

**QUESTIONSHEET 1**

- (a) percentage cover of *A. vinealis* increased;  
by about 50% in 25 years;  
percentage cover of *N. stricta* decreased; (a description is asked for here, not an explanation)  
by about 40% in 25 years; 4
- (b) *A. vinealis*;  
removing grazing led to large increase in its percentage cover;  
*N. stricta* thrived when sheep were grazing max 2
- (c) (previous) high percentage cover had been maintained by grazing pressure;  
reducing population of *A. vinealis*/competing species;  
thus less pressure/competition for space/light/salts on *N. stricta*;  
*A. vinealis* now flourishing and so deprives *N. stricta* of resources/percentage cover starts to fall; 4
- TOTAL 10**
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**QUESTIONSHEET 2**

- (a) decreased evaporation/increased soil moisture decreases water stress/provides water for transport/metabolism;  
increases in air temperature increase the rate of photosynthesis;  
decreased wind speed reduces wind damage/soil erosion/transpiration loss of water;  
increased soil temperature increases decomposition/release/uptake of nutrients; 4
- (b) (i) legumes/root nodules contain nitrogen-fixing bacteria/Rhizobium;  
convert nitrogen to ammonia/fix nitrogen;  
increase ammonia/nitrite/nitrate/amino acid/protein content of soil; 3
- (ii) waterlogging creates cold/anaerobic soil conditions;  
active uptake/root respiration inhibited;  
denitrification increased/denitrifying bacteria flourish;  
ploughing/draining aerates soil (reducing denitrification/increasing active uptake); max 3
- TOTAL 10**
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**QUESTIONSHEET 3**

- (a) vehicle/exhaust emissions/industrial waste gases/acid rain (nitrous/nitric acids); 1
- (b) nitrate ( $\text{NO}_3^-$ ); 1
- (c) Any two of: DNA/RNA/ATP/chlorophyll/proteins/amino acids;; 2
- (d) leaves may be tougher/distasteful/unpalatable/higher nutritive value so gain enough food in less time/reach full growth more quickly/equivalent statement; 1
- (e) less time/able to catch herbivorous insects/fewer herbivorous insects available;  
therefore starve; 2
- TOTAL 7**

**QUESTIONSHEET 4**

- (a) Var 1 =  $\frac{25-15}{15} \times 100$ ; = 0.67% ;
- Var 2 =  $\frac{16-14}{14} \times 100$ ; = 0.14% ; 4
- (b) A;  
mean growth much higher than site B;  
suggests tolerance of heavy metals; 3
- (c) heavy metals absorbed by roots/root hairs;  
act as non-competitive enzyme inhibitors;  
reduce rate of respiration/cell division/growth/mineral uptake; max 2
- (d) Any two of: identical nutrient solution/  
same depth of beads/  
identical copper solutions/  
care in handling seedlings/  
keep at same temperature/light intensity;; 2
- TOTAL 11**
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**QUESTIONSHEET 5**

- (a) spraying rapidly decreased all populations;  
populations of arachnids and other arthropods had almost recovered by 10 days/recovered rapidly;  
population of insects recovered more slowly; 3
- (b) (i) larger surface area :volume ratio;  
thus absorb a relatively higher concentration of insecticide; 2
- (ii) arachnids remain stationary/stay on web and so only contact spray which hits them;  
insects move about in foliage and so pick up extra contamination from leaf surfaces;  
insecticide more directed to inhibiting insect metabolism rather than arachnid metabolism; max 2
- TOTAL 7**

**QUESTIONSHEET 6**

- (a) most nutrients are in biomass/vegetation/trees;  
soil's nutrient content is poor;  
therefore quickly depleted when crops harvested;  
no nutrient recycling from leaf fall/fruit fall; **max 3**
- (b) poorly drained soils may be anaerobic;  
denitrifying bacteria/Thiobacillus/Pseudomonas thrive;  
may convert nitrates into nitrogen;  
root hairs cannot absorb minerals in absence of oxygen; **max 3**
- (c) energy is lost at each trophic level/only a fraction of the energy in producers reaches consumers;  
losses include respiration;  
loss in faeces;  
loss in indigestible material;  
not all of preceding organisms are eaten;  
as available energy declines, so does biomass;  
consumers may migrate/move away, producers cannot; **max 5**
- TOTAL 11**
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**QUESTIONSHEET 7**

- (a) as forest cover increases, stream pH decreases/becomes more acid;  
tends to level out above 50% cover, around pH 4.3; **2**
- (b) sulphates deposited by acid rain/dry deposition/from burning of fossil fuels/from urban areas/blown towards forest;  
trees/conifers filter/scavenge sulphate pollutants;  
and shed leaves which contain the extra sulphate (into soil);  
sulphates leached into streams; **max 3**
- (c) acid rain reduces soil pH;  
as pH falls, solubility of aluminium increases;  
aluminium (ions) leach/are washed/transported (in overland flow) to stream; **max 2**
- (d) decreased number of species/species diversity decreases;  
decreased abundance of zooplankton/phytoplankton/decomposers/invertebrates/fish;  
calcium shortages reduce numbers/diversity of crustaceans;  
ionic/osmoregulation effects/loss of ions, e.g. sodium;  
decreased fish stocks/reduced egg hatch/clogging of gills with mucus;  
increased deformities in insect larvae;  
decreased population of sensitive birds, e.g. Dipper; **max 4**
- TOTAL 11**

**QUESTIONSHEET 8**

- (a) as weed density increases, crop yield decreases;  
interspecific competition;  
for water/nutrients/minerals/light; 3
- (b) Advantages  
highly specific;  
no toxic residues;  
population of control agent decreases as target organism decreases in number;  
residual population makes second release unnecessary; max 2
- Disadvantages  
predator may attack non target species;  
may become pest itself;  
may be slow;  
will not kill all the pest/residual population of of control organism and pest survive; max 2
- (c) faster growth (than crop);  
rapid germination;  
prolific seed production;  
tall/large leaves (to reach sunlight over crop);  
wide spreading/deep root system (to gain more water/salts than crop); max 2
- TOTAL 9**
- 

**QUESTIONSHEET 9**

- a) excess input of nutrients into water courses/lakes/sea;  
nitrate/phosphate;  
due to leaching of NPK/nitrogenous fertilisers/detergents; max 2
- (b) (i) light penetration decreases;  
because of phytoplankton/floating algae/plants, organic matter/turbidity increases;  
thus (deprived of light and) cannot photosynthesise; max 2
- (ii) phytoplankton have rapid turnover/many plants die;  
are broken down by bacteria/aerobic bacteria/decomposition;  
which uses oxygen/increased BOD/biochemical oxygen demand; max 2
- (c) (i) phytoplankton/organic matter/nitrates have to be removed/increased filtration/coagulation/need to  
improve colour/taste; 1
- (ii) nitrates may be converted to nitrites in baby's stomach;  
nitrites reduce oxygen carrying capacity of haemoglobin/lead to methaemoglobinaemia/blue baby syndrome;  
nitrates may lead to formation of carcinogenic nitrosamines;  
nitrates in water linked to higher frequency of heart disease; max 2
- TOTAL 9**

**QUESTIONSHEET 10**

- (a) (i) extra nutrients cause overgrowth of algae/phytoplankton/floating plants in upper waters;  
phytoplankton/algae/floating plants photosynthesis;  
release oxygen;  
diffusion into/through water; **max 3**
- (ii) photosynthesising plants have died at this level (due to turbidity/many plants above);  
bacteria/decomposes digest/breakdown organic matter/dead phytoplankton/dead plants;  
using up available oxygen; **3**
- (b) nitrate/ $\text{NO}_3^-$  ;  
phosphate/ $\text{PO}_4^{3-}$  ; **2**
- (c) amount of oxygen required/used by living organisms in water;  
measure the dissolved oxygen content of a sample of water;  
using methylene blue/oxygen biosensor;  
keep another sample in the dark for 5 days;  
at 20 °C;  
measure its dissolved oxygen content;  
the difference between the two measurements is the BOD; **max 4**

**TOTAL 12****QUESTIONSHEET 11**

- (a) X = methane/ $\text{CH}_4$ ;  
Y = carbon dioxide/ $\text{CO}_2$ ; **2**
- (b) (i) used as fuel/ref. to biogas; **1**
- (ii) methane/carbon dioxide are (soluble) greenhouse gases/leaching may pollute aquifers/  
underground water supplies/risk of explosion; **1**
- (c) bacteria break down/digest/decompose the organic matter;  
can be anaerobic;  
ref. to fermentation;  
methane and carbon dioxide produced (in ratio 60:40); **max 3**

**TOTAL 7**

**QUESTIONSHEET 12**

- (a) (average) temperature;  
total rainfall;  
rainfall pattern;  
form of precipitation/rain/snow/hail;  
length of growing season;  
frost; **max 3**
- (b) industrial revolution/increased industrial/human activity/transport;  
increased burning of fossil fuels/increased release of CO<sub>2</sub>;  
leads to faster rates of photosynthesis; **max 2**
- (c) increased sunlight/moisture leads to increased plant growth;  
greater range of temperatures reduces species diversity/makes habitat more hostile;  
decreased moisture reducing growth/number/diversity of species;  
ref. to increased risk of frost damage to plants;  
reduced organic matter/litter input causes reduced nutrients;  
increased soil erosion due to wind/water run-off; **max 4**
- TOTAL 9**
- 

**QUESTIONSHEET 13**

- (a) loss/damage to biological/agricultural potential of land;  
loss of productivity; **2**
- (b) increasing/high population;  
increasing/high demand for fuel/wood;  
increasing/high livestock populations/demand for fodder/overgrazing;  
lack of rainfall/lowering of ground water levels/water table;  
inappropriate irrigation causing salinisation/salt accumulation;  
lack of tenure/ownership/over cultivation/over use of cash crops without use of dung/fertilisers; **max 4**
- (c) fall in water levels/water table;  
leads to loss of vegetation;  
leads to further fall in water table/less evapotranspiration/transpiration;  
less rainfall; **max 3**
- TOTAL 9**

**QUESTIONSHEET 14**

- (a) ref. to mechanical/industrialisation; (these points should be awarded in the context that United States has/uses  
 use of appliances; more than Bangladesh/Japan).  
 use of vehicles;  
 use of artificial fertilisers;  
 levels of consumption; **max 3**
- (b) (i) shortens food chain:  
 since energy is lost at each stage;  
 shorter chain is more energy efficient;  
 only eat producers (so no energy lost to herbivores); **max 3**
- (ii) legumes contain nitrogen-fixing bacteria in root nodules;  
 legumes can be ploughed into soil reducing need for nitrogenous fertilisers;  
 which require fossil fuels in their production; **max 2**

**TOTAL 8****QUESTIONSHEET 15**

- (a) increased burning of fossil fuels/coal/oil;  
 oxidises carbon forming CO<sub>2</sub>;  
 increased deforestation;  
 thus less CO<sub>2</sub> used in photosynthesis;  
 oceanic pollution reduces phytoplankton levels;  
 decreased oceanic storage as temperature increases;  
 solubility of CO<sub>2</sub> in water decreases as temperature rises **max 5**
- (b) Any two of:  
 methane/any nitrogen oxide/CFC/water vapour;; **2**

**TOTAL 7****QUESTIONSHEET 16**

- (a) the number. variety/variability of types/species of living organisms;  
 within a population/community/ecosystem;  
 reference to/quantified reference/species and ecosystem diversity index/Lincoln index; **max 2**
- (b) ethical reasons;  
 economic benefits/drugs/food sources;  
 maintain evolutionary processes/potential;  
 aesthetic reasons; **max 3**
- (c) organisms may be unable to adapt with sufficient speed to changes in temperature/rainfall/water availability;  
 may die out and interrupt a food chain/knock on effect;  
 sea level rise will cause flooding/habitat destruction; **max 2**

**TOTAL 7**

**QUESTIONSHEET 17**

- a) don't involve mining/drilling;  
 CO<sub>2</sub> released on combustion compensated by CO<sub>2</sub> absorbed during photosynthesis;  
 low sulphur content therefore little impact on acid rain;  
 can be produced rapidly/locally/on variety of scales/using waste land;  
 visually unobtrusive;  
 can use wastes/ash to restore minerals to soil; **max 4**
- (b) Advantage: uses wastes/cheap/easy to scale up/down;  
 Disadvantage: energy used/pollution created during distillation/land area used for non-food crops; **2**

**TOTAL 6****QUESTIONSHEET 18**

- (a) amount of oxygen required/used by living organisms in water;  
 measured at 20 °C over 5 days/ref to use of methylene blue;  
 kept in the dark for 5 days; **max 2**
- (b) treatment involves breakdown/digestion/oxidation of organic matter/waste;  
 (thus) treated sewage contains much less food/substrate;  
 for aerobic decomposition/bacteria;  
 (thus) fewer bacteria (using oxygen) in treated sewage; **max 3**
- (c) bacteria will breakdown/feed on/digest organic material;  
 consuming oxygen as they do so;  
 death of aerobes/reduction of species/species diversity; **max 2**

**TOTAL 7****QUESTIONSHEET 19**

- (a) (i) -28.3 °C; (allow -28.0 - -28.5 °C) **1**
- (ii) -9 °C; (allow -8.9 - -9.1 °C) **1**
- (b) death of shoot occurs at higher temperatures after exposure to acid mist/sulphuric acid and ammonium nitrate ;  
 ref. to economic cost/loss of productivity;  
 visible signs of acid rain damage may take months/years to become apparent; **max 2**
- (c) release of acidic gases from industry/exhausts;  
 sulphur and nitrogen oxides;  
 dissolve in rain/mist droplets form dilute acid; **max 2**

**TOTAL 6**



**QUESTIONSHEET 20**

- (a) gas/CO<sub>2</sub>/CH<sub>4</sub> released from decomposition/fermentation;  
of organic material; 2
- (b) Far East city;  
greatest vegetable/organic content; 2
- (c) (i) bacteria require organic waste for growth;  
but can only digest waste materials/cause decay in the presence of water;  
since enzymes/nutrients/products need to be dissolved; **max 2**
- (ii) would increase leaching volume/contaminate aquifers/waterways;  
possible eutrophication; 2
- TOTAL 8**
- 

**QUESTIONSHEET 21**

- (a) (i) loss of bank stability/increased erosion due to activity of coypu/burrowing;  
nutrients released from soil/vegetation;  
increased growing of reeds/vegetation; **max 2**
- (ii) leaching of nitrates/nitrogenous fertilisers;  
wind blow/run-off of phosphate fertilisers;  
ref to artificial/natural manure; **max 2**
- (b) phosphate less soluble/does not leach as quickly;  
transport into waterways by soil erosion therefore slower;  
phosphate removal harder at sewage treatment works; **max 2**
- TOTAL 6**