

**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  $NH_4^+ \rightarrow NO_2^-$ ;  
Nitrobacter  $NO_2^- \rightarrow NO_3^-$ ; **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 'aggressive' 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<sub>2</sub> is a greenhouse gas/absorbs radiation/prevents heat/radiation loss to space;  
thus atmosphere warms as CO<sub>2</sub> concentration rises;  
positive feedback causes increased temperature which causes increased CO<sub>2</sub> concentration; 3
- (b) respiration rate increased at higher temperatures producing more CO<sub>2</sub> ;  
since it is an enzyme controlled process;  
as ocean temperature rises CO<sub>2</sub> solubility decreases/ enters air; 3
- (c) methane/any nitrogen oxide/carbon monoxide/water vapour/CFCs; 1
- TOTAL 9**
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**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<sub>4</sub><sup>+</sup> → NO<sub>2</sub><sup>-</sup> → NO<sub>3</sub><sup>-</sup>;  
nitrate absorbed by grass (plant)/root hairs;  
incorporated into chlorophyll/porphyrin ring/of chlorophyll; max 4
- TOTAL 8**
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**QUESTIONSHEET 5**

- (a) as sugar content increases, percentage taken increases/earthworms appear to prefer leaves with higher sugar content;  
prefer ash most/beechn 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 Benedict's Reagent/  
heat to 70-80°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;  
(Credit any sensible suggestion.) 1

**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) denitrification occurs in anaerobic/waterlogged conditions;  
ploughing/draining reduces this/aerates soil;  
Thiobacillus/Pseudomonas denitrificans are anaerobic organisms; max 2
- TOTAL 9**
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**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<sub>2</sub> fixation is enzyme controlled;  
enzymes work faster at higher temperatures; 2
- (ii) respiration accelerated since enzyme controlled;  
thus greater use of respiratory substrates/less storage;  
stomata may be closed more due to transpiration stress;  
thus less CO<sub>2</sub> uptake and less photosynthesis; max 3

**TOTAL 12**

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**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;  
(Credit any other correct example) 2
- (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 availability; 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/communities; 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<sup>2</sup> 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**