AQA

A S S E S S M E N T and
Q U A L I F I C A T I O N S
A L L I A N C E

General Certificate of Education

Environmental Science 5441

ESC3 The Biosphere

Mark Scheme

2006 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.

Environmental Science

January 2006   **ESC3**

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

Question 1

(a)   Biome;
         number of organisms of the same species within a given area;
         ecosystem;   3

(b)   Habitat: the place where an organism lives;
         Niche: the role of an organism in the community/habitat/ecosystem;   2

                                                                      Total marks = 5

Question 2

(a)   (Steady) increase in numbers until day 140/50 species;
         rate of increase slows down/plateau reached after 140 days/50 species;   2

(b)   (i)   More niches/habitats available/more (types) of food available/
                  habitat more complex in structure/less competition from sheep;   1
                  [**R** decreased predation/disease/increased reproduction/density development factors]

         (ii)   All niches occupied/increased competition for resources/removal of
                  arresting factor;   1
                  [**R** ref to carrying capacity/environmental resistance/birth rate = death rate]

(c)   <u>Secondary</u> succession;   1

(d)   (i)   Pitfall trap/pooter;   1
                  [**R** quadrats/kick sampling]

         (ii)   Sweep net to acquire sample/dislodge resting insects;
                  count, mark and release;
                  allow time to mingle with remaining population;
                  catch second sample;
                  identical method outlined;
                  apply Lincoln Index;   MAX 4

                                                     Total marks = 10

Question 3

(a)   Suitable arrangement of quadrats (random/systematic);
        details of placing quadrats;
        suitable size for quadrat ($1m^2$ or 0.25 m^2);
        suitable number of quadrats (at least 10)/area;
        count number of cowslips in quadrat;
        calculate average per m^2/multiply to area of meadow;   MAX 4
        [**A** ref to problems of plants on margins]
        [**R** percentage cover]

(b)   (i) $3.0 \times 5000 = 15\,000$;   1
                [**A** 14 500 – 15 000]

        (ii)   Flooding/drought/fire/extreme of temperature/herbicide/fertiliser application/
                other suitable factor;

                explanation: loss of resources/limiting factor/growth of competitive species;
                1 mark for identifying an abiotic factor, 1 for explanation   2
                [**R** global warming/pollution]

(c)   The maximum number of individuals of a species that can be supported by an
        ecosystem in the longterm/sustainably/without depleting resources;   1

(d)   (i)   Right to existence/stewardship/duty of care;   1

        (ii)   Beauty/pleasure;   1

                                                              Total marks = 10

Question 4

(a)   (i)   Respiration;   1

        (ii)   Autotroph/(primary) producer/green plant;   1
                [**A** named plant]

        (iii)   Energy loss at <u>each transfer</u> between trophic levels;
                approx. 10% energy transferred;
                respiratory losses;
                eg of other losses (faeces/inedible parts etc);;
                second law of thermodynamics;   MAX 3

(b)   Provides energy;
        excites electrons/activates chlorophyll;
        photolysis of water;   MAX 2

(c) (i) Light (intensity); 1

(ii) Increase CO_2;
increase temperature;
increase nutrients;
control pests/predators/disease/weeds;
light period; MAX 2
[**R** increased water]
[**R** competition (unqualified)]

Total marks = 10

Question 5

(a) (i) Measure of the number of (individuals) species/types/variety of living organisms
in a community/area; 1

(ii) The total of all genes/alleles present in a particular population at a given time; 1

(b) (i) $\dfrac{260}{360} \times 1\,080\,000 = 780\,000$; 1

(ii) Hunting/collecting (eg butterflies)/overfishing (eg crabs);
habitat destruction;
removal of food source;
pesticide use/elimination of pest species;
introduction of predator/competitor;
qualified ref to pollution;
[**A** correct ref to climate change (anthropogenic)] MAX 3

(iii) Disruption of food chain/web/'knock-on' effect;
less food for invertebrate predator/predator starves;
credit example; MAX 2

(c) CITES;
prevents <u>trade</u> in endangered species;
OR
IWC;
eg of whaling restriction;
OR
Ramsar;
protects wetlands (for birds);
OR
SAC;
conserves habitats;
OR

SPA;
conserves bird species; 2
[**A** Earth Summit/Rio]
[**A** biodiversity treaty/Agenda 21]

Total marks = 10

Question 6

(a)   (i)   Oxygen;
            food;
            [**A** energy]
            shelter/nesting sites;   MAX 2
            [**A** nesting materials]

      (ii) Pollination;
            fruit/seed dispersal;
            removal of competitors;   MAX 2
            [**A** ref to carnivorous plants]
            [**R** ref to CO_2/fertiliser effect of excreta]

      (iii) Break down/removal of dead organisms/organic matter;
            release/recycling of nutrients;   MAX 2

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

(Visible) light needed for photosynthesis;
details of suitable wavelengths/colours;
appropriate temperature range for metabolic/chemical/enzyme activity;
[**A** named process]
details of temperature range/average temperature on Earth;
denaturation of enzymes/ >40 °C/at high temperatures;
CO_2 needed for photosynthesis;
O_2 needed for respiration;
O_3 layer shields organisms from damaging UV/prevents mutations/harm to organisms;
presence of (large amounts) of water in liquid state;
water needed as solvent for all metabolic reactions/transport medium;
water as habitat;
suitable comparative comment for Venus (too hot/large GHE/no water);
suitable comparative comment for Mars (too cold/little atmosphere/no liquid water);
[**A** temperature dependant on suitable distance from sun]
Earth's temperature permits H_2, O_2, N_2 and CO_2 to exist as gases;
wide range of minerals and essential elements present/carbon as basis of organic molecules (or other example);
Earth's gravity holds atmosphere;
qualified reference to rock cycle;
greenhouse gases/CO_2/CH_4 retain heat/warm atmosphere;   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