CAMBRIDGE INTERNATIONAL AS & A LEVEL BIOLOGY · 9700

BIOLOGY



MARK SCHEME

18 CLASSIFICATION, BIODIVERSITY AND CONSERVATION

SCORE	PERCENTAGE
/	%

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Paper 1 Multiple Choice Answers: Classification, Biodiversity and Cons

Question	Paper	Q. No.	Answer
1617	9700_s15_qp_11	39	A
1618	9700_s15_qp_11	40	D
1619	9700_w15_qp_11	38	C
1620	9700_s15_qp_11	38	D

244. 9700_s15_ms_22 Q: 6

(a) (i) (a) habitat ;
(a) population ;
producers / organisms ; **[3]**

(ii) (a) niche ;
(an) ecosystem ; **[2]**

(b) (i) *energy losses from*

1 reflection (from leaf surface) ;
2 idea that some light, passes through (leaf) / misses chloroplasts / strikes non-photosynthetic tissue ;
A suggestion that cell walls may not allow all of light through
3 heating plant ; **I** lost as heat to surroundings **A** converted to heat
4 evaporation ; **A** transpiration
5 not all light (reaching chlorophyll) is, the right wavelength (for photosynthesis) / AW / absorbed by chlorophyll ;
A idea that only a proportion of light energy is useable
A absorbed and, lost as phosphorescence / lost as luminescence / re-emitted
6 ref. to photosynthetic process inefficient ; **A** loss of heat energy during photosynthesis
7,8 AVP ;; e.g. ref. to photorespiration
ref. to factors that limit photosynthesis **[max 3]**

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(ii) **1** increased production of / more, biomass / plant matter / named (e.g. carbohydrate / cellulose / starch / oils) **;** **R** more plants **I** more crop **I** food
2 (so) more energy / more energy stores **;**
A more chemical energy produced
A higher energy
A suggestion that high PE crop may be more energy dense
3 more crop / greater yield, per unit, area / volume / time **;** **A** each year
4 idea of (comparatively) less space required (for growing) **;**
5 ref. to supplying increasing demand for, food / fuel **;**
6 more, profit (for farmers) / economic / AW **;** **I** cheaper
7 AVP **;** e.g. efficient use of carbon dioxide **[max 2]**

(iii) *credit all valid answers – this list is not exhaustive*

e.g. compound	**e.g. function of compound**
amino acids	production of proteins (for cell growth)**;** **A** provide energy / for respiration
proteins	cell division / mitosis / increase in cell number / increase in, biomass or yield / (cell) membranes **;** **A** reproduction **A** cell cycle **A** (tissue) repair **A** provide energy / for respiration
enzymes	synthesis of, macromolecules or organic molecules / anabolic reactions / for photosynthesis / for respiration **;** **[max 2]** **A** named molecules e.g. carbohydrates / amino acids / proteins / lipids / nucleic acids
(organic / nitrogenous) bases	component / synthesis of, nucleotides component of, DNA / RNA / nucleic acids **;**
nucleotides	component / synthesis of, DNA / RNA **;**
DNA	ref. genes / genetic material / coded information / genetic information, (for protein synthesis) **;**
RNA	ref. transcription / translation / protein synthesis **;**
(some) phospholipids	(for cell) membranes **;** **R** lipids
ATP	synthesis / anabolic reactions / active transport / translocation / described **;** **A** provide energy for reactions
chlorophyll	photosynthesis / light (dependent) stage **;**
NADP	(in) photosynthesis / light (dependent) stage **;**
NAD	(involved in) respiration **;**
FAD	(involved in) respiration **;**
auxin	growth hormone / cell elongation / cell division **;**
cytokinin	growth hormone / root growth **;**

[Total: 12]

245. 9700_s15_ms_23 Q: 6

(a) (i) nitrification ; [1]

(ii) by bacteria ;
denitrification / reduction;
ref. anaerobic conditions ; **A** ref. to waterlogging [max 2]

(b) (i) *idea of* (unit made up of) biotic and abiotic, components ; AW
further detail ; interacting / functioning together ;
A *idea of* self-sustaining unit [2]

(ii) carries out photosynthesis / converts light (energy) to chemical energy ;
A (photo)autotrophic
synthesises (complex) organic compounds from inorganic, compounds;
(occupies) lowest / first trophic level ; **A** acts as a producer [max 1]

(iii) place where an organism lives ; **A** population / species / community [1]

[Total: 7]

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Q1.

2 (a) (i) (primary) producers / autotrophs; **1**

(ii) population; **1**

(iii) community; **1**

(iv) ecosystem; **1**

(v) primary consumers; **R** first consumers **1**

(b) place / area / space where an organism lives;
example of a habitat from passage (desert / woodland / coral reef);
example of a physical / biotic condition in habitat given; **2 max**

(c) small leaves / needles / needle-like leaves;
R 'spines' / thorns / narrow / fewer leaves
reduce / small surface area;
temporary / shed leaves;
leaves dry out and then rehydrate;
fleshy leaves / succulent leaves / leaves with hypodermis;
curled / rolled, leaves; **R** curved / folded / coiled
(very) thick / waxy / impermeable, cuticle;
stomata surrounded by hairs / hairy leaves / hairs trap moisture;
sunken stomata / stomata in pits / crypts / grooves;
R inverted / few stomata
stomata closed during the day / stomata open at night;

***max 2** for features given above*

(so) reduces / slows down (rate of) transpiration / water loss / evaporation / diffusion of water vapour;
R prevents / avoids water loss
N.B. link to one valid feature above **3 max**

[Total: 10]

Q2.

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Question	Expected Answers	Marks
5 (a)	1 mark for working 86.5/809 x 100 (= 10.69); **A** 42 + 42 + 2.5/400 + 409 x 100 **R** 42/400 x 100 = 10.5 = 11 1 mark for correct answer 11%; **R** 10.7/other units if specified	**[2]**
(b)	Energy losses in respiration; **R** used up in/needed in respiration, energy lost in movement waste/urine/faeces/dead parts/excreta/excretion; primary consumers do not eat all the plant matter; **A** for secondary consumers not all parts of, plants/primary consumers, are digestible; energy losses as heat qualified e.g. in digestive system (of consumers)/to environment/atmosphere/surroundings; plants/primary consumers, migrate/swept away, by tide/waves AW; energy losses to decomposers;	**[max 4]**
(c)	proteins → amino acids; **A** proteins are decayed into amino acids deamination; ammonification/ammonia/ammonium ion; ammonia/ammonium ions, to nitrate; **A** nitrification oxidation;	**[max 2]**
		[Total: 8]

Q3.

5 (a) (bacterial urease converts) urea → ammonia;

ammonia → nitrite;
Nitrosomonas;
nitrite → to nitrate;
Nitrobacter;

nitrification;
oxidation / chemosynthesis; **[max 3]**

Q4.

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6 (a) (i) *any **two** of the following for one mark*

amphipods
shrimps
Arctic cod
little auk ; [1]

(ii) some animals feed at different (trophic) levels / animals do not obtain all their food from one (trophic) level ; **A** correct reference to at least two consumer levels
animals may feed on different (trophic) levels at different, times / seasons ;
some food chains, do not start from primary producers / start from decomposing matter ;

named examples from food web ; [2]

(b) proportion of, phytoplankton / copepods, that is digested / some remains undigested ;
phytoplankton have cell walls ;
proportion that is absorbed after digestion ;
loss in, egestion / faeces ; } *in terms of energy loss or energy availability*
loss in, excretion ;
loss in, respiration / heat (by copepods) ;
energy losses in movement / AW ;
AVP ; e.g. denser phytoplankton means less energy loss in feeding [2 max]

[Total: 5]

Q5.

2 (a) habitat ;
all the organisms / plants and animals / populations / AW, in the ecosystem / forest / place / area / habitat ;
niche ;
population ; [4]

(b) (i) primary consumer / herbivore ; [1]

(ii) (sloth) cannot digest, cellulose / cell wall (in leaves), itself ;
R cannot digest leaves **R** allows sloth to digest cellulose
able to, absorb / use, products / sugars, from, cellulose / cell wall, digestion ;
provide, vitamins / minerals ;
ref to, protein / nitrogen, recycling ;
idea of protection from gut, pathogens / parasites ; [1 max]

(iii) predators are, secondary consumers / tertiary consumers / top carnivores ;
(population, size / number of) predators limited by numbers of prey / sloths / AW ;
energy loss, between trophic levels / along food chain / inefficient energy transfer ;
detail e.g. only 10% transfer / respiration / heat / movement / excretion / inedible parts / egestion / to decomposers;
(prey numbers small so) competition for, food / prey ;
predators hunted by humans ;
habitats / areas, of predators destroyed ; [3 max]

[Total: 9]

Q6.

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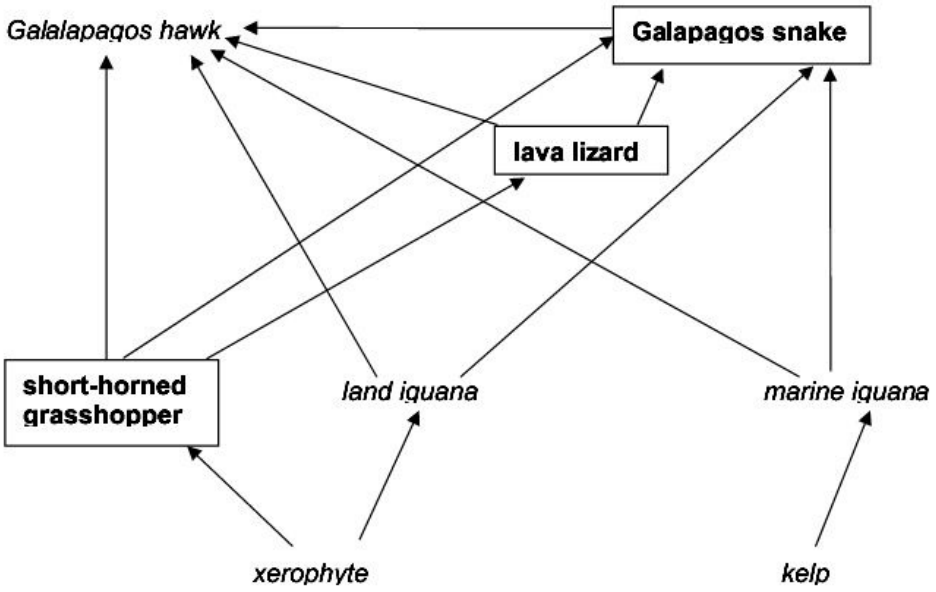
6 (a) **H** nitrogen fixation ;
J nitrification / oxidation ;
K denitrification / reduction ; [3]

(b) provide source of, fixed nitrogen / usable nitrogen / organic nitrogen / amino acids / ammonia / ammonium ions / AW ; **R** nitrate
ref. to protein production in legume ;
legume can, colonise / grow in, nitrogen / nitrate, deficient *or* poor soils ;
A not dependent on nitrate in soil
compete successfully with non-leguminous plants ; [2 max]

[Total: 5]

Q7.

6 (a)



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animals in correct boxes ;
all five animals to hawk ;
all animals except hawk to snake ;

(only) short-horned grasshopper to lava lizard
xerophyte to short-horned grasshopper and land iguana } ;
kelp to marine iguana

max 3 if all correct but one arrow head missing
max 2 if arrow heads, mixed in incorrect direction/missing [4]

(b) kelp and xerophytes ; *allow ecf for next two mps if only one organism*
both, photosynthetic/autotrophic/fix carbon/AW ; **A** both have chlorophyll
both are, at the start of the food web/at the first trophic level/the source of energy to rest of food web/AW ; [3]

[Total: 7]

Q8.

5 **(a)** conversion of/AW, nitrogen (gas)/N_2 ; *in context of atmospheric nitrogen*
(to) ammonium (ions/compounds)/NH_4^+/amino acids ;

further detail ; e.g. nitrogenase (enzyme)/ref. conversion from unreactive (nitrogen) to reactive (compound)/reduction of nitrogen/ATP required/anaerobic conditions required for enzyme function [3]

(b) **(i)** ammonification/putrefaction/decomposition/decay ; [1]

(ii) supplies, ammonia/ammonium ions, for, nitrifying bacteria/nitrification ;
ammonia/ammonium ions, converted/oxidised/AW ;
to nitrite ;
to nitrate ;
Nitrosomonas/*Nitrobacter* ; *in correct context*
ref. nitrate useable form for plants ; [2 max]

Q9.

2 **(a)** **(i)** *habitat* = **B** } ;
ecosystem = **A**

abiotic component = **C** ;

ecological niche = **F** ;

population = **E** } ;
community = **D** [max 4]

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(b) *seaweed* = (primary) producer ; **A** first (trophic level)

limpet / P. vulgata	*crab / C. maenas*	
primary consumer	secondary consumer	;
A 1° consumer	**A** 2° consumer	
A second (trophic level)	**A** third (trophic level)	

max 3 for energy losses

energy losses in
respiration ;
heat loss, qualified ; e.g. heat loss, from digestion / movement / metabolism
heat loss in respiration = 1 mark
indigestible parts ; **A** named, e.g. cellulose
inedible parts ;
excretion ; **A** named excretory products
egestion ; **I** waste
death, not eaten ; [max 4]

[Total: 8]

Q10.

6 **(a)** **(i)** denitrification ; [1]

(ii) nitrate required for, amino acid / protein / nucleic acid, production in plants ;
A other relevant named N-containing biochemicals
nitrogen (gas) not useable form for (most) plants ;

removal of nitrate
slows / AW, growth of plants ; **A** reduces crop yield **A** plants need nitrates for growth
decreases fertility of soil / fertilisers need to be added to soil ; [2]

(b) **(i)** nitrification ; [1]

(ii) *P. stutzeri* / bacteria, can be (added to the water and) used to, remove nitrate / carry out denitrification ;
detail ; e.g. use of filter bed
ref. to leave for sufficient time to remove nitrates
nitrogen escapes to air [2]

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(c) 1 air / oxygen, will not get into soil ;
2 lack of oxygen reduces uptake of ions by plants / AW ;
3 ref. saprobiotic bacteria and fungi / nitrifying bacteria / (some) nitrogen fixing bacteria, are aerobic ;
4 ref. reduced populations (of bacteria in mp 2) ;
5 example of effect on nitrogen cycle ;;
6 e.g. slower rate / AW, of decomposition / decay
nitrogen fixation cannot occur (as rapidly)
nitrification cannot occur / nitrate will not be produced / less nitrate produced
(more) denitrification will occur
7 crops / plants, will use up remaining nitrate ;
8 ref. leaching of, nitrates / other nutrients, for growth or (only) low levels of nitrates / other nutrients, for growth remain in soil ; **A** ref. leaching reducing soil fertility
9 AVP ; e.g. named example of another nutrient, with role
will take time to, recover nitrate levels / resume nitrogen fixation ;
fertilisers (previously) applied washed away ; [max 4]

[Total: 10]

Q11.

5 **(a)** *ignore **Y***
X = mitosis ;
Y = meiosis / mitosis [1]

(b) 1 chromosome number is halved / 2n → n / diploid → haploid ;
A 2 sets of chromosomes → 1 set of chromosomes

explanation to max 1
2 restore diploid number on fusion ; **R** restore full set if not qualified
3 avoids number doubling with each generation ;
4 allows expression of (recessive) alleles / AW ;
5 allows variation / new combinations of chromosomes ; [2]

(c) *if only use formulae, these must be correct – otherwise ignore*

1 nitrification / nitrifying / oxidation ;
2 ammonium ions to nitrite ions ;
3 nitrite ions to nitrate ions ; **A** one mark for ammonium to nitrate
4 *one named microorganism in correct context*
Nitrosomonas / Nitrobacter ; **R** *Rhizobium*
5 ammonium / nitrate / AW, absorbed by plants / leached / AW ;
R used by plant [max 3]

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(d) **1** ammonium ions are (positively) charged ; **A** hydrophilic / polar / water-soluble
2 cannot pass through, phospholipid bilayer / membrane ;

either
3 active transport ;
4 moved against concentration gradient ;
or
3 facilitated diffusion ;
4 moves down its concentration gradient ; [max 2]

[Total: 8]

Q12.

6 **(a)** **G** ;
A ;
B ;
F ; [4]

(b) *do not accept list ATP, DNA, RNA, phospholipid as these must be qualified*

1 idea of, increase in cell numbers / more cells ; **A** ref. to mitosis / cell division
2 ATP, qualified ; e.g. for, cell growth / anabolic reactions
3 (activated) nucleotides for, DNA / RNA, synthesis ;
4 phospholipid for membranes ;
5 DNA replication (for cell division) ;
6 RNA for, protein synthesis / AW ;
7 AVP ; e.g. activate glucose for glycolysis
ref. NADP, light-dependent reaction [max 3]

[Total: 7]

Q13.

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6 (a) (i) *max 3 if no reference to examples in passage*

habitat
location / place / area *or* (type of) local / AW, environment ;
characterised by, its physical features / the freshwater environment / its dominant producers;
where, an organism / a population, lives ;

commmunity
all populations of all species / AW ;
within a specified area / AW, at a particular time ; [max 4]

(ii) phytoplankton ; [1]

(iii) *accept plants for phytoplankton*

1 photosynthetic / carry out, photosynthesis / carbon fixation ; **A** autotrophic
2 conversion of light energy to chemical energy ;
3 equation ;
4 have light-absorbing pigments ; **A** chlorophyll
5 ref. to independence *or* dependence of other organisms ; *in context of energy*
6 ref. to input of energy to ecosystem ;
7 base of the food chain(s) / first trophic level / AW ; **A** consumed by, herbivores / primary consumers [max 3]

(b) (i) *energy losses*
in, egestion / faeces / undigested material ;
in excretion ; **A** urine / urea
heat from respiration ;

energy other uses
ref. maintenance ;; e.g active transport / metabolic reactions / digestion
for, muscle contraction / movement ; [max 3]

(ii) *any one valid suggestion e.g.*
more confined space so less movement ;
move more so greater energy loss (through respiration / as heat) ;
more predators so use more energy escaping from them ; [max 1]

[Total: 12]

Q14.

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3 (a) (i) **A =** denitrification / reduction ;
B = nitrogen fixation / lightning ;
C = nitrification / oxidation [3]

(ii) decomposition / decay ;
A reference to decomposers
saprotrophs / bacteria / fungi ;
A detritivores
digest / breakdown / hydrolyse, organic nitrogen / protein / amino acids / urea ;
protease / urease ;
deamination ;
production of ammonium (ions) / ammonification ;
nitrification / ammonium (ions) to nitrate (ions) ;

accept correct formulae for ammonium ions, nitrite ions and nitrate ions [max 3]

(b) (i) *phosphate*
any one relevant ;
e.g. part of structure of
AMP / ADP / ATP
nucleotide
nucleic acid / DNA / RNA / polynucleotide
phospholipid
A phospholipid bilayer
phosphorylation / enzyme activation
bone tissue

nitrate
any one relevant ;
e.g. (nitrogen for) amino acids / proteins / enzymes / named (e.g. haemoglobin)
AMP / ADP / ATP
nucleotide
nucleic acid / DNA / RNA / polynucleotide named nitrogen base (adenine / cytosine / thymine / uracil / guanine)
(some) phospholipids [2]

(ii) 1 growth linked to, increase in cell size / cell number ;
2 growth linked to, increase in biomass / reproduction ;
3 increases energy available as food for next trophic level ;
4 nitrogen is in, amino acids / proteins, for growth ;
5 ATP (containing phosphate) required for, transcription / protein synthesis / enzyme synthesis / anabolic reactions / growth ;
6 *idea that*, growth of cells / cell division, requires membrane synthesis ;
7 nitrogen in membrane proteins / phosphate in membrane phospholipids ;
8 (cell division and), DNA, synthesis / replication ;
9 *idea that* more biomass (per unit time) returned to soil ;
10 AVP ; e.g. ref. to phosphate taken up by plants and passed into food chain ; [max 3]

[Total: 11]

Q15.

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2 (a) 14 147; **1**

(b) 3.74%; **1**

(c) more energy available at lower trophic levels / less energy available at higher levels / energy lost between trophic levels;
any two figs from fig. 3.1 to qualify above statement (comparison req, no units needed);
therefore can sustain a larger population;
greater variety of food / not have to rely on one food source;
less chance of starvation / more chance of survival / less competition for food;
may feed on detritus / dead organisms / waste materials (dead leaves, faeces, urine); **max 2**

(d) breakdown / decay / feed on / digest / secrete hydrolytic enzymes onto, organic molecules / dead plant / animal / excreted / egested, material; R. decomposing
starch / cellulose, to sugars;
respire;
release carbon dioxide;
protein to amino acids;
deamination (of amino acids);
(release) ammonia (NH_3) / ammonium ions (NH_4^+) / ammonium compounds / ammonification;
(becomes available for) nitrification / ammonia -> nitrite -> nitrate / ammonia -> nitrates / ammonium -> nitrates;
R. nitrifying / named bacteria unqualified / ammonia -> nitrite
max 4

[Total 8]

Q16.

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3 (a) ***calcium***

bone/teeth, formation/strengthening; **R** calcium in bone

R calcium for healthy bones and teeth

enamel/shell, formation/strengthening;

reference to muscle/nerve/synapse, function e.g. muscle contraction, generation of nerve impulse;

blood clotting;

calcium pectate, in cell wall/middle lamella;

spindle formation;

for fertilisation/fusion of egg and sperm;

iron

forms part of, haem/haemoglobin/myoglobin; **A** transport of oxygen in haemoglobin
A forms prosthetic group of haemoglobin

reference cytochrome(s)/electron carrier(s);

important in chlorophyll synthesis;

prosthetic group of some/named, enzymes/catalase;

potassium

activates enzymes;

cofactor in, photosynthesis/glycolysis;

reference to nerve/muscle, function e.g. conduction of nerve impulse, muscle contraction;

maintains osmotic balance/water potential of cells;

stomatal, opening/closure/turgidity of guard cells;

reference to Na^+/K^+ pump mechanism - qualified; **3**

(b) (i) L - urea; **A** ammonia/creatinine/uric acid/NH_3 **R** NH_4

M - nitrite (ions); **A** NO_2^- **R** NO_2 **2**

(ii) nitrification; **A** oxidation/chemosynthesis **1**

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(c) (i) 15 mg/20 hours; **A** 55-40/60-40, 55-40/20, 15/60-40

0.75 (mg h^{-1}); **2**

(ii) ions/minerals/nitrates in batch P are absorbed (only) by diffusion; } } **A**

no/limited/less, energy for active absorption/transport; } converse } for

because (cyanide) inhibits, respiration (must be linked to explanation)/ATP synthesis; } batch N }

ions in batch N are absorbed by active transport (and diffusion);

(idea of) after 10 hours no concentration gradient in P;

as rate of assimilation/use = rate of absorption (so concentration in plant remains constant);

active transport continues in N against a concentration gradient (after 10 hours);

reference to appropriate figs (linked to an explanation of different absorption rates);

4 max

(iii) no ions in distilled water; **R** low ions

concentration gradient out of the roots;

ions lost by diffusion;

ions, used in amination/amino acid synthesis/protein synthesis;

A ions assimilated **R** used/utilised **2 max**

[Total 14]

Q17.

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1 **(a)** **H;**
C;
G;
B; **[4]**
R multiple answers.

(b) *oxygen to max 3*

from, air/atmosphere, into pneumatophores/breathing roots;
A roots suitably qualified.
diffusion, down concentration gradient/from high concentration to low concentration;
through/between, cells;
air spaces between cells;

water to max 3

osmosis;
from soil/mud into, root hair/epidermal cell/epidermis;
down water potential gradient/from high water potential to low water potential;
A into lower water potential/more negative water potential
root cell (vacuoles) have, salts/solutes/ions/minerals, to lower water potential/lower solute potential; **[5]**

[Total: 9]

Q18.

2 **(a)** nucleus/nuclear membrane/nuclear envelope/nucleolus;
ER/SER/RER;
Golgi (body/apparatus)/lysosomes;
larger ribosomes/80S ribosomes;
linear DNA/chromosomes/protein + DNA (in chromosomes);
mitochondrion/mitochondria;
cell wall made of cellulose; **R** cell wall unqualified
microtubules; **A** spindle fibres/centriole
large vacuole/tonoplast;
plasmodesmata; **[max 3]**

(b) high(er) resolution;
because of shorter wavelength;
more detail can be seen/much clearer, at the same magnification/can see two points that are close together/quote appropriate figs;
can see cell structures, that are not visible in the LM/
A e.g. ribosomes/membranes;
can see detail of structures just visible in LM with e.g.
A mitochondrion/chloroplast; **[max 2]**

(c) nitrogen fixation; **A** fixes nitrogen
converts nitrogen to ammonia; **A** NH_3/NH_4^+
further detail; e.g. nitrogenase/anaerobic conditions/ATP needed/H^+ needed
ammonia converted to amino acid(s);
(amino acids) exported to cells of legume;
in return for carbohydrate/sugars/sucrose/glucose/fructose;
symbiosis/mutualism;
helps legume survive in areas with low, N/nitrates;
A competitive advantage **[max 3]**

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(d) they have the same/similar function, to combine with oxygen;
idea of similar/same, primary sequence/sequence of amino acids;
idea of same/similar, tertiary structure/3D shape; **A** quaternary

common ancestry/both are eukaryotes,because they share some of the same genes; **[max 2]**

[Total: 10]

Q19.

6 **(a)** *definition of ecosystem*

community (of organisms) ;
physical / abiotic, factors / environment ;
ref to interaction between organisms ;
ref to interaction between organisms and physical environment ;
ref to 'self-contained' / delimited by some physical feature ;
use of named example to illustrate one above point ; [3 max]

(b) these (fierce) animals are, at the top of food chain / last in food chain ;
secondary / tertiary, consumer / top carnivores ;
ref to energy loss along food chains / energy lost between trophic levels / insufficient energy transfer ;
further detail, e.g. little energy trapped by (primary) producers / only 10% transfer / loss in, respiration / decomposition ;
large animals, require much energy / find it difficult to obtain sufficient energy ;
need large habitat to provide sufficient food ;
ref to fierce and maintaining territories ;
AVP ; e.g. hunting / competition [3 max]

(c) (legumes have) *Rhizobium* ;
in their root nodules ;
carry out nitrogen fixation ;
(legumes) not dependent on nitrate ions from soil ;
nitrogen / ammonium / nitrate, required for making, amino acids / proteins ;
ref to growth / reproduction ;
AVP ; e.g. have mycorrhiza [3 max]

Q20.

6 **B** 3
C 4
D 9
E 6
F 2 [5]

[Total: 5]

Q21.

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6 **(a)** 'self contained' / 'self-sustaining' / determined by same physical feature / defined area ;

community / all organisms / biotic factors, **and**, physical factors / abiotic factors / non-living factors / environment ;

ref. to interaction between, organisms (and physical environment) ; [2 max]

(b) *award two marks for the correct answer (5.5%)*
if no answer or incorrect answer or answer to too many decimal places, award one mark for working (88 / 1609)
88 / 1609 (× 100)
5.5 (%) ;; [2]

(c) *these are points for producers to primary consumers – accept ora for secondary consumers to tertiary consumers*
1 some parts inedible ;
2 indigestible / cannot digest cellulose or lignin ;
3 more material goes to decomposers (rather than consumers) ;
4 plant material is less energy rich / animal flesh is more energy rich ;
5 manipulated data in support ; e.g. ×2 to decomposers from producers
0.8% (energy available to primary consumers divided by the energy available to plants)
[3 max]

(d) *decomposers in recycling nitrogen*
protein → ammonia / ammonium ions = 1 mark
1 convert protein → amino acids ;
2 deamination ;
3 urea / amino acids → ammonia / ammonium ions ; **A** ammonification
4 make, ammonia / ammonium ions, available to nitrifying bacteria ;
A role of nitrifying bacteria / correctly named [2 max]

[Total: 9]

Q22.

6 **(a)** *community*

all populations / all organisms / all plants + animals (+ microorganisms) ;
R all the species

in same, place / ecosystem / area / (common) habitat, (at same time) ; [2 max]

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(b) (i) *award two marks for the correct answer (4.5%)*

if no answer or incorrect answer or answer to too many decimal places, award one mark for working (2946/65 800 × 100)

2946 / 65 800 (× 100)

4.5 (%) ;; [2 max]

(ii) energy available (from secondary consumers) is too small ; **R** no energy
2 kJ m^{-2} (per week) ; [2]

(iii) decomposers are, saprophytes / saprotrophs / saprobionts / bacteria / fungi ;

plant matter provides little, protein / AW ; ora **A** high carbon / low nitrogen
plant matter / cellulose / lignin, not easy to decompose ;
ref. to organic matter / energy source, in plants not easy to obtain ;
supply of nitrogen is, limiting factor / limits growth of decomposers ;
(animal waste) protein / amino acids / urea, provides nitrogen ;
(animal wastes) provide materials for growth of, decomposers ;
further detail e.g. amino acids for proteins / membrane proteins / (hydrolytic) enzymes / other named protein(s) / nucleotides / nucleic acids ;

more decomposers leads to faster decomposition (hence more energy flow) ; [3 max]

[Total: 9]

Q23.

1 (a) community ;
niche ; **A** role
second trophic level / first level consumers / primary consumer level ;
A *other appropriate terms* [3]

(b) *loss (of energy-containing food in producers or in grazers) in*
indigestible parts / not being absorbed / faeces / egestion ;;
one mark for producer, one mark for grazer

excretion (in, grazers / herbivores / primary consumers) ;
respiration (in, grazers / herbivores / primary consumers) ;
loss of energy in movement / AW (in, grazers / herbivores / primary consumers);
AVP ; e.g. heat energy [max 2]

[Total: 5]

Q24.

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5 **(a)** glycogen ; [1]

(b) xerophyte / xerophyllic ; **A** phonetic e.g. zerophyte [1]

(c) haploid (cell) ; **A** monoploid [1]

(d) (primary) producer ; **R** first ***ignore*** autotrophic [1]

(e) (nitrogen) fixation ; **A** nitrogen fixing bacteria [1]

[Total: 5]

Q25.

6 **(a)** **(i)** (for) chlorophyll (structure / synthesis) ;
(for) ATP functioning ;
(for) enzyme functioning / enzyme cofactor ;
signalling ion / regulates carbon fixation ;
(for) DNA / RNA, synthesis ;
stabilises, DNA / RNA, structure ; **A** required in translation
(matrix of) bone ; [max 1]

(ii) mutualistic association / AW ; **A** ref. to mycorrhiza
qualified; e.g. further detail of relationship, named nutrients

arrow from plant to fungi
ref. (some) fungi are, parasitic / pathogenic (on plants) ; **A** pathogens
leakage (from plants) of assimilates ;

arrow from fungi to plant
plants absorb nutrients, excreted by fungi / from decomposition by fungi ; [2]

(b) **(i)** 5th / 6th ; **A** top carnivore [1]

(ii) idea of little energy available, at / towards, top / end, of food chain ;
too few organisms in level below ;
expend much energy catching animals in trophic level below ;
to obtain, a wider range of / varied, nutrients ;
reduced competition ; [max 2]

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(c) (i) *community*
all, populations of all species / organisms, living in a particular area, at one time / AW ; (1)

habitat
place / location / environment / AW, where, a population / an organism, lives ; **A** community (1) [2]

(ii) soil is source of nutrients for, plants / producers ;
plants / producers, provide energy for ecosystems ;
ref. recycling nutrients (by soil organisms) ;
ref. to importance of, carbon / nitrogen, in, organic / complex molecules ;
AVP ; e.g. detail of nutrient cycling, maintains balance of nitrogen in air [max 3]

[Total: 11]

Q26.

3 (a) (i) active, transport / uptake ;

max 2
movement, against the concentration gradient / from low to high concentration ; **A** diffusion gradient
requires energy (from ATP) ;
specificity / specific binding site ; **A** complementary shape
conformational change / change in 3-D shape ; **A** ref. to, 'flip-flop' / 'kissing gate' mechanism [max 3]

(ii) (70S) ribosomes ; *ignore size* [1]

(iii) ammonia / ammonium / ammonium ions ; **A** NH_3 / NH_4^+ [1]

(b) (i) *two marks for correct answer*
35(%) ;;

1 mark if correct working but not to whole number
90 / 255 × 100 = 35.29 / 35.3 [2]

(ii) idea that nitrogen removed is replaced by nitrogen added ;
denitrification / denitrifying bacteria ; **A** named bacteria e.g. *Pseudomonas aeruginosa* / *Thiobacillus denitrificans*
convert / AW, nitrate / nitrite (to nitrogen gas) ;
AVP ; e.g. occurs, when oxygen depleted / waterlogged soils
volcanic action adds nitrogen [max 2]

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(c) **1** increase / maintain, nitrogen content of soil ; **A** add, ammonium / nitrates, to soil
2 increase / maintain, soil fertility ;
3 uptake / absorption, of, ammonium ions / nitrates /fixed nitrogen (by plants) ;
4 (plants use) for, amino acid / protein, production ;
5 increased, growth / yield, of (crop) plants ;
6 ref. feeding, livestock / human populations ;
7 reduced need for fertilisers ;
8 example of environmental benefit of reduced fertilisers ;
9 cost saving from reduced use of fertilisers ;
10 qualified ref. to, *Rhizobium* / legumes ; [max 3]

[Total: 12]

Q27.

6 **(a)** **(i)** population ; [1]

(ii) ecosystem ; [1]

(iii) denitrification ; [1]

(b) **(i)** *if more than one answer – take first answer only*

secondary consumer ; **A** second consumer / 2° consumer
A third trophic level **R** carnivore [1]

(ii) *do not award marks unless it is clear there are energy losses in the crabs (not the mangrove)*
energy losses in
respiration ;
movement / muscle contraction ;
reproduction / AW ;
digestion ;
egestion / food not absorbed / loss in faeces ;
excretion / loss in urine / ref to named excretory product ;
ecdysis / moulting ;
(named) inedible parts ; *there is energy in shells*
dead crabs eaten by, other consumers / detritivores / decomposers ; [max 2]

(c) **1** protein / amino acids, (in leaf litter) ;
2 ref to, decomposition / decay / decomposers / saprobiotic bacteria or fungi ;
3 deamination ;
4 amino acid converted to, ammonia / ammonium ;
5 ammonia / ammonium, converted / oxidised , to nitrite (ions) / NO_2^- ;
6 nitrite (ions) / NO_2^-, converted to, nitrate (ions) / NO_3^- ;
7 by, nitrification / nitrifying bacteria / named example ; e.g. *Nitrosomonas / Nitrobacter*
8 nitrate (ions) / NO_3^-, taken up / absorbed, by mangrove / plant (roots) ;
9 AVP ; e.g. ammonia / ammonium, taken up [max 4]

[Total: 10]

Q28.

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4 **(a)** *ignore reference to, first / third / fourth, trophic level*

(primary) producer ;
secondary consumer ; **A** second / 2°, consumer
tertiary consumer ; **A** third / 3°, consumer [3]

(b) 1 polar bear is, tertiary / quaternary consumer / top carnivore ; **A** in fourth / fifth, trophic level
2 feeds (only) on ringed seals ;
3 therefore limited, food / energy, supply ;
4 reference to ringed seals competing for food / food for seals shared with, others / named ;
5 reference to energy loss, within / between, trophic levels ; **A** approx 90% loss from one trophic level to the next
6 any two examples of, energy / heat, loss in lower trophic levels ; e.g. heat loss from, respiration / movement / digestion / excretion / egestion / indigestible parts / to decomposers / death but not eaten [max 4]

(c) *decrease in population of Arctic cod so higher trophic levels*
1 less, food / energy, (for consumers of cod / higher consumers) ;
2 more competition for food ;
3 consumers / named consumers, of cod feed on other levels ;
4 starvation / decrease in population / extinction(s) (of other species) ;
5 migration to areas where food is more plentiful ;

lower trophic levels
6 increase in numbers of
either, copepods / AW *or*
arrow worms / AW ;
7 (so) decrease in population of phytoplankton ; *only if mp 4 not scored*
8 (so) increased competition with bivalve molluscs ; *only if mp 2 not scored* [max 3]

[Total: 10]

Q29.

3 **(a)** **(i)** all arrow heads in correct direction (phytoplankton to herring / krill, krill to herring, herring and krill to whale); [1]

(ii) secondary / tertiary, consumer;
A third / fourth (trophic level) [1]

(iii) 1 plenty of food available / AW;
A feeding on more than one trophic level
2 further detail; e.g. phytoplankton efficient at converting light energy
phytoplankton blooms
little / no competition
ref. efficient feeding mechanism
3 short food chains / fewer links of the food chain;
4 less energy lost overall;
A *idea in terms of* percent lost at each level
5 few, indigestible / inedible parts; [max 3]

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(b) 1 fat / blubber = triglyceride;
2 fat / blubber / triglyceride, used as energy, store / reserve;

decreases
3 less fat in cells; ora
A fewer fat-filled cells / less adipose tissue
4 mobilised / respired / converted to fatty acids (**A** glucose), to release energy (during non-feeding season);
5 energy (from fat mobilisation) used, qualified; e.g. for movement

increases
6 food eaten / during feeding season, conversion to, fat / AW (for storage);
7 ref. thermal insulation;
A *idea of* prevents heat loss **R** keeps it warm [max 2]

(c) 1 (good) solvent / AW; e.g. (many) ions / minerals dissolve (in water)
A idea of (sufficient) dissolved respiratory gases (to support life)
2 provides, buoyancy / support / AW;
A *idea of floating*
3 (buoyancy / support) enables some to attain a large size / supports large mass / enables phytoplankton to remain, near / at surface;
4 high specific heat (capacity);
5 qualified; aquatic environment, more temperature stable / slow to change temperature / helps whale to maintain constant body temperature
6 ice, floats / less dense than water;
7 acts as insulator / prevents heat loss from water / water is underneath allowing survival in the winter;
8 transparent, for light penetration / for photosynthesis / for visual cues;
9 (density changes causing convection) currents, maintain circulation of nutrients / make nutrients available to support phytoplankton;
10 **AVP**; e.g. ref. to surface tension prevents sinking (small organisms) ref. to gamete movement [max 3]

[Total: 10]

Q30.

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6 **(a)** biotic and abiotic, components / AW ;
A alternatives to biotic and abiotic
including community / AW for biotic and habitat / environment, for abiotic
interacting / AW ; *idea of* interactions between organisms *or* interactions between organisms and abiotic environment
in an identifiable / a defined / a self-contained area / place / unit / environment / AW ;
A *idea of place if qualified with correct example* [2]

(b) **(i)** grasses / shrubs / trees ;
A singular or plural [1]

(ii) spider / predatory insect ;
A singular or plural [1]

(c) *energy loss at each level because of*
1 inedible parts / not all of the organism can be eaten ;
2 indigestible parts / not all is digested / egestion / faeces ;
3&4 *energy / heat, losses from* ;;
respiration **R** energy used for respiration
movement **A** energy used for movement
excretion
digestion
ignore *energy not utilised by plants by e.g. reflection from leaves, etc.* [max 3]

(d) *following death of organisms or excretion of nitrogenous waste*
1 decomposers / saprotrophs / bacteria / fungi / scavengers / detritivores ;
2 digest / breakdown / hydrolyse, protein / urea ;
3 *idea of* assimilation in / growth of, decomposers / AW ;
4 deamination ;
5 production of ammonium (ions) / ammonification ; **A** ammonia / NH_3
6 nitrification described *or* denitrification described ;
A formulae for ammonium ions, nitrite ions and nitrate ions but must be correct including signs
A nitrification described in terms of ammonium (ions) to nitrate (ions)
ignore nitrogen fixation as used correctly (N_2 to fixed N)
ignore uptake of nitrate ions or ammonium ions by plants
do not credit nitrification if any confusion with nitrogen fixation [max 3]

[Total: 10]

Q31.

6 **(a)** *niche*
functional role / function / role / AW, of a species within an ecosystem ;
A population / organism, *for species*
accept description

community
all populations of all species / all organisms / AW, living in a (particular) area / AW, (at the same time) ; [2]

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(b) 1 changing / increasing / decreasing, numbers of sea otters has (large) effect on the rest of the ecosystem ;

effect on kelp

2 prey on sea urchins, which, graze / feed on, kelp ;
3 if, no / few, otters numbers of urchins increase, so kelp decreases ; ora
4 sea urchins have no other predator ;

role of kelp

5 kelp, is a producer / initial input of energy into ecosystem ;
6 so less kelp means less energy available for the ecosystem ;
7 kelp provides habitats for many other species ;
8 loss of kelp (significantly), changes structure of ecosystem / ref. to 'deforestation' ;

effect on other organisms

9 decrease in numbers (of sea otters) leads (initially) to increase in numbers of their prey / named organism from Fig. 6.1; ora
10 *for any one example* ref. to consequence / knock-on effect ;
11 AVP ; e.g. ref. to effect on, energy flow through ecosystem / regulation of populations within the ecosystem / community structure [max 4]

(c) 1 (determine) energy content of consumed kelp, absorbed / that can be used, by sea urchins ; AW
2 (determine) energy content of kelp consumed by sea urchins ;

allow other reasonable suggestions for mps 1 and 2

3 *idea of* comparing energy contents and expressing as a, percentage / proportion / ratio ;
A equation *or* worded e.g. mp 1 divided by mp 2

4 (calculated as) per unit, area / volume, per unit time ;
A example e.g.(J) m^{-3} $year^{-1}$ [max 3]

[Total: 9]

Q32.

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5 (a) *max 2 if no examples from passage given*
population

1 all individuals / all organisms / AW, of,
Trichophilus welckeri
three-toed sloths / *Bradypus variegatus*
one / a, species of roundworm
one / a, species of insect *any one* ;
one / a, species of saprotrophic fungi
one / a, species of algae
A one (particular), species / kind / type
I e.g. the roundworms etc.
treat as neutral same organisms

2 *idea of* in, an (specified) area / AW ; e.g. place / habitat e.g. (sloths) in the, forest / trees (at one time)in central / south America
in the sloth's fur / on the sloth

3 at the same time ; *allow once only*

4 (named organisms) share same gene pool / ref. isolated from other populations (of the same species) ;
community

5 all populations of all species / all organisms / AW, living in a (particular) area / AW ;

6 examples ; all the organisms living on the sloths fur
or
roundworms, insects, fungi, algae, on sloth's fur/ in same area
in second example do not need ref. to fur or area if mp 5 given

7 at, the same / one, time ; *allow once only* [max 4]

(b) 1 has biotic and abiotic components / biological and physical components ;
A living and non-living components

2 described by use of examples from text ; e.g. water and organisms
A fur as an abiotic factor

3 ref. energy flow / nutrient cycling ;
A described e.g. food web, algae as producers, fungi as decomposers
A food chains *look for at least one link*

4 ref. interactions / functional entity ; AW e.g. self-contained / self-sustaining / inter-relationships [max 3]

[Total: 7]

Q33.

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2 **(a)** 1 nitrogen, converted / reduced / fixed, to, ammonium / ammonia (in root nodules) ;
A correct equation $N_2 (+ 6e^- + 8H^+) \rightarrow (2)NH_4^+ / (2)NH_3$
R if nitrogen fixation is said to happen in the soil
I nitrogen fixation is carried out by leguminous plant

2 (catalysed by) nitrogenase ; *accept if part of equation*

3 ATP, hydrolysed / AW ; *accept if part of equation*

4 ref. to anaerobic conditions ;

5 ammonia (converted) to amino acids to protein (in plants) ;

6 plant protein, digested / hydrolysed / broken down, by animals (into amino acids and absorbed) ;

7 amino acids used to synthesise (animal) protein ; [max 5]

Q34.

(ii) more digestion means that there is more energy available to the animal ;
ora = undigested material means less energy to the animal

2 more digested material means more energy for, secondary consumers / carnivores / next trophic level / for the food chain ; ora

3 more digested material means more trophic levels ; ora

4 more undigested material provides more energy to decomposers / AW ;

5 AVP ; e.g. ref. to (named) animal productivity
A secondary, production / productivity [max 2]

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Q1.

1 (a) 1. killed / hunted, qualified ; e.g. for meat / for fur / blood sport / takes human food / thought to be dangerous **A** poaching (unqualified)
2. war ;
3. sale of live young ;
4. habitat destruction / AW ;
5. loss of / competition for food ;
6. AVP ; e.g. disease [3 max]

(b) (i) 1. fewer animals need to be caught (for zoos) ;
2. ref. becoming pregnant ; e.g. IVF / finding a mate
3. reintroduction into the wild ;
4. research easier with captive animals / AW ;
5. ref. increase in numbers ;
6. ante or postnatal care ; [3 max]

(ii) 1. inbreeding / AW ;
2. gene pool too small ;
3. no fear of humans / difficulty in socialising with other gorillas ;
4. difficulty in, finding food / reproducing ;
5. ref. transfer of pathogens ;
6. ref. effects of captivity ; e.g. stress [2 max]

[Total: 8]

Q2.

1 (a) higher population (growth), higher (rate of) deforestation / ora ;
ref. 2 named countries (or letters) and paired figs ;
ref. Vietnam (not fitting trend) ; [2 max]

(b) (i) 1 ref. variety of, species / organisms / plants / animals ;
2 variation **within** species / AW ;
3 genetic diversity **between** species / AW ; [2 max]

(ii) *economic*
1 (some, species / plants / animals may have) uses in the future ;
2 medical uses / example ;
3 resource material ; e.g. wood for building / fibres for clothes
4 food (for humans) / agriculture ;
5 tourism / example ;
6 ref. maintain gene pool / genetic diversity ;
7 prevention of natural disasters ;
8 AVP ; e.g. ref. biological control (predators / parasites reduce pest populations)
[4 max]

[Total: 8]

Q3.

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3 (a) 1 loss of habitat ; **A** deforestation

2 building / industry / farming / localised use of wood ; *ignore logging / timber production*

3 difficulty in finding food ; **A** increased competition **R** no food

4 poaching / hunting ;

5 ref. ivory trade ; [3 max]

(b) 1 of no use to humans ;

2 protected in burrows ;

3 variety of food ;

4 small quantity of food required ;

5 short gestation ;

6 large number of offspring ;

7 camouflaged ;

8 (sophisticated) early warning system ; [3 max]

[Total: 6]

Q4.

1 (a) $\frac{(275-90)}{10}$ or $\frac{185}{10}$ or $\frac{1705}{10}$ for 1 mark

18.5 ;; **A** 19 **R** 18 [2]

(b) 1 avoid disturbance to, nest sites/nesting females ; **R** ref. to mating

2 protect, nest sites/young, from predators ;

3 avoid sea pollution ;

4 example of pollution ; e.g. do not throw rubbish into sea / avoid discharge from boats/light pollution (beaches)

5 take care when fishing (with nets) ;

6 stop hunting of adults ; **A** trading ban on turtle products

7 captive breeding programmes/AW ;

8 conservation areas/zoos ;

9 education/ecotourism ; [5 max]

[Total: 7]

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Q5.

1 **(a)** 1 more nests in, areas of low salinity/less salty areas ; **ora**

2 comment about result for salinity 16-20 not following trend ;

3 2 paired figs with units ; *linked to 1* [3]

(b) **(i)** $\frac{(31 - 8)}{8}$ (× 100)

287.5/288 ;;

allow one mark for suitable working if incorrect answer [2]

(ii) *any two from*

1 (ensure) low salinity or more freshwater ;

2 nest sites protected ;

3 education/ecotourism ;

4 assisted breeding ;

5 ban on hunting ;

6 preventing pollution ; [2 max]

[Total: 7]

Q6.

1 **(a)** 36 ;;
allow one mark for number not rounded up i.e. 35.7
or
allow working of $\frac{X}{7} \times 100$ [2]

(b) 1. reduction in extent of ice sheet ;
2. reduction in number of, seals / prey / food **or** increased competition for food ;
3. idea of increased distance to travel to find food ;
4. loss / destruction, of breeding sites ;
5. result of named human activity ; e.g. mining / drilling / killing / building / pollution
6. disease ; [3 max]

(c) *applies to U. maritimus but accept ora*
1. DNA linear ;
2. DNA in nucleus **or** has, nuclear membrane / nucleus ;
3. DNA, associated with protein / in chromosomes ;
4. ribosome, 22 nm diameter / 80s ;
5. membrane bound organelles / named organelle ;
6. no cell wall ;
7. size up to 40μm ; [3 max]

[Total: 8]

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Q7.

1 **(a)** 1. pools drying up ;
2. pools, affected by the sea / more salty ;
3. disease / parasite, (causing high death rate) ;
4. changes to sand dunes ; e.g. by humans or natural causes
5. increase in predators ;
6. decrease in food ;
7. named pollution ; e.g. acid rain affecting pH of pools
8. named human activity ; e.g. taking toads / road kill / food for humans
9. increased competition ; [3 max]

(b) 616 or 617 ;;
allow one mark for working if incorrect answer [2]

(c) **(i)** idea of feeding on other organisms ;
to obtain organic compounds ; [2]

(ii) animalia **and** fungi ; [1]

(d) people more interested in vertebrates
or
vertebrates, larger / more visible ; [1]

[Total: 9]

Q8.

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6 **(a)** 1 large, so easy to detect ;

2 taken by collectors ;

3 destroyed due to smell ;

4 habitat destruction / named example ; e.g. effect of grazing / building / agriculture

5 AVP ; e.g. not easily pollinated / detail of *Rafflesia* / flowers infrequently [3 max]

(b) **(i)** diversity of ecosystems in a region ;

the number of different species in each ecosystem ;

the genetic diversity within populations of each species ; [1 max]

(ii) 1. (some, species / plants / animals may have) uses in the future ;

2. medical uses / example ;

3. resource material ; e.g. wood for building / fibres for clothes / food (for humans) / agriculture ;

4. ecotourism ;

5. maintain, gene pool / genetic diversity ;

6. prevention of natural disasters ;

7. aesthetic reasons ;

8. to maintain stability in, ecosystems / food chains ; [4 max]

[Total: 8]

Q9.

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6 (a) (i) may be of use in the future ;

(may produce) medicines / AW ;

resources (for humans) ;
e.g. wood for building / fibres for clothes / fuel / food / agriculture

maintain, gene pool / genetic diversity ;

to maintain stability in ecosystems ;

aesthetic reasons ;

(eco)tourism ; [3 max]

(ii) dried / kept cool ; [1]

(b) (i) positive correlation / number of plant genera increases as rainfall increases ;

paired figs ; *genera number & rainfall in 2 countries showing the trend*

China does not fit the pattern ; [2 max]

(ii) temperature ;

light intensity ; *ignore sunlight / light / sun*

day length ;

humidity ;

carbon dioxide concentration ;

wind ; [2 max]

[Total: 8]

Q10.

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1 **(a)** P = 2.15 and R = 19 for 3marks ;;;

Allow one mark for working if incorrect answer(s) [3]

			unicell **P**	unicell **R**
(b)	kingdom		prokaryote	protoctista ; ***R** eukaryote alone*
(c)	features	1	0.5 – 5 µm	up to 40µm ;
		2	DNA circular *ignore plasmid*	DNA linear ;
		3	DNA free / in cytoplasm ***R** no nucleus*	DNA in nucleus / AW ;
		4	DNA naked	DNA associated with protein / histones ;
		5	70s / 18nm, ribosomes	80s / 22nm, ribosomes ;
		6	No ER	ER ;
		7	few organelles	many types of organelle ;
		8	no organelles surrounded by membrane / no named organelle	organelles surrounded by membrane / named organelle ;

[5 max]

notes

look for pairings if not side by side and link with red line

give credit for two paired statements in same box

no credit for single statements

allow ecf if P and R kingdoms swapped

[Total: 9]

Q11.

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2 (a) 1 ref. variety of, species / organisms ;
2 genetic diversity within species / AW ;
3 genetic diversity between species ;
4 wide range of, habitats / ecosystems ; [3 max]

(b) 1 ref. rapid growth of plants / high rate of photosynthesis ;
2 large number of plant, species / types ;
3 flowers / fruit / leaves, (for animals) throughout the year ;
4 provides, niches / habitats ; [2 max]

(c) *allow up to two good examples for each role*

1 *ecological role*
e.g. ;; (nutrient cycling / climate)

2 *economic role*
e.g. ;; (food / medication / timber / ecotourism)

3 *ethical role*
e.g. ;; (indigenous people)

4 *AVP*
e.g. ;; (gene bank / interdependence of species) [4 max]

[Total:9]

Q12.

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Question	Expected Answers	Marks

1 (a)

eukaryotic		prokaryotic
1. linear / strands	**or**	circular ;
2. in nucleus	**or**	(free) in cytoplasm ;
3. associated with, proteins or histones	**or**	naked ;
4. in chromosomes	**or**	not in chromosomes ;

assume eukaryotic if not stated [2 max]

(b) 1 habitat destruction / deforestation ;

2 disease ;

3 fall in prey numbers / difficulty in finding food ;

4 increased competition (with other carnivores) ;

5/6 ref. named human activities ; ; e.g. killing / agriculture / logging
R pollution [3 max]

(c) 1 national parks ;

2 zoos ;

3 captive breeding programmes ;

4 AVP ; e.g. banning hunting / gamete banks / education qualified [2 max]

[Total:7]

Q13.

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Question			Expected Answers	Marks
1	(a)	1	species threatened with extinction ;	
		2	numbers reduced to critical level / population too small ;	
		3	such low numbers that reproduction is affected ;	[2 max]
	(b)	1	(maintain colony) in zoo ;	
		2	captive breeding (programme) ;	
		3	assisted reproduction ; e.g. IVF	
		4	educate public ;	
		5	national parks / conservation areas ;	
		6	habitat protection ;	
		7	ban, hunting / poaching ;	[4 max]
				[Total:6]

Q14.

Question			Expected Answers	Marks
1				

process or feature	kingdom				
	Prokaryotae	Protoctista	Fungi	Plantae	Animalia
80s ribosomes	×	✓	✓	✓	✓
cell walls contain chitin	×	×	✓	×	× ;
circular DNA	✓	×	×	×	× ;
endoplasmic reticulum		✓	✓	✓	✓ ;
most species unicellular	✓	✓	×	×	× ;
autotrophic	✓	✓	×	✓	× ;
heterotrophic	✓	✓	✓	×	✓ ;

one mark for each correct row

if there are any blanks in a row then award no marks for that row

[6]

[Total: 6]

Q15.

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1 **(a)** 1 mallard numbers have increased **and** the others have decreased ;

decrease due to

2 pesticides / pollution / fertilisers ;

3 change in temperature or pH of water ;

4 lack of named food source ;

5 increased competition / AW ;

6 direct human interference on **lake** ; e.g. fishing / sailing etc
not related to marking point 2

mallard increase due to

7 doesn't eat, insects / molluscs / fish ;

8 less other birds so less competition ; [4 max]

(b) 1 cultural / aesthetic / leisure, reasons ;

2 moral / ethical, reasons ; e.g. right to exist / prevent extinction

3 resource material ; e.g. wood for building / fibres for clothes / food for humans

4 ecotourism ;

5 economic benefits ;

6 ref. resource / species, may have use in future / AW ; e.g. medical use

7 maintains, food webs / food chains ; **A** description

8 nutrient cycling / protection against erosion ;

9 climate stability ;

10 maintains, large gene pool / genetic variation ;

[4 max]

Q16.

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1 **(a)** 1 pollution ;

2 environment / habitat, change qualified ; e.g. increase in water temperature / change in water pH

3 overfishing ;

4 loss of food / more competition for food ;

5 direct human interference qualified ; e.g. pleasure boats [3 max]

(b) variety of / different / total number of, species ;

genetic diversity of species / AW ; [2]

(c) *any three from*

1 tourism / leisure ;

2 economic benefits ;

3 food for humans ;

4 ref. resource / species, may have use in future / AW ;

5 maintains, food webs / food chains ; **A** description

6 nutrient cycling ;

7 maintains, (large) gene pool / genetic variation ; [3 max]

[Total: 8]

Q17.

1 **(a)** allopatric ; [1]

(b) 1. packs / populations, isolated from each other ;
2. inbreeding / no interbreeding ;
3. little mutation ;
4. AVP ; e.g. small population to start with / small gene pool to start with [2 max]

(c) 1. agriculture / buildings / AW ;
2. *idea of* wolves dying ;
3. hunting / trapping / AW ;
4. hybridisation / infertility / change in (wolf) gene pool / loss of wolf alleles / AW ; [4]

(d) 28(%) ;; [2]
allow one mark for number not rounded up or incorrect answer but correct idea regarding working

[Total: 9]

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Q18.

1 (a) 96 ;; [2]
allow one mark for correct working with either incorrect answer or answer not rounded down

(b) 1. stop killing ;
2. education ;
3. stop trade in tiger parts ;
4. zoos / national parks ;
5. captive breeding / AW ;
6. release back into wild ;
7. replant forests / AW ;
8. protect remaining forest / stop deforestation ;
9. AVP ; e.g. incentives to indigenous people / ban use in circuses or as pets [4 max]

(c) *assume animalia unless otherwise stated*
1. heterotrophic / AW ;
2. locomotion ; **ora**
3. male gametes motile ; **ora**
4. detail cell structure ; e.g. no cell wall / no tonoplast **ora** *ignore ref. to cellulose* [2 max]

[Total: 8]

Q19.

7 (a) *corals*
1. (cells) have no chloroplasts ;
2. (cells) have no, cell walls / large vacuoles ;
3. are heterotrophic / not autotrophic / not photosynthetic ; [2 max]

(b) biotic and abiotic components **or** living and non-living components ;
correct ref. to interaction ; [2]

(c) (i) Indian Ocean = 22(%)
Pacific Ocean = 9(%) ;
both correct for 1 mark [1]

(ii) any three from
1. named marine pollutant ; e.g. oil / sewage
2. example of climate change ; e.g. sea level rising /
change in sea temperature / decrease in oxygen concentration of sea
3. (increasing carbon dioxide) decrease in pH of sea ;
4. intensive fishing ;
5. tourism qualified ;
6. removal of parts of reef ;
7. reclaiming land ; [3 max]

[Total: 8]

Q20.

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8 **(a)** any number between 873 – 882 inclusive ;;

allow one mark for correct working or for number not rounded up [max 2]

(b) *named species (no mark)*

*four **relevant** reasons for a named species* ; ; ; ;
e.g. animal species
direct human effect e.g. hunting / fishing / collection / skins
habitat destruction
climate change qualified
increase in pollution
spread / increase, in disease or new disease
lack of food
increased predation

e.g. plant species
direct human effect e.g. specimen collection / logging
habitat destruction
climate change qualified
increase in pollution
spread / increase, in disease or new disease
loss of pollinators
increased competition from introduced plants [4]

[Total: 6]

Q21.

8 **(a)** 7 500 ;;

allow one mark for correct working
allow one mark for 7.5 tonnes [2]

(b) 1. stop / reduce, fishing ; **A** correct ref. to quotas / moratorium

2. ref. to size of nets ;

3. ref. to methods of fishing ;

4. control pollution ;

5. education ;

6. captive breeding and release / restocking from fish farms ;

7. ref. to marine reserves ; [max 3]

[Total: 5]

Q22.

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7 (a) *any five from:*

1. (touching hairs causes), action potential / depolarisation ;
2. auxin increase triggered in hinge cells ;
3. H^+ / hydrogen ions, pumped into cell walls ;
4. calcium pectate 'glue' in cell wall dissolved ;
5. Ca^{2+} ions enter hinge cell ;
6. water follows by osmosis ;
7. hinge / midrib, cells expand ;
8. trap lobes, flip from convex to concave / change in elastic tension ; [max. 5]

(b) (i) random sampling using frame quadrats ; [1]

(ii) Simpson's index of diversity ; [1]

(iii) Spearman's rank correlation coefficient ; [1]

[Total: 8]

Q23.

4 (a) 1 maintains biodiversity ;

2 maintain, genetic diversity / genetic variation / gene pool ;

3 (loss of a species) may affect food, chains / webs ;

4 use by humans ; e.g. medical use / building materials / food

5 (eco)tourism ;

6 ethical / moral / aesthetic, reasons ; [max 3]

(b) (i) *assume answer refers to the botanic garden population unless otherwise stated*

statement about position relative to **A**, **B** or **C** ; e.g. closest to **B** / lower than **A** and **B** / higher than **C**

use of comparative figures ; e.g. 30.74 plus one other [2]

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(ii) 1 small number / (only) 10, sampled ;

2 some, variants / alleles, were not included in the sample ;

3 **C** may be smaller than the other populations ;

4 **C** may have developed from only a small number of original plants ;

5 (so) only a small number of, alleles / variants, (present in the original population) ; **A** small gene pool / less genetic diversity [max 2]

(iii) 1 *idea of* better chance of survival in changing conditions ;

2 example of change ; e.g. climatic / increased competition / new disease / new pest

3 less chance of, two harmful recessive alleles coming together / inbreeding depression ; [max 2]

(iv) 1 (environmental) conditions similar to those in the, wild / natural habitat ;

2 within pollination distance / AW ;

3 *ref. to* possible reintroduction of plants to the wild ; [max 2]

(c) (i) *assume answer refers to the seeds unless otherwise stated*

1 *idea that* seeds are small **and** easier to store ;

2 seeds can be stored for a long time ;

3 little maintenance required ;

4 less prone to, disease / being eaten ;

5 seeds can be stored anywhere in the world ; [max 2]

(ii) 1 to check that seeds are still, viable / able to germinate ;

2 to produce new plants from which fresh seeds can be collected ;

3 to, find / verify, conditions for breaking seed dormancy (should plants be needed) ; [max 2]

[Total: 15]

Q24.

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2 **(a)** 1 supplied with food ;

2 monitor health of the, mother/offspring ;

3 (sperm/eggs) stored/frozen ; **A** sperm bank

4 artificial insemination/in vitro fertilisation ; **A** AI/IVF

5 *ref. to* cloning/surrogacy/fostering (of young) ;

6 fertilised eggs incubated artificially ;

7 transfer of breeding partners between zoos ;

8 maintenance of records ;

9 maintains genetic diversity ;

10 protection from, predators/ shooting/disease ; [max 4]

(b) 1 no longer living in natural habitat ;

2 stress ;

3 behavioural changes ;

4 *idea of* disruption to normal reproductive cycles ;

5 reject mate ; [max 2]

(c) 1 may find difficulty in moving around (due to previously been captive) ;

2 *idea of* difficulty obtaining food/short of food/outcompeted for food ;

3 difficulty integrating with others of members of their species ;

4 disease ;

5 *idea of* lack of survival skills ; **A** lack of fear of, humans/predators [max 2]

(d) lead poisoning/lead is an enzyme inhibitor ; [1]

[Total: 9]

Q25.

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1 (a) (existence of many) different species;
with (a wide range of) different, genes/alleles;
(many) different, habitats/ecosystems; max 2

(b) has a very high, species diversity/biodiversity;
is being lost rapidly;
may be a carbon sink/ref. to global warming;
loss may affect rainfall patterns;
loss may affect, soil erosion/flooding; max 3

(c) (i) more variety of plants in system A than (B, C or) D;
ref. to different levels of vegetation in original forest (canopy, understory);
therefore greater variety of habitats for birds;
greater variety of food sources for birds; ref. pesticides; max 2

(ii) more coffee trees grown in a (unit) area;
no competition with other trees;
better availability of light;
loss of habitats for pests;
increased use of fertilisers;
increased use of pesticides; max 2

(iii) populations of pests (on coffee trees) can become very high in D;
plentiful food source for them;
fewer bird species to predate them/fewer predators; max 2

(d) nitrogen fixation;
bacteria/*Rhizobium*/root nodules, provide nitrate/ammonium; 2

(e) pay premium for coffee grown, in system A/in sustainable way;
provide, grants/subsidies, to coffee farmers to use system A;
encourage/educate/inform, consumers to encourage them to buy coffee grown in system A;
find uses for the non-coffee trees in system A; max 2

[Total 15]

Section B

1.

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9 (a) 1. cultural/aesthetic / leisure, reasons;

2. moral/ethical, reasons ; e.g. right to exist/prevent extinction;

3. resource material ; e.g. wood (for building)/fibres for clothes/food for humans/(herbal) medicine

4. (eco)tourism;

5. economic benefits;

6. ref. resource / species, may have use in future/AW;
e.g. medical use

7. maintains, food webs / food chains;
A description

8. nutrient cycling;

9. protection against erosion;

10. climate stability;

11. maintains, (large) gene pool/genetic variation;

12. scientific research; [max 7]

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(b) *advantages* (max 5)

13. can monitor health of mother;
14. can monitor development of foetus;
15. storage of, sperm/eggs/gametes;
16. artificial insemination;
17. IVF;
18. ref. surrogate mothers;
19. international cooperation;
20. genetic records kept;
21. can prevent extinction/extend range of a species/used in restoring ecosystem;

disadvantages (max 5)

22. unnatural environment;
23. stress in captivity;
24. behavioural changes;
25. reproductive cycles disrupted;
26. may reject selected mate;
27. examples of problems with release ;;
28. difficulty in finding food
    may not integrate into groups
    more susceptible to disease
    very little natural habitat left to release animals into [max 8]

[Total: 15]

2.

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9 **(a)** *similarities*
eukaryotic (cells) ;

detail of eukaryotic cell ;; e.g. nucleus / linear DNA / chromosomes associated with histones / (named) membrane-bound organelles / 80S ribosomes

differences
single-celled **or** colonial / multicellular ;

autotrophic **or** heterotrophic ;

motile **or** unable to move ;

cell wall **or** no cell wall ;

vacuole **or** no vacuole ;

different life cycles ; [max 7]

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(b) fall in numbers ;

danger of becoming extinct ;

ref. (IUCN / International Union for Conservation of Nature) / red list ;

one mark for idea, additional mark if qualified with point specific to named example
e.g.
habitat destruction ;
detail ;

climate change ;
detail ; e.g. rise in temperature

increase in disease ;
detail ;

increase in, predators / grazers ;
detail ;

decrease in food ;
detail ;

named pollutant and habitat affected ;
detail ;

hunting / killing / poaching / removal (plant) ;
detail ; e.g. trade in animal parts, selling rare plants

increased competition ;
detail ;

lack of human education ;
detail ;

disturbance to breeding sites ;
detail ; [max 8]

[Total:15]

3.

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9 **(a)** multicellular ;

differentiated cells ;

(most) have, vascular tissue / xylem and phloem ;

eukaryotic (cells) ;

ref. meristems ;

(most) are not motile ;

motile gametes **only** in mosses and ferns ;

autotrophic nutrition / photosynthesis ;

cells have:
chloroplasts ;

large / central, vacuole ;

walls made of cellulose ; [max 8]

(b) place in zoos ;

protected against, disease / predation ;

captive breeding programme ;

ref. assisted reproduction / cloning / sperm banks ;

released into wild ;

ref. national parks / reserves ;

rangers patrol parks ;

human access restricted ;

controlled agriculture ;

controlled industry ;

visitor centres / education ;

habitat / breeding sites, protected ;

banning sale of protected animals or their products ;

banning hunting ; [max 7]

[Total:15]

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