

1. **DO NOT CREDIT** immune for **any** mark point
- 1 mutation;
 - 2 sulfonamide is selective, agent / pressure;
 - 3 resistant survive / non resistant die;
IGNORE refs to (survivors) breed / reproduce;
 - 4 (resistance) allele / gene / mutation, passed to, offspring / next generation;
 - 5 (happens) over many generations;
IGNORE refs to time. Look for generations
 - 6 AVP;
*e.g. mutation is, **random** / spontaneous allele / gene, passed on by, plasmids / horizontal transmission*

[4]

2. (i) bacteria, killed / destroyed / cannot grow / lyse, in presence of antibiotic;
DO NOT CREDIT 'antibiotic works better' **or** 'there are no bacteria there' **or** 'bacteria are broken down'

1

- (ii) streptomycin;
IGNORE '4' as it is the number rather than the name

1

- (iii) **DO NOT CREDIT** responses which simply refer to selecting the best antibiotic

- 1 cheap / AW;
- 2 (test is) quick to carry out / (deals with several antibiotics) at same time / AW;
DO NOT CREDIT speed of antibiotic action
- 3 (idea of) allowing early treatment of patient;
- 4 (idea of) compares antibiotics under same conditions;
- 5 (correct antibiotic first time) to prevent antibiotic resistance developing;

3 max

[5]

3. (new) drugs come from (named) organisms;

ACCEPT plants / animals / fungi / species / etc.

biodiversity is reducing;

habitats / named habitat, destroyed / lost;

ACCEPT deforestation / natural environment lost

reason for habitat destruction;

e.g. global warming

logging

fuel

crops

construction / industrialisation

mining

fishing

pollution

tourism

ACCEPT any other valid reason that will destroy natural habitats but **not** general statements such as 'human development' or 'business'

[2]

4. (a) *habitat*

1 the place where, an organism / organisms / a population / a community, lives;

ACCEPT animal or plant

ACCEPT location / environment / area

DO NOT CREDIT ecosystem

1 max

biodiversity

2 variety of life / the range of living organisms found / AW;

DO NOT CREDIT ref to variation

ACCEPT species richness / species diversity

3 variety / range, of, habitats / ecosystems;

4 number of different species;

must have ref to number / how many / etc.

5 variety / genetic diversity, within species;

2 max

- (b) **DO NOT CREDIT** ref to 'fair test' unless qualified
 not random / should have been random;
 unrepresentative / skewed / biased, results;
'misleading' is not quite good enough
 creates an over-estimate of diversity;
 may miss some (dominant) species / does not cover full range of species;
CREDIT plant / animal instead of species
 2 max
- (c) (i) remove units from the body of the table **and**
 put units in column heading / AW;
ALLOW 'measurement' or 'type of measurement' instead of
 'unit'
DO NOT CREDIT 'units are not necessary in table'
 1
- (ii) bell shaped;
 - must start at 0% cover and after 0m and finish at 0% cover and before 100m
 - line must cross the line for bracken
 - allow sharp angle for peak of bell
 peak / highest point, for line between peaks
 for bracken and cotton grass (on horizontal axis);
 peak / highest point, for line lower than both
 bracken and cotton grass (on vertical axis);
 3
- (iii) 1 absent at bottom of slope / present at top of slope;
DO NOT CREDIT that bracken is present at top if answer also
 implies that some bracken is present at the bottom
ALLOW 'before 40 - 50m' as AW for 'bottom'
ALLOW 'after 40 - 50m' as AW for 'top'
ALLOW 'start' instead of 'bottom' and 'finish' or 'end' or
 'higher up' instead of 'top'
 Needs to be stated – cannot be implied from mp 2
- 2 amount of bracken / percentage cover,
 increases with increasing distance;
- 3 comparative figs. with units;
 two percentages at two stated distances (must be from table)
 e.g. 0% at 0m and 74% at 100m
 or percentage difference between two stated distances
ALLOW 'percentage cover' instead of % for units
DO NOT CREDIT 0% at the bottom and 74% at the top (as no
 distance has been quoted)
 2 max

- (d) (i) **IGNORE** observe
IGNORE animals for this habitat
IGNORE 'species richness' and any other calculation
 record / identify / list / AW, all species / (all) other plants;
ACCEPT the number of plants / species
 (count / estimate) numbers of individuals within each species / AW;
*If the formula is given, only credit this mark if 'n' is explained
 in terms of the number of individuals within the species*

2 max

- (ii) not stable / at risk / low ability to withstand change / AW;
 more likely to lose species;
IGNORE 'biodiversity is low' as this is given in the question
IGNORE 'only a few species' or 'dominated by a few species'
 as these are descriptions of low biodiversity

1 max

[14]

5. (i) likely to become extinct / on the verge of extinction /
 numbers are not sustainable /
 numbers too low for survival of species /
 numbers drop below 10% of (original) population;
DO NOT CREDIT 'may' / 'might' / 'could' become extinct
CREDIT 'die out' or 'wiped out' instead of extinct

1

- (ii) 133 333;;

*Award 2 marks for a correct answer, even if no working
 shown.*

***ALLOW** 1 mark for seeing 133 333.3333... if answer is
 incorrectly rounded or not rounded to a whole number.*

*If the answer is incorrect **ALLOW** 1 mark for $\frac{4000 \times 100}{3}$*

2

[3]

6. (i) painkiller still being used;

in captivity – allow reverse argument for in the wild
 fed uncontaminated food / keep away from painkiller;
 health of individuals monitored / treated for disease;
 eggs (artificially) incubated / young hand reared;
 reduced mortality of young;
 provision of mate / females breeding can be manipulated;
 protection, from hunting / predation;
 competition reduced (between, individuals / species);

IGNORE ref to controlling diet or nutrition

e.g. hormones / artificial insemination / artificial selection
'safer environment' is not quite enough

4 max

- (ii) maintain / increase, genetic variation / gene pool;

reduce risk of, inbreeding / breeding between related birds;
 different 'races' of vulture in different areas /
 geographical variation / different subspecies;
 less likely **all** contaminated with painkiller;
 less risk of losing all individuals due to,
 disease / natural disaster / human action;

In the context of the vultures, rather than 'biodiversity'

CREDIT different alleles

DO NOT CREDIT different genes

CREDIT ora for idea of promoting outbreeding

ALLOW ref to types of (white-backed) vulture

3 max

[7]

7. reason **or** explanation;;;

*Suitable examples include but are **not** limited to:*

- maintains biodiversity
- part of food chain / part of ecosystem / part of food web /
- scavengers
- have a right to existence / moral reason
- specific religious reason
- give pleasure / beautiful creatures
- ecotourism
- useful product / source of medicine / medical research
- genetic resource
- saves clearing up / remove carcasses
- prevents disease
- keeps, rat / dog, population down

CREDIT any three valid suggestions.

Ignore the numbers on the answer lines.

Mark as prose and award points as they arise.

The idea of research must be qualified

[3]

8. ban / make illegal, use of **this** painkiller;
 provide alternative painkillers
 (that do not have the same ecological impact);
 no hunting / no killing / legal protection,
 of white-backed vultures;
 protected areas / sanctuary / reserves;
 provide breeding sites;
 prevent habitat destruction;
 monitoring (of vultures) / tagging;
 feeding programme (for released birds) /
 provide uncontaminated carcasses;
 qualified ref. to education;
 promotion of ecotourism;
 in case the population falls again,
 sperm and egg banks / frozen embryos;

e.g. to farmers / local people (on importance of vultures)

[3]

9. (i) nucleus / nuclei;

If more than 1 answer given = 0

1

- (ii) *mildew ...*

(usually) chitin / not cellulose (cell), wall;
external digestion / secretes enzymes externally;
 heterotrophic / saprophytic / saprotrophic / saprobiont;
 no, plastids / chloroplasts / amyloplasts;
 spores;
 hyphae / mycelium;
 multi-nucleate / coenocytic / aseptate;

If 1st statement INCORRECT, max 1

Must be external or outside or equivalent

CREDIT syncytium / syncytial

2 max

- (iii) *pear tree ...*

cellulose cell walls;
 multicellular;
 has, chloroplasts / plastids / chlorophyll /
 photosynthetic pigment;
 (photo)autotrophic / performs photosynthesis;

If 1st statement INCORRECT, max 1

IGNORE any references to vacuoles or other organelles

'makes its own food' is not enough

2 max

- (iv) Protoctista / Protoctist(s);
 Animalia / animal(s);

CREDIT in either order

DO NOT CREDIT Protista / Protist look for the 'c'

2

[7]

10. (i) discontinuous;

CREDIT at any point in the answer
IGNORE genetic

1

single / few, genes;
qualitative;
discrete categories / either low or high resistance /
no intermediates;

CREDIT a description of **discontinuous** variation (to
max 2) even if the type of variation given is incorrect.

no / small / little, environmental effects;

CREDIT 'large / only, genetic effect'

2 max

- (ii) artificial selection / selective breeding;
cross / breed, Iranian / resistant, wheat with,
high yield / UK, wheat;
method to prevent self, pollination / fertilisation;
select, best offspring / offspring with good yield and resistant;
(back) cross to high yield (UK) wheat / interbreed best offspring
/ interbreed offspring with both characteristics;
idea of breeding (and selecting) for many generations;

IGNORE country incorrectly linked to characteristic as
long as the correct cross has been described

e.g. removing anthers / bag stigma

3 max

[6]

11. genetic variation;
 (due to) mutation;
 (mutation is) spontaneous / random / pre-existing;
 (due to) sexual reproduction;
 mildew fungus produces large numbers of,
 spores / gametes / offspring;
 wheat resistance acts as a selection pressure;
 (individuals that overcome resistance)
 have selective advantage / are more likely to survive;
 pass on, mutation / (mutated) allele (to offspring);
 increase in allele frequency (of allele to overcome resistance);
- IGNORE** 'survival of the fittest' as this is not an explanation*
- CREDIT** ora for those with selective disadvantage*
- ALLOW** gene*
- DO NOT CREDIT** characteristic / ability*
- [4]
12. (i) *any three from the following:*
award mark only if structure related to suitable function
- variable region is antigen binding site; **R** receptors / 'sticky ends' / active site
- (shape of) variable region specific to antigen / amino acid sequence (of variable region) gives, complementary / matching, shape;
- hinge region allows flexibility in binding / AW;
- constant region, for binding to receptors on cells / phagocytes / mast cells;
 AVP; e.g. disulphide bonds hold polypeptide chains together
- 3
- (ii) human and chimp are more closely related;
 common ancestor is more recent;
 less time for, mutations / variation, to arise;
- 2
- [5]
13. (a) number of different species present/AW;
- 1
- (b) (i) 0.62;;
- award one mark if working correct but answer wrong*
- 2

(ii) *award marks only if comparative points given*

hedge vegetation has greater species richness than wheat;
 numbers of insects under hedge more evenly spread compared with
 numbers in wheat field / AW;
 more niches for insects in vegetation under hedge/ more species of
 plants grow under hedge than in wheat field/ AW;
 ref. use of, chemicals/ insecticides/herbicides, on wheat and not
 on hedge vegetation;

AVP; e.g. ref. plants under hedge more likely to be wild/native
 compared with wheat crop / AW

max 3

(c) *Any four from the following:*

ref. random samples;
 sweep net;
 repeats in each habitat;
 ref need for same technique in each habitat;
 classify and count numbers of each species(of insect) caught;

AVP; e.g. further detail of sampling such as use of suitable chemical to
 stun the insects;

max 5

[11]

14. (i) ref to (bio)diversity values and need for conservation;
 ref to endangered species and need for protection;
 ref to laws concerning endangered species (that might affect decision);
 ref to planning stipulation e.g. translocation of species;

AVP; e.g. example of type of local planning decision;

max 3

- (ii) damage to environment / ecosystem;
 disturbance to animals in area;
 habitats best left alone / left to nature/AW;

AVP; e.g. may advertise presence of endangered species to collectors

max 2

[5]

15. Animalia / animal(s);
 Phylum; **A** phylum
 Order; **A** order
Panthera;
 species;

[5]

16. Fungi; **A** fungi
 Protoctista; **A** protoctists / protista / protists
[2]
17. scientific knowledge changes as new discoveries are made / AW;
 technological developments lead to new discoveries;
 named technological development; e.g. microscopes, new DNA technology
 ref. (legitimate) differences of opinion amongst biologists/scientists /taxonomists;
 ref. true bacteria (bacteria) and archaea;
 ref. differences between bacteria and archaea; e.g. different RNA
 polymerase, membrane structure, flagellae, histones
 AVP; e.g. other relevant detail of prokaryotes max 4
[4]
18. (a) (i) change in DNA/ genetic material, through spontaneous mutation; 1
 (ii) DNA/ genetic material, determines protein structure/
 controls protein synthesis;
 (mutation) changes protein structure/ enzyme structure/ antigen structure; 2
- (b) *any four from following:*
 development of new strains (of bacterium)/ bacteria multiply rapidly;
 development of resistance to antibiotics;
 need to find more antibiotics;
 need wide range of antibiotics for one species of bacterium;
 vaccines no longer effective;
 AVP; e.g. antibodies may not recognise changed antigens /
 no longer effective / ref. MRSA 4
[7]
19. (a) (i) species numbers have become low / habitat reduced, qualified;
 population has reached a critical level / AW;
 there is a risk of extinction; max 2
- (ii) *any two from the following:*
 shot to prevent damage to farmland; **A** other appropriate reason
 habitat destruction;
 hunting;
 poaching;
 killed for horn; **A** ivory
 killed, for meat / hides; 2

(b) *any two from the following:*

signatory countries made it illegal to, kill / poach, rhinos;
 ban placed on trade (in horns);
 increased cooperation between countries;
 permits / licenses, issued;
 education / raising awareness;

2

[6]

20. source of food;
 source of plant varieties for cross breeding / selection;
 to breed in disease resistance / pest resistance;
 to breed in other named characteristic; e.g. higher protein content /
 quicker growth
 source of natural predators to pests;
 AVP;

max 4

[4]

21. (i) mutation/AW;

1 max

(ii) disinfect surfaces (regularly) (use disinfectant/alcohol);
 wash hands, regularly/between patients;
 alcohol/antibacterial, hand wash/gel;
 medical staff wear hair nets;
 screen/regular nose swabs for, hospitalised patients/medical personnel;
 isolation of infected people;
 restricted visiting;
 replacement/sterilization, of bedding/surgical equipment;
 use disposable, gloves/overalls/aprons;
 correct disposal of above;
 education about measures/enforcement of measures;
 barrier nursing/suitably trained nurses;
 AVP; e.g. disinfect skin before surgery

2 max

[3]

22. (i) eukaryotic; **A** *eukaryotic feature*
heterotrophic; **R** *unable to photosynthesise* **A** *saprotrophic, parasitic*
(hyphal/cell) wall of chitin;
(most made out of) hyphae; **A** *ref to mycelium*
(reproduce by) spores;
ref to glycogen stores;
multinucleate/AW; max 3
- (ii) eukaryotic/nucleus;
membrane bound organelles/named membrane bound organelle;
A *two named membrane bound organelles for 2 marks* **R** *chloroplast*
(cell) wall;
sessile/AW; **R** *reference to roots*
(reproduce by) spores; max 2
- [5]**
23. (i) increased percentage resistant as erythromycin used more initially;
to almost 20%/19%;
natural selection;
erythromycin is selective agent;
resistance is selective advantage/selective pressure for resistance;
resistants survive and pass mutation to offspring;
peaks 1993 after drop in erythromycin use;
peaks of doses and resistance not coincident;
fall to 15% in '94;
less erythromycin use since 1988/peak use 1988;
selective pressure reduced but not zero;
resistance still has selective advantage; max 4
- (ii) gene mutation;
random;
change in DNA, base code/triplet code;
addition/deletion/substitution;
vertical transmission; max 2
- acquiring R plasmid;
by, conjugation/horizontal transmission;
from same or different species;
by, transformation/transfer from (bacterio)phage; max 2
- [8]**

24. *viability*
 ensure that seeds are germinated from time to time;
 collect new seeds produced;
 ref to suitable storage conditions; 2 max
- variability*
 ensure that you have many seeds;
 collect seeds from different areas;
 ref to mixture of genotypes; 2 max max 3
- [3]
25. *Management problems*
 1 capture of species/AW;
 2 numbers of species caught ref to extinction;
 3 ref to named example e.g. elephants;
 4 maintenance of genetic variability/gene pool;
 5 ref to funding;
 6 ref to species ownership/AW;
 7 problems of storage and maintenance;
 8 ref to specific example of problem; e.g. inbreeding/altered breeding/seed preparation;
 9 AVP;
- Need for success*
 10 stop extinction/maintain gene pool;
 11 potential medical benefits;
 12 agricultural benefits/artificial selection;
 13 named example of crop improvement;
 14 ethical/moral responsibility for future generations;
 15 AVP; 3 max max 7
- QWC - legible text with accurate spelling, punctuation and grammar** 1
- [8]
26. a species threatened with extinction / AW;
 man-made or natural changes in their environment /AW;
 A hunting and poaching
 numbers, reduced to a critical level / so low that reproduction affected /
 AW; A only small numbers left max 2
- [2]

27. captive breeding

- 1 rescued / collected, animals / AW;
- 2 problems of capture e.g. stress;
- 3 exchange of animals between zoos;
- 4 exchange of, genetic resource / alleles;
- 5 gene (sperm / egg) banks;
- 6 artificial insemination / AW;
- 7 (international) database;
- 8 many animals to avoid inbreeding;
- 9 inbreeding depression;
- 10 requires biological knowledge and skills;
- 11 expensive;
- 12 AVP; e.g. use of other named example or conditions of captive breeding max 5

reintroduction

- 13 habitats might have suffered destruction;
- 14 threat of, hunting / poaching, remains;
- 15 not able to find food / AW;
- 16 change in animal behaviour e.g. stress *or* no fear of, humans / predators;
- 17 failure to breed out of captivity;
- 18 ref to immunity to disease;
- 19 AVP; e.g. use of other named example max 5 max 7

QWC – clear, well organised using specialist terms;

1

award the QWC mark if three of the following are used in correct context and explained

gene (sperm / egg) bank
 gene
 inbreeding / inbreeding depression
 genetic resource
 alleles
 stress
 immunity

[8]

28. 1 establish study area either with strips and with no strips;
 2 (line or belt) / transect / random sampling / field walk;
 3 use quadrats;
 4 at regular intervals / random coordinates;
 5 appropriate size of quadrat;
 6 identification of plant species / ref to use of keys;
 7 record presence / absence;
 8 % frequency / % cover;
 9 biodiversity index e.g. Simpson's diversity index;
 10 Braun-Blanquet scale / ACFOR / DOMIN;
 11 AVP; e.g. seed and pollen traps max 5 [5]
29. (loss of) beneficial organisms;
 ref to, pest predators / biological control;
 removal of pollinators;
 (loss of) food sources / damage to food chains;
 ref to named example e.g. less berries therefore less birds;
 AVP; e.g. example of predator or pollinator
 AVP; e.g. loss of genetic resource max 3 [3]
30. Animalia / animal ;
 phylum ;
 class ;
 Panthera ;
 species ; **A** binomial name [5]
31. reduction in moisture content / dehydration ;
 freezing (-20 °C) ; **A** low temperatures
 growth of adult plants ; 2 max [2]
32. (a) hunting / poaching / AW ;
 habitat destruction ;
 lack of food supply ;
 ref to intraspecific competition / AW ;
 ref to interspecific competition / AW ;
 disease ;
 predation (by other animals) ; 2 max

(b) captive stress / atypical behaviour ;
 altered breeding cycles ;
 inability to mate due to foreign situation idea ;
 compatibility of mate / AW ;
 unknown habitat requirements / AW ;
 dietary requirements ;
 AVP ;

3 max

(c) too tame ;
 open to predation ;
 unable to reintegrate back into population ;
 difficulties in finding food ;
 predators / poachers, still present in area ;
 habitat, has changed / disappeared ;
 AVP ; e.g. behaviour has been altered
 AVP ; resistance from local human population

2 max

(d) ref to, inbreeding / inbreeding depression ;
 decrease in size of gene pool ;
 inheritance of recessive, alleles / characteristics ; **R** genes
 passed onto future generations ;
 leads to a decrease in population numbers again ;
 loss of certain alleles from the gene pool ; **R** genes
 vulnerability to disease ;

3 max

[10]

33. maintains, genetic diversity / genetic variation / species diversity / large gene pool /
 biodiversity ;
 preserves species which could have medicinal benefits ;
 preserves alternative species of crops if others diseased ;
 preserves species which could be grown if climate changed ;
 AVP ; e.g. preserves attractive species / duty of humans to preserve other species
 AVP ; e.g. for genetic engineering

2 max

[2]

34. (i) to maintain genetic diversity / prevent genetic erosion ;
A maintain, genetic variation / gene pool
 for, future / unknown / potential, use ;
 for changed environmental conditions ; **A** climate change
 e.g. of such change ;
 to counteract, inbreeding / extinction ; 3 max
- (ii) use, emasculated hermaphrodite / female plant ;
 cross with, male / hermaphrodite, with resistance ; **A** female resistant and
 male not offspring, grown in presence of disease / challenged ;
 select offspring with resistance and commercial traits ;
 cross to commercial plant for alleles of background genes ;
 idea of many generations ; 3 max
- [6]**
35. (i) numbers have become low / habitat reduced, qualified ;
 population reached a critical level / AW ;
 there is a risk of extinction ; 2
- (ii) shot to prevent damage to farmland ; **A** other appropriate reason
 habitat destruction ;
 hunting ;
 poaching ;
 killed for horn ; **A** ivory
 killed, for meat / hides ; 2 max
- [4]**
36. trees felled for wood (to sell / export) ;
 cleared for, agricultural land / cash crops ;
 cleared for building, villages / towns ;
 cleared for roads ;
 mining / industrial development ;
 AVP ; 3 max
- [3]**

37. *mark up to a maximum of 3 for each section*

economic reasons

some species may be of use in the future ;
for medical uses ; *accept in either section*
example ;
for, agricultural / silvicultural, purposes ;
(eco)tourism ;
prevention of natural disasters ;
save local forest communities ;
AVP ;

ethical reasons

idea that man has no right to cause the extinction of species, so must be prepared to help save them ;

need to save them for future generations ;
aesthetic reasons ;
ref to indigenous people(s) ;
AVP ;

both ethical and economic

sustainable use of resource ;
ref to example of sustainable use ;
ref to use of genetic material ;
ref to gene pool ;

5 max

[5]

- (b) *ecological*
- 1 prevents disruption of food, chains / webs;
 - 2 maintenance of, ecosystems / habitats;
 - 3 interdependence of species / AW;
 - 4+5 credit two good examples;; e.g. dispersal of seeds, pollination
 - 6 AVP; max 3
- economic*
- 7 importance of gene pool;
 - 8 some species, may be of use in the future / not yet discovered;
 - 9 for medicinal purposes;
 - 10 example;
 - 11 fishing / agricultural / silvicultural, purposes;
 - 12 could be crossed with existing agricultural, species / strains;
 - 13 to improve yield;
 - 14 increase hardiness;
 - 15 increase, disease / pest resistance;
 - 16 tourism;
 - 17 AVP; max 4
- ethical*
- 18 reduction in biodiversity is a result of human activity, so have a moral responsibility to try to put things right / AW;
 - 19 for future generations;
 - 20 AVP; max 8
- QWC – legible text with accurate spelling, punctuation and grammar;** 1
- (c) purchase of land;
 setting up, nature reserves / bird reserves / nesting sites;
 managing of such reserves / full time wardens;
 recruiting / training, volunteers;
 education / raising public awareness;
 through advertising / national campaigns;
 giving talks / lectures;
 publishing magazines;
 bird / wildlife, surveys;
 selling products; e.g. nest boxes, bird feeders
 lobbying Members of Parliament; **R** Government
 monitoring any activities which might harm, wildlife / habitats;
 prosecuting, egg collectors / dealers in endangered species;
 AVP; e.g. rehabilitation of injured wildlife, captive breeding and release programmes max 4

[15]