AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Environmental Science 5441

ESC3 The Biosphere

Mark Scheme

2007 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.

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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

Environmental Science

January 2007   **ESC3**

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

Question 1

	Letter
A primary producer	**K**;
A secondary consumer	**B/D/E/F/G**;
An organism that feeds at more than one trophic level	**A**;
An organism that would be least efficient at converting the energy it receives into new growth	**K**;
An organism at the fourth trophic level	**A/C**;

Total marks = 5

_____

Question 2

(a)   Zonation;   1

(b)   (i)   Tape laid from low tide level to high tide level (or vice versa)/across the inter-tidal
                   region/at right angles/perpendicular to shoreline (or sea);
                   quadrats laid along tape at (regular) intervals/continuously;
                   [**A** point quadrat]
                   suitable method of recording abundance eg % cover/frequency/density/use of
                   abundance scale;   3

          (ii)   Environmental gradient present/change in species composition expected;   1
                   [**A** comment regarding unsuitability of alternative methods/line transect/
                   random quadrats]

(c)   Ref to differing periods of exposure to air/cover by water;
          differing ability to withstand desiccation;
          egs of adaptations to withstand desiccation/damage (mucus layer/spiralling/
          rolling up);
          ref to differing photosynthetic pigments;
          ref to predation/grazing pressure/competition;   MAX 2

(d)   (i)   Correct use of $\sum \mathbf{n(n-1)}/134/(2+90+12+30)$;
correct answer: 3.45/3.4;   2

    (ii)   Takes account of number of individuals/relative abundance/population size
(as well as number of species);
diversity indicates stability;   MAX 1

Total marks = 10

___

Question 3

(a)   Small gene pool in welsh population/imported birds increase gene pool;
risk of inbreeding/named consequence of inbreeding eg increased genetic disorders/ increased
susceptibility to disease/decreased variation;
[**R** interbreeding]
qualified problems of small Welsh population eg risk of local extinction;
hard to find/difficult to capture;   MAX 2

(b)   (i)   Adequate food available/lack of competition for food/resources/no environmental
resistance;
suitable breeding habitat/nesting conditions available/biotic potential reached;
protected species/habitat;
[**A** lack of persecution by humans]
increased breeding success explained/bigger choice of mates;
lack of predators;   MAX 2

    (ii)   Maximum population that the environment can support sustainably/
in the long term/without depleting resources;   1

(c)   Trade controls/CITES (must be related to <u>trade</u>);
captive breeding;
repopulation of wild;
other methods to increase breeding success/sperm banks/AI/frozen embryos;;
banning damaging activities/legislation;
establishment of protected areas/nature reserves/conservation of habitat;
qualified habitat management (nest boxes/supplementary food);;
control or removal of predators/competitors/non-native species;
education/raising public awareness;
sustainable exploitation/quotas (eg for whales/fisheries);   MAX 5

Total marks = 10

___

Question 4

(a) $\dfrac{120}{5000} \times (100)$; (principle – divide products by radiation received)

2.4%; 2

(b) Some light reflected (at leaf surface);
some misses chloroplasts/photosynthetic parts;
only certain wavelengths used;
absorbed and converted to heat/used to evaporate water;
presence of other named limiting factors; MAX 3

(c) (i) Correct shading on graph where photosynthesis >respiration; 1

(ii) Photosynthesis dependent on enzyme activity;
concept of denaturation ;
[**R** enzymes 'killed']
stomata close/leaf wilts; MAX 2

(iii) Release of energy;
[**R** production of energy]
from food or glucose/correct word equation; 2

Total marks = 10

_____

Question 5

(a) (i) Non-living/physical/chemical part of environment; 1

(ii) Appropriate example (eg flooding/fire/temperature/rainfall/other suitable factor);
specific density independent effect explained; 2
[**R** unqualified pollution]

(b) Obtain sample of population;
marking with non-toxic paint/not visible to predators or equivalent;
leave for suitable time interval (before re-sampling/recapture);
count marked <u>and</u> unmarked;
correct equation; MAX 3

(c) Decrease in food supply;
increase in competition/competition for mates;
increase in predation;
increase in disease;
<u>qualified</u> human interference; MAX 3

(d) Births + Immigrants = Deaths + Emigrants; 1

Total marks = 10

_____

Question 6

(a) (i) SAC – protection of rare/internationally important <u>habitats</u>; 1
    [**R** landscape]

(ii) SSSI – conservation of rare or scientifically important species/geological/physiographic
    features; 1

(iii) SPA – conservation of important areas for <u>birds</u>; 1

(b) Advantage – grants/subsidies/compensation available;
    disadvantage -   restricts use/reduces profit/public access allowed; 2

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

Problems:
    habitat loss;
    reduction in species diversity;
    increase in rare/endangered species/ref to possible extinctions;
    presence of non-native competitors/increase in competition;
    named human activity (eg spray drift from agriculture/trampling/fires);
    correct reference to natural change (eg succession/erosion/flooding);
    pollution <u>qualified</u>;
    [**R** littering]
    lack of funding for conservation;

Solutions:
    legal protection/designations/named designation;
    restricted access areas/visitor management;
    habitat restoration/reduction in agrochemical use/reduction in other named
    damaging operation;
    habitat management eg drainage/coppicing/burning/grazing/mowing;
    management of succession;
    removal of invasive species/biological control;
    raising public awareness/education;

raising money <u>for conservation</u>/giving grants for conservation; MAX 8

[**A** extra expansion or relevant examples for additional marks for each problem or solution]

Maximum 6 marks for each of problems and solutions.

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