QUESTIONSHEET 1

(a) (i) $\frac{84}{100} \times \frac{15}{100} \times 100 =$ and $\frac{16}{100} \times \frac{15}{100} \times 100 =$;

12.6 ; 2.4 ; **3**

(ii) $\chi^2 = \frac{(78 - 71.4)^2}{71.4} + \frac{(6 - 12.6)^2}{12.6} + \frac{(7 - 13.6)^2}{13.6} + \frac{(9 - 2.4)^2}{2.4}$;

(accept later stages of working if correct)

= 25.42 ; **2**

(iii) n = 1; **1**

(iv) reject the null hypothesis;
because calculated value is greater than the critical value; **2**
(allow consequential error if value from (ii) is incorrect)

(b) generate random numbers from tables/by computer;
use them as random coordinates for placing quadrats;
use 1.0/0.5 metre^2 quadrats;
no need to count numbers of plants/% cover, just need to record presence or absence;
use standard method for recording plants which touch quadrat sides;
comment on need for many replicates; **max 5**

TOTAL 13

QUESTIONSHEET 2

(a) (i) Total number of voles caught = 64;
$\frac{64}{8} = 8$; **2**

(ii) $\frac{(7-8)^2}{8} + \frac{(9-8)^2}{8} + \frac{(10-8)^2}{8} + \frac{(10-8)^2}{8} + \frac{(8-8)^2}{8} + \frac{(7-8)^2}{8} + \frac{(2-8)^2}{8} + \frac{(11-8)^2}{8}$;

(Allow later stages in working if correct)

$\chi^2 = 7.0$; **2**

(iii) number of degrees of freedom = 8-1 = 7; (n -1) **1**

(iv) accept the null hypothesis;
since calculated value is less than critical value;
thus there is a 95% probability that the discrepancy is due to chance alone/any equivalent statement; **3**

(b) use capture-recapture technique;
mark captured voles with a (harmless) spot of paint and release;
count number recaptured;
to avoid counting recaptures twice mark with a second spot of paint before release;
calculate the population using the formula,
total population size = $\frac{\text{total number of marked animals x total caught in sample}}{\text{number of marked animals recaptured}}$; **max 4**

TOTAL 12

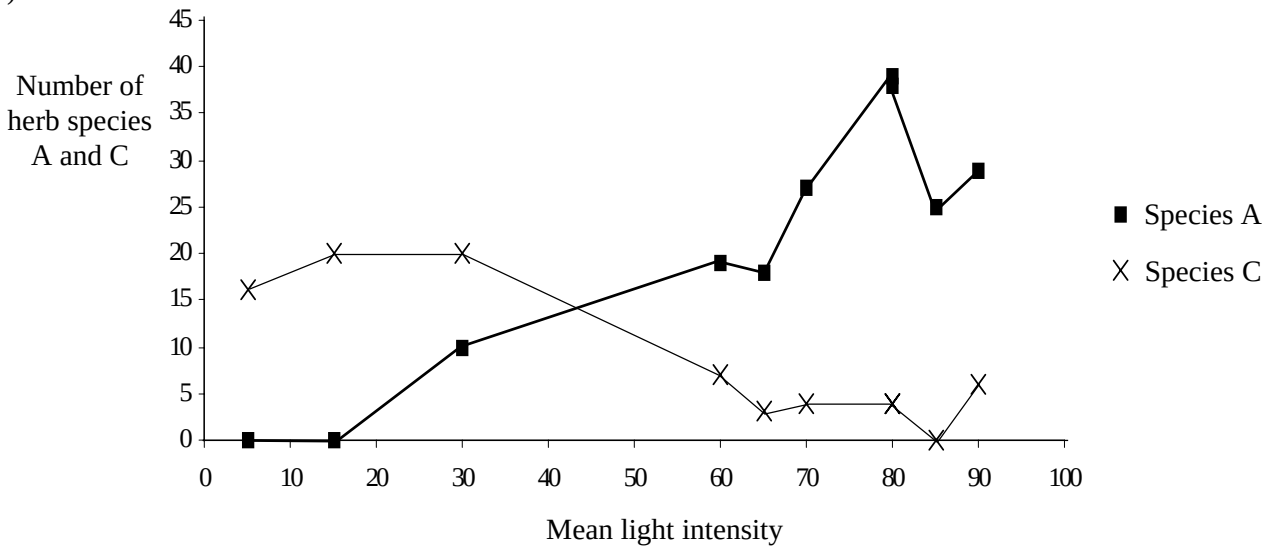
QUESTIONSHEET 3

(a) set up coordinate grid/use tapes along 2 sides;
generate random numbers for co-ordinates;
co-ordinate indicates centre of sampling quadrat; **max 2**

(b) Advantage:
unbiased/allows statistical testing; **1**

Disadvantage:
coverage may be uneven/unrepresentative/large areas may be missed; **1**

(c) (i)



correct axes (light intensity on x-axis);
suitable scale;
accurate plotting;
joining points with a ruled straight line; (IOB recommendations)
key/curves labelled; **5**

(ii) number increases as average light intensity decreases/converse; **1**

(iii) shade tolerant/loving plant/able to photosynthesise efficiently at low light intensities/low compensation point; **1**

(d) thinner epidermis;
large/many chloroplasts;
chloroplasts concentrated towards upper/adaxial surface;
high chlorophyll concentration;
larger leaves; **max 2**

TOTAL 13

QUESTIONSHEET 4

(a) as pH increases, so does number of species/increase in acidity reduces number of species/converse; **1**

(b) stream pH may be influenced by point sources of acids/may change over short distances;
need to obtain representative value/minimise effect of anomalous values; **2**

(c) may influence ion activity eg Ca^{2+}/Al^{3+};
may influence solubility of toxins/metals;
may effect physiology/named process in a species/enzyme action may be inhibited/enhanced; **max 2**

(d) temperature;
light intensity;
concentrations of metals;
oxygen concentration; **max 2**

TOTAL 7

QUESTIONSHEET 5

(a) (i) random sampling/random quadrats; **1**

(ii) line transect/line sampling; **1**

(b) (i) effectively increases length of growing season;
greater photosynthesis;
increased growth/yield/profit; **max 2**

(ii) inhibits branches/encourages apical growth;
reduces light reaching ground/reduces growth of ground flora/competition; **2**

TOTAL 6

QUESTIONSHEET 6

(a) the number of organisms of a species in one area at one time; **1**

(b) $N = \frac{66 \times 54}{16}$; = 222.75; (accept 222 - 223) **2**

(c) marking does not affect probability of recapture;
marking persists over trapping period/marks do not wear/wash off;
the population remains constant over the sampling period;
the samples consitute an accurate cross section of the population/sexes/ages etc; **max 3**

TOTAL 6

QUESTIONSHEET 7

(a) will not provide a random sample;
because of 'handedness'/subjectivity/bias/differences between samplers' throwing ability; **2**

(b) set up grid using tapes at right angles/along two sides of lawn;
generate random/numbers for use as co-ordinates;
using accurate technique e.g. computer/tables;
place quadrat at intersection;
count number of dandelions in the quadrat;
repeat at least 10 times and calculate the mean density per quadrat area;
calculate daisy population in total lawn area; **max 5**

(c) (i) total area = 25 x 30 = 750 m^2;
1 % sample = 7.5m^2;
area of quadrat = 0.50 x 0.50 = 0,25 m^2;
number of quadrats required = $\frac{7.5}{0.25}$ = 30; **max 3**

TOTAL 10

QUESTIONSHEET 8

(a) 39.1; **1**

(b) collect more leaves at each height/point;
collect equal number of leaves at each height/point;
use more than one tree;
measure light intensity at each point;
repeat at different times of day/different days; **max 3**

(c) lay leaf flat on graph paper and draw round margin;
count up total number of squares included;
count up total number of ½ squares included and add into total;
multiply by two to get total surface area (both sides of leaf); **max 3**

TOTAL 7

QUESTIONSHEET 9

(a) (i) Any three of:
insufficient seeds/
lack of replicates/
uneven spacing/
growth confused with germination/
only used one acid/
use of tissue paper rather than soil/
only one watering;;; **3**

(b) unsuitable pH may inhibit enzyme action;
ref diastase which mobilises starch reserves/proteases which mobilise protein reserves;
may inhibit gibberellin secretion (and so enzymes are not activated); **max 2**

TOTAL 5

QUESTIONSHEET 10

(a) relative abundance/population density; **1**

(b) Biotic:
predators; food supply; human activity; **max 2**

Abiotic:
temperature changes; inundation/tidal covering; exposure/wave action/turbulence; varying salinity/dehydration; **max 2**

(c) (i) L. neritoides can withstand dessication/exposure to air/temperature change;
L. littoralis requires constant cover by seawater/spray/cannot withstand dessication; **2**

(ii) Nucella lapillus is found all over the shore since it can feed on all species of periwinkle/limpet;
particular Littorina sps. only found on specific areas of the shore; **2**

TOTAL 9

QUESTIONSHEET 11

(a) Advantage:
allows (parametric) statistical treatment/unbiased; **1**

Disadvantage:
may give unrepresentative/clumped/sample/large areas may be missed; **1**

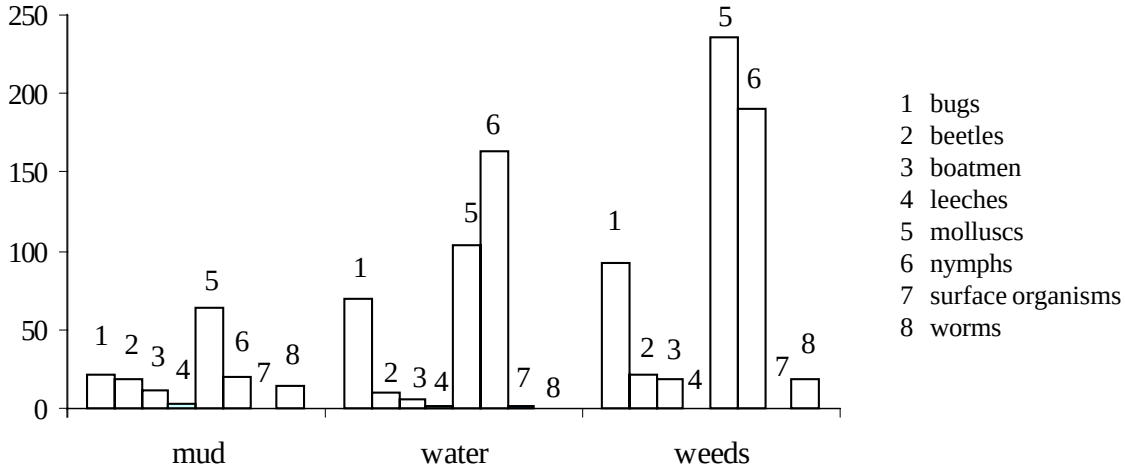
(b) select defined area/population;
description of measurement of Pleurococcus e.g. grid on transparent acetate/plastic;
suitable grid size/1 cm^2 grid squares;
random selection of sampling area on trees;
record of percentage cover (green colouration);
elimination of other variables e.g. age/species/condition of trees or equivalent;
calculation of mean values/need for sufficiently large sample; **max 5**

(c) more sunlight so more photosynthesis;
thus more growth/cell division;
higher temperatures mean faster enzyme action/more photosynthesis; **2**

TOTAL 9

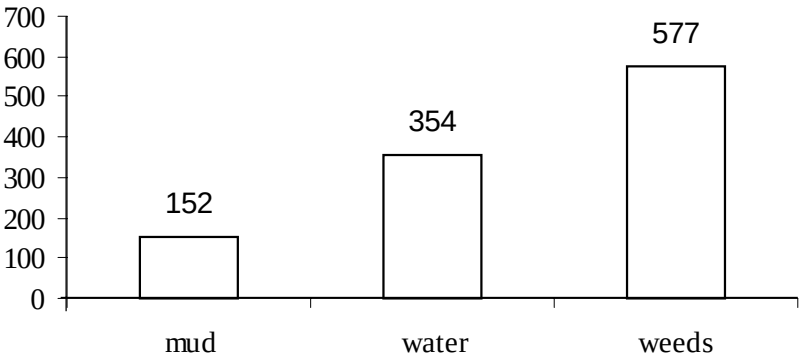
QUESTIONSHEET 12

(a)



1 bugs
2 beetles
3 boatmen
4 leeches
5 molluscs
6 nymphs
7 surface organisms
8 worms

OR



axes labelled;
suitable scale;
correct plotting;
key; **4**

(b) Any two of:
unequal sampling intensity/unequal sample sizes/only part of microhabitat sampled; **2**

(c) weeds provide cover/place to hide from predators;
weeds provide food for herbivores;
higher O_2 tension around weeds; **max 2**

TOTAL 8