AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Environmental Science 5441/6441

ESC3 The Biosphere

Mark Scheme

2005 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 2005   **ESC 3**

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

Question 1

(a)

Importance to living organisms
Chemical reactions take place in solution/needed for nutrient uptake/ transport of substances/dilution of waste;
Floating ice insulates/prevents water freezing solid (for survival of organisms beneath); [**A** reference to ice layer creating habitat]
Allows light to penetrate for water plants/photosynthesis; [**A** allows predators to see prey in water (or converse)]

3

(b)   Allows efficient enzyme activity/speed of chemical reactions;
       high temperatures denature/deactivate enzymes;
       [**R** 'kill' enzymes]
       temperature range allows water in liquid state;   MAX 2

Total marks = 5

Question 2

(a)   Community of living organisms interdependent with their abiotic environment;   1
        (needs both components)

(b)   (i)   Hawk/fox;   1

        (ii)   Secondary consumer;   1

(c)   Less food for shrew/hedgehog;
        [**A** ref. to extinction/decline in numbers]
        less detritivore activity/breaking up dead grass;   MAX 1

(d)   (i)   Wrong wavelength;
                used to evaporate water;
                falls on non-photosynthetic parts;
                reflected by leaf (cuticle);
                transmitted through the leaf;   MAX 2
                [**A** heat loss]
                [**R** ref. to limiting factors]

        (ii)   Plant food/cellulose harder to digest than animal food/protein (or converse);
                less waste (in faeces) produced by carnivores/more waste by herbivores;   MAX 1

        (iii)   Energy loss at each transfer/energy transfer inefficient/approx 10% transferred;
                very little energy left beyond four levels;
                [**A** energy runs out]
                loss through respiration;
                [**A** metabolism]
                inedible parts/not all of plant or animal eaten;
                loss through faeces/egestion/excretion;   MAX 3

                                                                                 Total marks = 10

Question 3

(a)

Designation
D (Ramsar site);
B (Sites of Special Scientific Interest / SSSI);
C (Environmentally Sensitive Areas / ESA);
E (Special Protection Areas / SPA);

4

(b) (i)   Voluntary organisation rely on membership subscriptions/merchandising/
          legacies/donations;
          statutory organisations funded by taxes (or implication);
          [**R** funded by government if unqualified]   2

     (ii) English Nature/Countryside Council for Wales/Scottish Natural Heritage/
          Dept of the Environment for Northern Ireland;   1

(c) (i)   Political lobbying/petitions;
          direct intervention/protests;
          fundraising (qualified);
          campaigns;
          raise public awareness/education;   MAX 2

     (ii) Ref to development in national interest (e.g. military)/overridden by government;   1

Total marks = 10

Question 4

(a) (i) Change /development of vegetation/species (over time/at one site);
          where no vegetation has grown previously;   2

     (ii) Vegetation binds/stabilises sand;
           increased humus/organic content of soil/nutrient content/fertility;
           soil is created/soil depth increases/structure improves;
           increased water holding capacity of soil/increased soil moisture;
           vegetation changes pH/salinity of soil decreases;   MAX 3

(b) (i) Large number of traps used in each area (minimum 10);
          random/systematic arrangement traps;
          justification of positioning of traps;
          suitable length of time before emptying (e.g. 24hours)/same length of time for all traps;
          reason for trap design e.g. raised mound or stone to prevent rain/large animals entering;
          justified use of bait/use of alcohol (or equivalent) to kill catch;
          repeat experiments for reliability/repeat at different time of day (e.g. at night)/
          different seasons;   MAX 3

     (ii) $\dfrac{650}{102}$;   6.4 (6.37);   2

                                                                    Total marks = 10

Question 5

(a) (i) Few (reproducing) individuals/time taken to adapt to new surroundings/
          population establishing;
          high death rate linked to unstable environment;
          time to synthesise enzymes (for micro-organisms);   MAX 1

     (ii) Increased competition/pressure on vital resources/food/space/water;
           increased environmental resistance;
           reduced biotic potential/increased death rate;
           build up of waste products;
           increased disease/predation;   MAX 2

     (iii) Birth rate equals death rate/carrying capacity reached;   1

(b) (i) Eliminates bias/allows statistical tests;   1

     (ii) Used when comparing two different areas/no gradient present/
           no gradual change in vegetation expected;   1

(iii)   Mark out sample area of suitable size e.g. 10m^2 in each location;
grid with co-ordinates to locate position of quadrats;
[**R** quadrats 'thrown']
appropriate quadrat size (e.g. 0.5m side length/0.25m^2)/gridded quadrat used;
appropriate number of quadrats in each area (minimum 10);
estimate area of ground/count number of squares covered by each species;   MAX 3

(iv)   subjective judgement/estimation/approximation;
[**R** 'inaccurate' unless qualified]
difficult when plants are layered/stratified/covered by others/flattened;   MAX 1

Total marks = 10

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Question 6

(a)   (i) $8000 \times \dfrac{5.4}{100}$ = 432 (km^2);   1

(ii) $\dfrac{1800000}{2860000} \times 100$ = 62.94 (62.937) % left; [**A** 62.9]

100 – 62.94 = 37.06 removed;   [**A** 37 – 37.1]

OR

1060000; $\dfrac{1060000 \times 100}{2860000}$ = 37.06%;   2

(b)   Logging/timber trade/fuelwood;
agriculture/crops/subsistence farming;
plantations/cash crops;
cattle ranching;
cleared for road building/transport;
mining/quarrying/oil extraction;
HEP;
cleared for urbanisation/resettlement/housing;
forest (i.e. natural) fires;
[**A** infrastructure]
[**R** development/deforestation/construction/flooding(if unqualified)/flooding]   MAX 3

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

High biodiversity/rare species/prevents extinction of endangered species;
(economic benefits) –   food source (for man);
                        medicines;
                        industrial products;
                        timber;
ecological stability/no disruption to food chains/web;
maintain gene pool/genetic diversity/genetic resource;
regulation of atmospheric gases /CO_2:O_2 balance/produces O_2/reduces CO_2;
prevention of global climate change/global warming/temperature increase;
regulation of water cycle;
prevention of soil erosion / mud slides;
ref. to indigenous people;
ref. to ecotourism;
aesthetic/beauty/pleasure;
scientific research/education (other than linked to medicines);
stewardship/moral/ethical;   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