QUESTIONSHEET 1

(a) (i) increased artificial fixation/conversion of N_2 to NH_3/Haber process/production of artificial nitrogenous fertilisers;
increased use of manure from intensive stock farming;
increased leaching of nitrates;
increased mineralisation/release of NO_2 / N_2O by ploughing/burning; **4**

(ii) increased use of fossil fuels;
increased release of nitrogen oxides into atmosphere;
increased acid rain/nitric/nitrous acid; **3**

(b) (i) conversion of ammonium/NH_4^+ into nitrate/NO_2^- into nitrate (NO_3^-) ions;
credit correct genus e.g. Nitrosomonas $NH_4^+ \longrightarrow NO_2^-$;
Nitrobacter $NO_2^- \longrightarrow NO_3^-$; **3**

(ii) excess enrichment of water by nutrients/nitrates/phosphates;
which leach into waterways/effluent release;
cause algal blooms;
which restrict light supply/increase turbidity;
thus algae die and decay by aerobic bacterial action;
ref increased BOD/biochemical oxygen demand
thus O_2 deprivation results in animals dying also; **max 4**

TOTAL 14

QUESTIONSHEET 2

(a) crush/grind/ measure known number/mass of walnut leaves;
use water; (reject alcohol since this would inhibit germination)
filter;
add 1cm^3 extract to 9cm^3 (distilled) water; **4**

(b) same number of seeds/seeds from same packet/batch/same spacing of seeds;
same volume of extract used/measure germination in each tray at same time;
same temperature;
include control with only water/no walnut extract; **max 2**

(c) percentage/number of seeds germinating over stated time period; **1**

(d) germination = emergence of radicle;
measured time for each percentage of seeds to germinate; **2**

(e) reduces competition since inhibits growth of other plants;
for water/nutrients;
juglone may stimulate growth of black walnut seedlings;
ref walnut trees are 'aggresive' plants; **max 2**

TOTAL 11

QUESTIONSHEET 3

(a) (i) enzymes work faster at higher temperatures;
dark reaction/light independent stage is temperature dependent/enzyme controlled/may be limited by low temperature; **2**

(ii) CO_2 is a greenhouse gas/absorbs radiation/prevents heat/radiation loss to space;
thus atmosphere warms as CO_2 concentration rises;
positive feedback causes increased temperature which causes increased CO_2 concentration; **3**

(b) respiration rate increased at higher temperatures producing more CO_2 ;
since it is an enzyme controlled process;
as ocean temperature rises CO_2 solubility decreases/ enters air; **3**

(c) methane/any nitrogen oxide/carbon monoxide/water vapour/CFCs; **1**

TOTAL 9

QUESTIONSHEET 4

(a) size/area of box represents quantity of biomass/energy at each level;
decrease because energy is lost between each level;
as heat (respiration)/faeces/not all organisms at preceding level being eaten; **3**

(b) respiration; **1**

(c) rabbit dies/eaten by predator and digested/lost as urea in urine by normal body protein turnover;
decomposition of body/predator faeces/predator urine;
extracellular digestion by decomposition/ref saprophytic action;
protein $NH_4^+ \rightarrow NO_2^- \rightarrow NO_3^-$;
nitrate absorbed by grass (plant)/root hairs;
incorporated into chlorophyll/porphyrin ring/of chlorophyll; **max 4**

TOTAL 8

QUESTIONSHEET 5

(a) as sugar content increases, percentage taken increases/earthworms appear to prefer leaves with higher sugar content;
prefer ash most/beech least;
prefer ash to sycamore even though they have the same sugar content; **max 2**

(b) Any five of : macerate leaves/use of pestle and mortar/obtain leaf extract in solution/
to leaf solution add equal volume of Benedicts' Reagent/
heat to 70-80^{0}C/
red/yellow precipitate indicates reducing sugar/
relative concentration of sugar determined visually by spectrophotometry/
credit non-reducing sugar test/glucose oxidase test/use of glucose biosensor;;;;; **5**

(c) Any two of: equal number of discs of each species/
discs equal size/
discs equal spacing/
bin kept covered/in dark;; **2**

(d) nitrogen/tannin content/roughness/texture/colour/presence of polyphenol/chlorophyll/of cuticle; **1**
(Credit any sensible suggestion.)

TOTAL 10

QUESTIONSHEET 6

(a) conversion of atmospheric/gaseous nitrogen to ammonia/$N_2 \rightarrow NH_3$;
ammonia can be used by the plant/bacteria to synthesise amino acids/protein; **2**

(b) all protect the enzyme/nitrogenase from oxygen/high oxygen concentrations;
oxygen is a competitive inhibitor of nitrogenase;
nitrogenase reduces the nitrogen molecule into ammonia; **max 2**

(c) (i) may give plant extra survival value/faster growth/reproductive rate;
outcompeting other plants in the environment;
which may not survive/become extinct;
fundamentally changing the community in a disadvantageous way/leading to a loss of insects/insect food plants/breaking food chains/loss of biodiversity; **3**

(ii) dentrification occurs in anaerobic/waterlogged conditions;
ploughing/draining reduces this/aerates soil;
Thiobacillus/Pseudomanas denitrificans are anaerobic organisms; **max 2**

TOTAL 9

QUESTIONSHEET 7

(a) energy flow/food dependency/feeding; **1**

(b) (i) beetles/caterpillars/aphids/woodlice/millipedes/fly larvae/woodmouse/grey squirrel/slugs/earthworms (any three); **1**

(ii) woodpecker; **1**

(c) box area represents numbers;
number of organisms decreases from lower trophic levels to higher;
due to energy loss at each level;
due to respiration/excretion/deforestation/not all organisms eaten;
fewer organisms can be supported in next level;
accept higher organisms tend to be larger; **max 4**

TOTAL 7

QUESTIONSHEET 8

(a) (i) annual production = 30,000 + 59,000 + 31,000 = 120,000 tonnes;
120,000 × 20 = 2,400,000 tonnes; **2**

(ii) in 20 years each hectare will absorb 120 tonnes; (accept reasonable figures from graph)

area needed = $\frac{2{,}400{,}000}{120}$ = 20,000 hectares; **2**

(b) warming of atmosphere/global warming;
due to accumulation of carbon dioxide/methane/nitrogen oxides/water vapour;
which trap/slow release of long wave radiation/retain heat energy in atmosphere; **3**

(c) (i) light independent reaction/CO_2 fixation is enzyme controlled;
enzymes work faster at higher temperatures; **2**

(ii) respiration accelerated since enzyme controlled;
thus greater use of repiratory substrates/less storage;
stomata may be closed more due to transpiration stress;
thus less CO_2 uptake and less photosynthesis; **max 3**

TOTAL 12

QUESTIONSHEET 9

(a) (i) competition between different species for food/nesting sites/display sites;
e.g. (three species of) woodpeckers compete with each other for nest sites/treecreeper, blackcaps, woodpeckers compete for insects; **2**

(ii) describes habitat and role of species;
e.g. sparrowhawk lives in large woods where it is a top carnivore; **2**
(Credit any other correct example)

(b) some bird species require glades/open areas/dead wood;
these reduce timber production; **2**

(c) increases diversity of other types of organism/non-tree species;
different trees provide microhabitats attracting a wider variety of insects/birds; **2**

TOTAL 8

QUESTIONSHEET 10

(a) succession; **1**

(b) (i) Any one of:
sunken stomata/thickened epidermis/extensive root system/reduced leaf area/rolled leaves; **1**

(ii) Any one of:
aerenchyma/tissues with large number of air spaces/floating leaves with stomata on upper surface/leaves in water currents finely divided/hydrophobic surfaces/surface hairs to trap air; **1**

(c) dead plant material/humus/organic matter accumulates;
site dries/soil rises above water level;
conditions become less favourable/unfavourable for hydrophytes/more favourable for mesophytes;
reference to colonisation by herbaceous plants, shrubs, trees;
reference to correct/qualified change in conditions/light regime/water availabilty; **max 3**

TOTAL 6

QUESTIONSHEET 11

(a) first species to colonise/can colonise bare ground;
usually lichens/algae;
have adaptations to survive in extreme conditions;
can initiate a plant succession; **max 3**

(b) indicates complexity/stability/allows comparisons of different ecosystems/communties; **1**

(c) trees/conifers may shade other species;
acidify soils/reduce water/salt availability; **max 2**

TOTAL 6

QUESTIONSHEET 12

(a) (i) the particular environment in which an organism lives;
with characteristic climatic and edaphic conditions;
and a characteristic community of living organisms; **3**

(ii) several populations which interact together in a habitat;
through flow of energy via trophic levels and recycling of nutrients;
over a particular time; **3**

(iii) a group of individuals belonging to the same species;
in the same area/same community;
at the same time; **3**

(b) select similar lawns/areas of the same lawn;
mown at different frequencies/once, twice, three times a month or similar;
sample using quadrats;
1 metre^2 size;
generate random numbers to set up random coordinates (to place quadrats);
count number of plantains in each quadrat;
at least five quadrats per area;
work out population density/number of plantains per square metre;
repeat sampling every week for about three months;
standard procedure adopted about counting plantains touching sides of quadrats; **max 6**

TOTAL 15