AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Environmental Science 5441/6441

ESC7 Written Alternative to Practical Investigation

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   **ESC7**

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

SECTION A

Question 1

(a)   (i)   Cotton/linen (are natural fibres) and would biodegrade quickly;
                   bags could not be obtained/found easily when dug up/bags remain intact;   2

         (ii)   7mm/largest most appropriate;
                   all decomposers/detritivores need to be present/have different roles;   2
                   [**A** reasoned answer for smallest mesh size   MAX 1]

(b)   Depth of burial;
         same size discs;
         same soil type/soil properties/named soil property;
         equal compaction of soil above buried leaf discs;
         time of year/season/temperature range/weather conditions (for start time);
         similar age of leaf fragments/young leaves/avoid veins/from same part of tree;
         time discs left buried;
         leaves not diseased;   MAX 3

(c)   Skin protection /gloves;
         protection from inhalation/face mask/use in well ventilated area;
         avoid near children/food;
         avoid adverse weather/windy conditions;
         obey manufactures instructions re. concentration and volume;
         safe storage/clear labelling;
         washing hands after use;   MAX 2

(d)   (i)

| Plot C	April 2003	October 2003	April 2004
Percentage mass remaining	**60**	**52**	**42**

All 3 correct = 2 marks
2 correct = 1 mark
< 2 correct = 0 marks   MAX 2

(ii)   Different starting mass/difficulty of obtaining same mass at start of experiment;   1

(iii)   Use of appropriate line graph;
suitable labelling for axes;
points plotted correctly (according to figures calculated by candidate);
appropriate scale;
if bar graph plotted – MAX 2   4

Graph to Show Percentage of Leaf Tissue Remaining After 18 Months

Total marks = 16

3
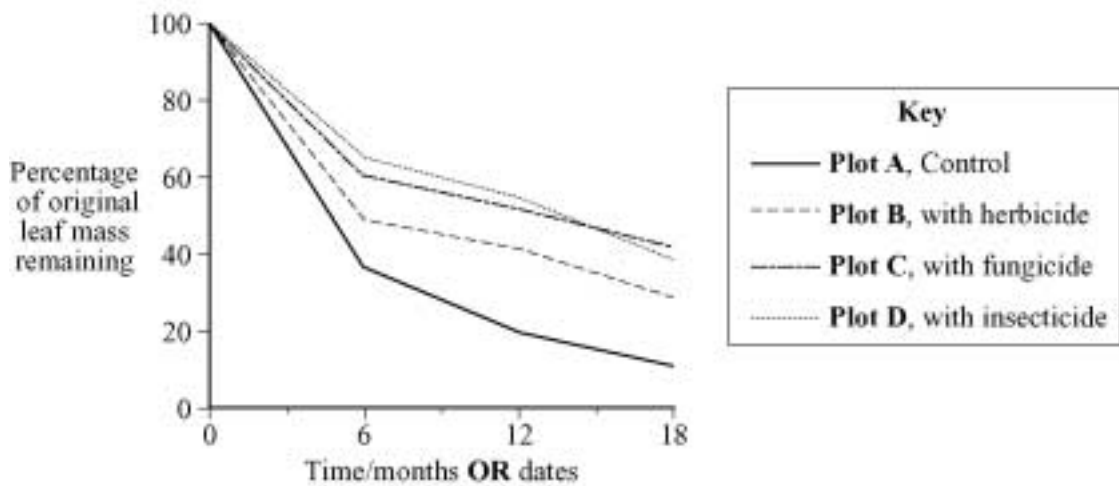
Question 2

(a) (i) Soil organisms move away from source of light/heat/dry soil;
         drop through sieve/mesh into collecting vessel;
         shiny sides of funnel to prevent escape;
         preservative/killing fluid prevents carnivores eating other organisms;
         many soil organisms are mobile;   MAX 2

    (ii) Grid with co-ordinates;
         random number table/computer generated for location of individual quadrats;   2

(b) (i) Greater number of organisms when compost added to garden soil;   1

    (ii) Test: Mann Whitney U test;   1
         Reason: test of significance/difference between 2 averages (rather than correlation
               or association);
               no evidence to suggest normal distribution/non-parametric test;
               data counted (rather than measured);
               appropriate amount of data/>5;   MAX 2

    (iii) Attempt to rank data;
         correct ranking of data;;
         correct value for U for each dataset;;
         correct critical value extracted from the table;   6

    (iv) Correct conclusion; [**A** conclusion from candidates calculated value even if incorrect] 1

         [If another statistical test (e.g. t test) is used, correct working and conclusions will be
         credited up to a maximum of 2 marks for part (b)(iii)]

    (v) Possibility of obtaining result by chance is (less than) 5%/95% confident a
         significant relationship exists;   1

                                                                    Total marks = 16
_____

Question 3

(a)   (i)   Quick growing/easy to obtain/germinates well;   1

        (ii)   Watering regime;
                light exposure;
                [**R** water/light unqualified]
                [**R** pH]
                mass/volume/amount of growing medium used;
                temperature;
                same size of tray;
                same age of seeds;
                same depth;
                same spacing;
                same variety of radish;   MAX 3

        (iii)   Water content of plant variable;   1
                [**A** biomass only measured]

        (iv)   Eliminates anomalous results/improves accuracy/mean can be calculated;   1
                [**A** 10% of sample]

        (v)   Dry seedlings at temperature approximately 100 °C;
                drive off water without harming organic content;
                weigh/find mass after drying;
                dry to constant mass;   MAX 3

(b)   (i)   Nutrient content/named nutrient;
                organic content;
                water holding capacity;
                [**R** water content]
                soil bulk density;
                thermal capacity/colour;
                pH;   MAX 2

        (ii)   E.g. organic matter:
                        find mass of dry soil sample;
                        heat strongly;
                        cool in dessicator;
                        reweigh to constant mass;   MAX 3

                                                                                        Total marks = 14

SECTION B

Question 4

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

             All chemicals slow rate compared to control;
             rate fastest in first 6 months;

             added insecticide/fungicide slowed rate of decomposition most;
             insecticide kills springtails/soil insects/detritivores;
             organic material not shredded effectively/surface area not increased;
             decomposers unable to function efficiently;
             fungicide kills fungi/decomposer;
             fewer enzymes to break down plant material;
             fungicides toxic to earthworms;
             herbicides less harmful to decomposition process;
             herbicides less toxic to fungi/detritivores;
             herbicides decrease soil organic matter (by killing weeds);
             herbicides provide food for soil organisms (as organic);   **MAX 7**

    (ii)   Slight trend of more invertebrates found in soil with added compost;
             but difference not significant;
             more food/detritus for organisms;
             more drainage/water holding/aeration of soil improves structure for organisms; **MAX 3**

    (iii)   Similar pattern of growth in both growth media/garden compost almost as effective;
             peat shows slightly greater growth overall;
             supports use of garden compost as alternative to peat;
             ref. to figures in graph;
             correct reference to nutrient level/water holding capacity;   **MAX 3**

(b)   Soil in plot A should have been watered (with 5 litres weekly);
       leaves buried therefore chemicals may not have reached them in equivalent volumes;
       specific comments on small sample size (number/size of plots/number of Tullgren
       funnels/number of seeds/number of bags/repeats needed);
       nematodes/very small invertebrates/soil micro-organisms/earthworms not sampled;
       random sampling (e.g. for Tullgren funnels) may miss organisms e.g. with clumped distribution;
       results of lab experiments may be unrepresentative of results in field;
       results of lab experiments may differ with other types of plant;
       comment on concentration of chemicals used;
       physical removal of leaf fragments (e.g. by detritivores/washed out);
       comments re. variability of content of garden compost;
       short timescale for radish experiment;
       suitable comment on precision of measurements/human error;   **MAX 5**

(c)   (i)   Water Plot A with equivalent volume of water/5 litres weekly;
    larger sample sizes/more repeats;
    separate counts for different invertebrate species;
    sampling of organisms not detected in Tullgren funnel;
    analysing material content of compost;   MAX 3

    (ii)   Use different types of leaves for decomposition;
    effectiveness of different garden chemicals;
    investigate soil invertebrate population in different growing media;
    investigate populations of micro-organisms/earthworms/nematodes;
    carry out compost/peat trials in the field;
    use with horticultural/different crops;
    repeat with different types of commercial compost/farmyard manure/
    composted material;
    different concentrations of chemicals;
    different quantities of compost added;   MAX 3

(d)   Avoid or reduce garden chemicals;
    switch to organic methods/named organic alternative;
    encourage composting/discourage use of peat;
    encouragement of large scale composting/green recycling;
    education related to chemical use/peat conservation/home composting (e.g. leaflets etc);
    suggest government initiatives e.g. subsidies/grants;
    incentives to home composting (e.g. free/subsidised compost bins);   MAX 5

Total marks = 29