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General Certificate of Education

Environmental Science 5441

ESC3 The Biosphere

Mark Scheme

2007 examination – June series

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Environmental Science**June 2007****Instructions: ; = 1 mark / = alternative response A = accept R = reject****Question 1**

	Letter	
Sampling bottom dwelling fresh water invertebrates	A	;
Sampling night flying moths	H	;
Comparing populations of daisies in two lawns with different weed control treatments	F	;
Collecting invertebrates in a soil or leaf litter sample	B	;
Investigating the zonation of seaweeds down a rocky shore	E	;

Total marks = 5

Question 2

- (a) (i) Low pH/acidic streams have smaller number of animal species (or converse),
[A positive correlation] 1
- (ii) Neutral pH;
[R 'highest pH' unless qualified] 1
- (iii) Stream 1; (1)
- Explanation**
(very) acidic/(very) low pH;
lowest number of organisms/lowest (bio)diversity/lowest number of plant species;
few nutrients available to plants (at low pH);
plants support fewer animal species/less food for animals/few producers to establish food chains;
fewer alternative food sources if food becomes scarce/greater risk of food chain disruption; (MAX 2) MAX 3
[R reference to gene pool]
- (iv) Use of electronic probe/pH meter/universal indicator;
[R litmus paper]
details of use (eg controls/repeats/means/calibration/comparison with colour standards etc); 2
- (b) Each level provides food for one above/phytoplankton and algae support higher levels;
inefficient transfer of energy/food;
energy loss in respiration/movement/heat;
mass/energy loss via faeces/uneaten/inedible parts/excretion; MAX 3

Total marks = 10

Question 3

- (a) Total organic matter/energy fixed by plants less respiratory loss/NPP = GPP – R;
 [A metabolism (as alternative to respiration)]
 energy available to be passed to/eaten by herbivores/primary consumers; MAX 1
 [A heterotrophs]
- (b) (i) Rapid cycling of nutrients; }
 warm temperatures; }
 high rainfall; }
 high light intensity; }
 12 month growing season; }
 [R ref to high (bio)diversity] }
 [A 1 factor with full explanation related to lack of limiting factors/optimum }
 conditions for photosynthesis for 2 marks] } MAX 2
- (ii) Abundant nutrients available (from rivers/sea); A minerals
shallow so light available (for photosynthesis);
shallow so warm temperatures (for photosynthesis); MAX 2
 [A 1 factor with full explanation for 2 marks]
- (c) Large area of Earth's surface; 1
- (d) Predation/grazing/disease/parasites;
 reduced (surface area for) photosynthesis/plant growth;
OR
 competition for light/nutrients/space;
 therefore reduced photosynthesis/plant growth;
OR
 named human activity (e.g. deforestation/cutting down trees);
 less photosynthesising material/plant growth;
 (correct factor and effect needed) 2
- (e) Oil/diesel/petrol/fuel pollution from boats;
 [R 'pollution' if unqualified]
 [A chemicals from boats]
 qualified pollution by tourists (eg increased sewage/litter/noise);
 physical damage from boats/damage or removal by (or for) tourists;
 increased revenue for conservation;
 increased education and awareness through visits;
 tourist developments/turbidity from dredging for reclamation; MAX 2

Total marks = 10

Question 4

- (a) (i) Primary succession/lithosere; 1
- (ii) Sand dune/salt marsh/volcanic lava flow/newly erupted volcanic island/
landslip/drying lake bed/other suitable example; 1
[A gravestone]
[A names of seres (psammosere/xerosere/halosere/hydrosere)]
[R 'rock'/mountains]
- (b) (i) Pioneers/pioneer community/colonisers; 1
- (ii) Climax (community); 1
[R plagioclimax/deflected climax]
- (c) Formation of soil;
increase in organic matter/leaf litter/humus;
increase in nutrients/soil fertility;
increase in moisture retention;
increase in soil depth;
roots/plants bind soil;
increase in shade/humidity/temperature/shelter from wind/other named abiotic factor/
change in microclimate;
change in soil pH;
concept of new conditions leading to establishment of new species;
introduction of new species by dispersal mechanisms; MAX 4
- (d) **Major catastrophic event:**
eg extreme weather/fire/flooding/volcanic ash fall/climate change/tree fall/
human interference (eg deforestation/introduction of non-native species);
- Explanation:**
dominant species removed/trees removed/conditions more suitable for other species/ref
to secondary succession (plagioclimax/deflected succession)/competition from non-
native or introduced species; 2

Total marks = 10

Question 5

- (a) (i) Absorb heat/resist change in temperature; 1
- (ii) Oxygen/O₂; 1
- (iii) Dissolves in water/trapped in leaves/not collected in funnel/sticks to glassware/used by plant (in respiration); 1
[R used in photosynthesis]
- (b) Use equal mass/size of pondweed;
equal distance from light source/light intensity;
[A same wavelength]
same time period;
same water temperature;
ensure all bubbles move into tube;
stir water soil solution;
allow time for pondweed to adjust at start;
[A same amount of CO₂]
[A same volume of water]
[R same equipment/soil type] MAX 3
- (c) (i) (Red)/orange and blue; (both needed)
greatest amount of photosynthesis (when these absorbed); 2
- (ii) Reflected from leaf;
used to evaporate water;
falls on non-photosynthetic structures;
passes through leaf/transmission;
converted to heat; MAX 2

Total marks = 10

Question 6

- (a) (i) Correct answer: 280 (2 marks);;

correct use of data but wrong answer = (1 mark)

$$P = \frac{(40 \times 42)}{6} \quad \text{OR} \quad \frac{1680}{6}$$

2

$$[\text{R } \frac{40 \times 36}{6} / 240]$$

- (ii) Sample too small/too few traps/not enough repeats;
 too short a time to mix;
 clumped distribution of animals;
 factors affecting probability of capture/recapture;
 birth/death of some woodlice;
 immigration/emigration;
 marking method affected woodlouse behaviour/more obvious to predators;
 mark removed by moulting;

MAX 3

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

Zoos:

place of safety/ref to native habitat destruction/continued threat;
 some species cannot be kept in captivity;
 captive breeding;
 problem of inbreeding/reference to gene pool;
 [R interbreeding]
 other breeding problems (lack of mates/stress);
 release to wild;
 problems of release/survival in the wild;
 role in conservation education;
 generates revenue for conservation from visitors/sponsorship of animals;
 allows research in endangered species;
 qualified research in endangered species;

(MAX 6)

Seed banks:

not all plant species suitable;
 example of unsuitable species/ref to recalcitrant species;
 take up less space than growing plants;
 seeds dehydrated/moisture content reduced;
 seeds cooled/frozen;
 problems of viability/controlled germination to check viability or get more seeds;
 maintain (genetic) diversity for future use;
 ref to Millennium Seed Bank/other named example;
 reference to native habitat loss if not credited in zoos;
 reference to re-establishing in the wild if not credited in zoos;
 qualified research in endangered species if not credited in zoos;

(MAX 6)

MAX 8

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
