few different species present;
planted more recently/less colonisation; (MAX 1) | 2 |
| 2 | (d) | (i) End point of succession/final seral stage; | 1 |
| 2 | (d) | (ii) Climate (influence of named factor required);
altitude/soil depth;
named human interference/mowing;
drainage/waterlogging;
natural grazing; | MAX 2 |
| 2 | (e) | Higher diversity;
more food plants/more niches/more habitats available;
natural/native species; | MAX 2 |

Total marks = 10

Question 3

- 3 (a) 2°: algae → limpets → starfish OR plant plankton → barnacles/mussels → starfish;
3°: plant plankton → animal plankton → barnacles/mussels → starfish; 2
[A correct explanation]
- 3 (b) Low digestibility/different composition (carbohydrate/fat/protein)/
different size/different proportion of edible to inedible content; 1
- 3 (c) (i) Change along an environmental gradient/spatial separation
of species; 1
- 3 (c) (ii) Tidal movements;
different exposure to water/air;
ref to adaptation of species; MAX 2
- 3 (c) (iii) Direction of transect specified;
quadrats laid alongside transect line;
arrangement of quadrats specified (continuous/
set intervals);
method of recording organisms (density/frequency/
abundance/% cover)/species count; 4
[A point frame/quadrat]

Total marks = 10

Question 4

- | | | | | |
|---|-----|------|--|-------|
| 4 | (a) | (i) | Only trace of oxygen available; | 1 |
| 4 | (a) | (ii) | Presence of (green) plants/development of photosynthesis/
autotrophic nutrition;
[R ref to trees alone] | 1 |
| 4 | (b) | | Allows presence of water in <u>liquid</u> state/change of state of water/
water cycle;
range suitable for enzyme activity/metabolic/chemical reactions; | 2 |
| 4 | (c) | (i) | (Linear) increase in rate of photosynthesis up to (4.5 units/80);
rate reaches plateau with increased light after (4.5/80); | 2 |
| 4 | (c) | (ii) | Light needed for photosynthesis therefore increase/light is
limiting factor;
rate of increase slows when some other factor becomes
limiting; | 2 |
| 4 | (d) | | Increase temperature/protect from frost;
protect from wind;
protect from herbivores/grazers/disease;
reduce water loss/transpiration;
[A evaporation]
concept of providing a 'mini-greenhouse'; | MAX 2 |

Total marks = 10

Question 5

- 5 (a) Few (reproducing) individuals/time taken to adapt to new surroundings;
high death rate linked to unstable environment;
time to synthesise enzymes (for micro-organisms); MAX 1
- 5 (b) (i) Population doubling time constant/proportional
rate of change constant/rate of increase increasing;
[A logarithmic/geometric growth] 1
- 5 (b) (ii) Resources/named resource become limiting/
ref to environmental resistance; 1
- 5 (c) *Density independent factor:*
suitable physical/climatic factor/abiotic factor; 1
- Density dependent factor:*
available food supply/disease/competition/predation; 1
- 5 (d) (i) Increased competition/pressure on resources/
food/space/water;
increased environmental resistance;
reduced biotic potential/reduced reproduction/
increased death rate;
build up of waste products;
increased disease/predation; MAX 2
- 5 (d) (ii) Maximum population size that the environment can support
sustainably/in the long term/without depleting resources; 1
- 5 (d) (iii) Birth rate = death rate; 1
- 5 (e) Disturbance brings about the opposite effect/increase results
in decrease;
results in return to original state; MAX 1

Total marks = 10

Question 6

- 6** (a) Use of random numbers/random sampling;
 [A systematic or stratified sampling]
 grid and/or co-ordinates;
 number of individuals counted/frequency/density/% cover;
 large number of quadrats/repeats;
 suitable comments on determining distribution related to the diagram;;
 eg random: little variation in number/most quadrats
 show plant species
 clustered: large variation/only some quadrats
 show plant species
 uniform: very similar or same number found
 in every quadrat MAX 5
 [A use of nearest neighbour]

- 6** (b) *Quality of Written Communication is assessed in this answer*
- Named UK habitat; (eg woodland)
 protection of habitat for rare/endangered species/prevention of extinction;
 aesthetic/beauty;
 ethical/moral/stewardship/duty of care;
 ecological balance/maintenance of species diversity;
 maintenance of atmosphere;
 education/scientific research/monitoring;
 recreation/leisure/tourism;
 use of species for food/medicines;
 use of species for raw materials/industry;
 maintenance of genetic resource/gene pool/future resource; MAX 8
 (credit relevant expansion/examples throughout – maximum one per marking point)
 [A prevention of flooding – wetland habitat]

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