GCE 2005
January Series

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Mark Scheme

Environmental Science – ESC3

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 2005   **ESC3**

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

Question 1

(a)   Organism needing ready-made source of organic molecules or food /unable to make own
organic molecules/food;
[**A** consume other organisms]
organisms able to make organic molecules from simple/inorganic raw materials;
[**A** ref. to process of photosynthesis]
organisms/series of organisms between which energy is transferred;   3

(b) O_2 given off (for use by aerobic organisms/respiration);
gave rise to ozone layer;
less competition for 'organic soup'/alternative feeding strategy;   MAX 2
[**R** ref. to food chains/food source/CO_2]

Total marks = 5

_____

Question 2

(a)   (i)   Proportional rate of change constant/population doubling time constant/
rate of increase increasing;   1
[**A** logarithmic/geometric growth]

        (ii)   More/better quality food/better diet/advances in agriculture;
improved sanitation/hygiene/clean water;
better medical care/less disease/vaccination/immunisation/antibiotics;
better housing/living conditions;
migration into new areas made possible/more space available;
better working conditions/improved industry/fuels;   MAX 4

(b)   (i)   Women have longer life expectancy than men;
since 1841 life expectancy (of both males and females) has increased;
life expectancy has approximately doubled between 1841 and 2001/increase more
rapid since 1891;
gap between life expectancy of males and females has increased with time;   MAX 3

    (ii)   **Economic:**
              more old people needing medical care/ref. to pensioners/larger dependency
              burden on economically active population/increased taxes on working population;   1
              [**R** ref. to general population increase]
              [**A** ref. to more people with jobs paying taxes]

              Environmental:
              increased energy demand/increased pollution/increased pressure on
              land/countryside/more waste disposal needed;   1

                                                                 Total marks = 10

Question 3

(a)   (i)   Point **B** has less photosynthesis;
              less CO_2 removed from atmosphere;
              [**A** converse]
              OR
              more decomposition at point **B**/ground level;
              more CO_2 produced;   2
              [**R** ref. to wind/CO_2 being trapped]

     (ii)   Insufficient light (for photosynthesis);   1

(b)   Less pollination;
      less seed/fruit dispersal;
      less detritivore activity/decomposition/nutrient cycling/faeces provide nutrients;   MAX 2

(c)   (i)   Total organic molecules synthesised by green plants less that used in
              respiration/NPP = GPP-R;   1
              [**A** energy available to 1° consumer/herbivore]

     (ii)   Greater light intensity in tropics;
              no water shortage in TRF;
              biomass of TRF greater/stratified/dense vegetation/high species diversity;
              warmer temperatures in tropics;
              increased rate of photosynthesis/growth/enzyme activity;
              longer growing season in tropics/no seasonal growth/growth all year;
              faster recycling of nutrients/decomposition;   MAX 4
              [**R** more nutrients]

                                                                   Total marks = 10

Question 4

(a) (i) 8/10; = 80%;   2
          [**A** 80 for 1 mark]

(ii) $\dfrac{0+1+4+5+5+9+10+15+20+25}{10} = \dfrac{94}{10}; = 9.4(\%);$ 2
          [**A** $\pm$ 0.1%]

(b) **Advantage:**
     overcomes problems where individual plants not easy to recognise (grasses/moss)/
     quicker to carry out/ more useful environmental index/index of plant activity;   1

     Disadvantage:
     subjective/estimate only/ less suitable for statistical analysis/less accurate/difficult if
     vegetation is layered;   1

(c) (i) Suitable apparatus used – light meter/electronic probe;
          readings at constant height above ground level/reference to calibration/repeats/
          readings at each site;   2

(ii) Difference in soil moisture;
          [**R** rainfall]
          difference in exposure/shading/temperature;
          difference in soil depth;
          competition/grazing pressure;
          variation in nutrient availability/organic matter;
          pH/salinity;   MAX 2
          [**R** altitude/wind/aspect/steepness]

Total marks = 10

Question 5

(a) (i) Number of both plant and animal species increased with time;
          number of plant and animal species in long grass has increased greatly;
          number of plant and animal species in short grass increased slightly/little change;
          difference in number of species between long and short grass increased;   MAX 2

(ii) Long grass has less human activity (to disturb wildlife); [**A** converse]
          long grass has more niches available/microclimate;
          long grass has more plant species present therefore more food plants for animals;
          long grass cut less often so more seeding/easier for seedlings/plants to establish;
          long grass creates more shade/stops soil drying;
          allows prey to hide/more shelter/safer for animals;   MAX 4

(b) (i) Greater stability of ecosystem/idea of balance/less prone to disruption;
          reasoned explanation e.g. more interacting species/more complex food web;   2
          [**R** reference to gene pool]

      (ii)   Difficulty with identification;
              difficulty in distinguishing individual plants;   2

Total marks = 10

Question 6

(a)   (Low numbers) in danger of extinction;   1
         [**A** very rare]
         [**R** threat (unqualified)]

(b)   (i)   Problems of inbreeding/small gene pool;
              stress/behavioural change/problems/disruption of breeding cycle;
              not in natural habitat/different nutrition/temperature etc.;
              little choice of mate;   MAX 2

      (ii)   Too little habitat remains;
              used to humans/tame/lack of hunting ability/survival skills;
              vulnerable to predators/competition;
              vulnerable to disease;   MAX 2

(c)   Named designations (e.g. nature reserve/SSSI/SPA/SAC);
       named government initiatives/legislation (e.g. ESA/Countryside Stewardship Scheme/ Wildlife
       and Countryside Act);
       field gene banks;
       seed banks;
       botanic gardens/zoos (as a place of safety – not in context of captive breeding);
       frozen sperm/eggs/embryos/assisted reproduction/cloning;
       culling;
       removal of predators;
       removal of competition from exotic/non-native species;
       named international agreements/conventions (e.g. CITIES/Ramsar/IWC);
       education;
       provision of supplementary (alternative) food/nesting materials;
       qualified reference to reduction of pollution (DDT/pesticides);   MAX 10

       1 mark for method;
       1 mark for additional detail/purpose/principles;
       1 mark for suitable example;

Total marks = 15