

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 (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) $\text{Var 1} = \frac{25-15}{15} \times 100; = 0.67\%$;
- $\text{Var 2} = \frac{16-14}{14} \times 100; = 0.14\%$; **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/ NO_3^- ;
phosphate/ 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/ CH_4 ;
Y = carbon dioxide/ 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 CO₂;
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**
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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**
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QUESTIONSHEET 15

- (a) increased burning of fossil fuels/coal/oil;
 oxidises carbon forming CO₂;
 increased deforestation;
 thus less CO₂ used in photosynthesis;
 oceanic pollution reduces phytoplankton levels;
 decreased oceanic storage as temperature increases;
 solubility of CO₂ 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;
 CO₂ released on combustion compensated by CO₂ 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/CO₂/CH₄ 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**
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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**