

1. obese;
iron;
haemoglobin;

[3]

2. 24.7;;

If answer incorrect or to the wrong number of dp, then

ALLOW one mark for working: $69 \div 1.67^2$

24.74 = one mark

IGNORE 25 and look for working mark

*If units are given, they **must** be kg m^{-2} (or kg/m^2)*

Max 1 for incorrect units

[2]

3. (i) overweight / borderline overweight;

DO NOT CREDIT if more than one answer given

1

- (ii) 1 very close to border / AW;

DO NOT CREDIT mistake reading graph

- 2 graph does not distinguish between male and female;

- 3 does not measure actual fat / AW;

- 4 has, more / less, muscle / bone (than normal)

OR

(does not take into account) muscle / bone, mass / density / weight;

Must refer to idea of amount of muscle / bone being different from normal.

DO NOT CREDIT muscle / bone unqualified

CREDIT has osteoporosis as ref. to different bone density

- 5 muscle / bone, heavier / denser, than fat / AW;

- 6 pregnant;

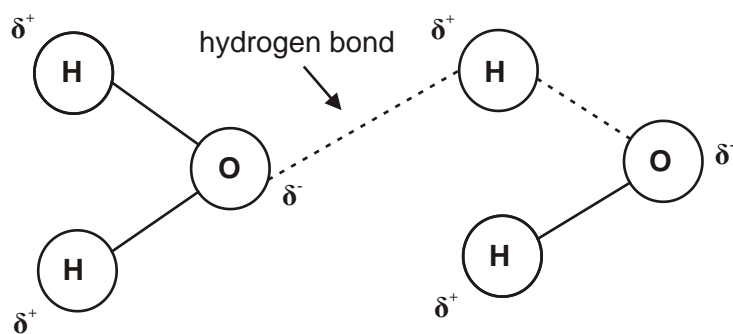
2 max

[3]

4. 1 coronary heart disease / CHD / atherosclerosis / angina /
coronary thrombosis / myocardial infarction / heart attack /
cardiac arrest / cardiovascular disease / stroke;
DO NOT CREDIT heart disease alone / arteriosclerosis
- 2 (osteo)arthritis;
DO NOT CREDIT rheumatoid arthritis
- 3 (Type 2) diabetes;
DO NOT CREDIT Type 1 diabetes
- 4 high blood pressure / hypertension;
- 5 gallstones;
- 6 cancer;
ACCEPT any type of cancer

[2]

5.



- 1 hydrogen bond represented as,
horizontal / vertical, dashed line between **O** on one molecule and **H** on the adjacent
molecule;
*DO NOT CREDIT if >1 H bond is drawn between the same
two molecules*
- 2 hydrogen / **H**, bond label (on any drawn bond between 2 molecules);
- 3 (delta positive) δ^+ on **each** drawn **H**
and (delta negative) (2) δ^- on **each** drawn **O**;
*if both molecules drawn, δ^+ and δ^- on **all** atoms.
ACCEPT d (lower case) for δ*

[3]

6. *ice floats*

P1 (ice less dense because) molecules spread out;

P2 molecules form, crystal structure / lattice / AW;

P3 ice forms insulating layer / clearly described;

e.g. acts as a barrier to the cold

P4 water (below ice), does not freeze / still liquid / remains water / kept at higher temperature;

S1 organisms do not freeze;

DO NOT ACCEPT die (because 'survival' stated in stem)

S2 animals / organisms, can still, swim / move;

S3 allows, currents / nutrients, to circulate;

solubility

P5 ions / named ion, polar / charged;

P6 ions / named ion, attracted to / bind to / interact with, water;

S4 (named) organisms / plants / animals, uptake / AW, minerals / named mineral / nutrients;

ACCEPT obtain / enters / goes in / gets

S5 correct use of named, mineral / nutrient, in organism;

*needs to be more specific than 'for growth / metabolism'
suitable examples include but are not limited to: nitrates for
amino acids / protein / (named) nucleic acid / phosphate for
ATP / phospholipids / plasma membrane / magnesium for
chlorophyll etc*

temperature stability

P7 many / stable, (hydrogen) bonds between molecules;

*Many hydrogen bonds between molecules = 2 marks (gets P7
and H)*

P8 at lot of energy to, force apart molecules / break bonds;

ACCEPT heat as alternative to energy

P9 high (specific) heat capacity;

DO NOT CREDIT latent heat capacity

S6 temperature does not change much / small variation in temperature;

*could refer to organisms **or** surrounding water*

ACCEPT stays cool in summer / stays warm in winter

DO NOT CREDIT constant alone

S7 effect of temperature on, enzymes / metabolic rate;

ACCEPT any reference to temperature affecting enzyme activity / metabolic rate

S8 gases remain soluble;

Award once in any section

H hydrogen bonds;

DO NOT CREDIT if in incorrect context

(e.g. they are strong bonds)

7 max

QWC - Award if you see a P mark **and** an S mark within the **same** section;

Look for the S mark first, then award QWC if there is a P mark in the same section in the mark scheme

1

[8]

7. hydrolysis / hydrolytic;
hydrophilic;

ACCEPT phonetic spelling throughout

IGNORE head

[2]

8. (i) X;

1

- (ii) 1 substrate / PABA, **and**, inhibitor / sulfonamide, similar shape;
ACCEPT similar structure DO NOT CREDIT same
- 2 able to, bind / fit into / block, active site;
- 3 (shape) complimentary to active site;
DO NOT CREDIT refs to PABA and sulfonamide being complementary to each other or to the enzyme (alone)
- 4 both have, hex / benzene / 6-C, (ring);
- 5 both have, NH₂ / amine;
- 6 correct ref to a difference between sulfonamide and PABA;
*e.g. only sulfonamide contains S
sulfonamide has 1 more NH₂ group
sulfonamide has SONH₂ but PABA has N₂
only PABA has COOH group*

3

[4]

9. (i) *without inhibitor*

- 1 more, PABA / substrate, molecules enter active site;
ACCEPT more successful collisions between substrate and active site
- 2 more, enzyme substrate complexes / ESCs, formed;
- 3 at low concentration not all active sites occupied / at high concentration all active sites occupied;
*ACCEPT active sites filled / no free active sites
DO NOT CREDIT active sites run out*
- 4 achieves / reaches, max (turnover) rate / V_{max};
*ACCEPT 'cannot work any quicker'
DO NOT CREDIT 'optimum rate' or 'rate levels off'*
- 5 (at high substrate concentration) enzyme concentration limiting;

3 max

(ii) *with inhibitor*

- 1 inhibitor / sulfonamide, can, fit / block / bind to / compete for, active site;
- 2 (occupies it) for a short time / temporary / reversibly;
- 3 fewer active sites available (for substrate) / AW;
ACCEPT substrate can't access active site
- 4 (idea of) more substrate reduces chance of inhibitor getting in;
ACCEPT more ESC formed in context of overcoming inhibition / substrate can out-compete inhibitor

2 max

[5]

10. ***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]

11. (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]

12. (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]

13. (a) (i) L;
M;
J;

If 2nd letter given, no mark

3

- (ii) **CREDIT** answers from clearly drawn diagrams with bonds labelled

- 1 peptide bond;
ACCEPT peptide link
- 2 between, amine / **J** group (of one amino acid) and carboxyl / **L** group (of another);
- 3 H (from amine group) combines with OH (from carboxyl group);
- 4 condensation reaction
OR
water, lost / eliminated / produced / created / AW;
- 5 covalent;

3 max

- (b) **1** some R groups, attract / repel;
- 2** disulfide, bridges / bond;
- 3** between, cysteine / SH / S (atoms);
- 4** hydrogen / H, bonds;
DO NOT CREDIT in context of *secondary* structure
- 5** ionic bonds between, oppositely charged / + and -, R groups;
- 6** hydrophilic R groups, on outside of molecule / in contact with water (molecules);
- 7** hydrophobic R groups, on inside of molecule / shielded from water (molecules);

4 max

[10]

j

14. (i) **AWARD 1 mark per correct row**
Comparative statements must be made in a row

	glycogen	collagen	
1	carbohydrate / polysaccharide	protein / polypeptide	;
2	(alpha) glucose (units)	amino acid (units)	;
3	identical units	different amino acid units	;
4	glycosidic, bonds / links	peptide, bonds / links	;
5	branched	unbranched / linear	;
6	non-helical	helical	;
7	one chain (per molecule)	three chains (per molecule)	;
8	no cross links	cross links (between chains)	;
9	contains C H O	contains C H O N	;

2 **DO NOT CREDIT** beta

5 **ALLOW** straight

7 **DO NOT CREDIT** strands

9 **IGNORE S** (for collagen)

3 max

(ii) (high tensile) strength / strong;
IGNORE fibrous / tough

does not stretch / is not elastic;

insoluble;

flexible;

Mark the 1st answer on each numbered line

2 max

[5]

15. (i) (diagram shows that some) individuals have more than one risk factor;

DO NOT CREDIT CHD is multifactorial

1

- (ii) *Mark the 1st answer on each numbered line.*

- 1 high, saturated / animal, fat diet;
ACCEPT absence of polyunsaturated fats
- 2 high salt intake;
- 3 (diet) low in (named) antioxidants / vitamin A / vitamin C / vitamin E;
- 4 obesity;
- 5 genetic / heredity / inherited / ethnicity / race;
- 6 gender / sex;
- 7 excess alcohol consumption;
must indicate, excess / high levels
- 8 (increasing) age;
- 9 diabetes;
- 10 stress;

2 max

- (iii) **DO NOT CREDIT** hybrid ticks
IGNORE crosses in the 'blank' boxes

effect	nicotine	carbon monoxide	
increases heart rate	✓		;
constricts arterioles	✓		;
damages the lining of arteries		✓	;
reduces the ability of haemoglobin to carry oxygen		✓	;
makes platelets sticky	✓		;

4

[7]

16. 1 damage to endothelium;
 2 LDLs contain, saturated fat / cholesterol;
 DO NOT CREDIT moves / transports
 CREDIT LDLs are protein and saturated fat / cholesterol
 3 LDLs collect at site of damage;
 must be stated
 4 fatty substances / cholesterol / LDLs, deposited, in artery wall / under
 endothelium;
 ACCEPT fats / lipids
 ACCEPT under lining of artery wall
 DO NOT CREDIT veins / vessels / capillaries

[2]

17. 1 increases size / AW, of lumen;
 ACCEPT reduces blockage in lumen
 2 increases / eases / decreases resistance to, blood flow;
 ACCEPT 'more blood' / 'blood flows more freely' /
 'blood flows as normal' / 'quicker blood flow'
 3 (therefore) more, O₂ / glucose;
 needs idea of more oxygen (than before operation)
 CREDIT idea of preventing oxygen starvation
 4 for aerobic respiration;
 5 in, heart muscle / cardiac muscle / myocardium;
 6 more CO₂ removed;
 'i more oxygenated blood' gets mark points 2 and 3

[4]

18. (i) deoxyribose (sugar);
 phosphate (group);
 DO NOT CREDIT dioxyribose
 DO NOT CREDIT phosphate head or phosphate backbone
 (nitrogenous / purine or pyrimidine) base / one correctly named base;
 DO NOT CREDIT letter instead of named base
 DO NOT CREDIT uracil
 DO NOT CREDIT incorrect spelling of thymine with 'a'

- (ii) has ribose;
 uracil / U, instead of, thymine / T;
DO NOT CREDIT *incorrect spelling of thymine with 'a'*
 single stranded;
 3 forms / AW;
assume answer refers to RNA unless otherwise stated

2 max

[5]

19. 1 untwist / unwind;
DO NOT CREDIT *unravel*
- S 2 unzip / described;
DO NOT CREDIT *strands separating without qualification*
- S 3 H bond breaks;
 4 both strands act as template;
- N 5 (aligning of) free (DNA) nucleotides;
DO NOT CREDIT *bases*
- N 6 complementary, base / nucleotide, pairing;
- N 7 C to G **and** T to A / purine to pyrimidine;
6 & 7 *Do not consider for QWC if mark awarded in the context of breaking apart or DNA structure only, rather than forming new double helix*

- R 8 hydrogen bonds reform;
 R 9 sugar-phosphate back bone forms;
 R 10 (using) covalent / phosphodiester, bond;
 11 semi-conservative replication;
 12 DNA polymerase;
 CREDIT at any stage in the process
 13 AVP;
 e.g. ligase / helicase / gyrase used in correct context
 C – G 3 H bonds / T – A 2 H bonds
 activation of free nucleotides (with 2 phosphates)
 synthesis in the 5' to 3' direction
 Okazaki fragments on lagging strand

6 max

QWC - correct sequence - 1 **S** mark, then 1 **N** mark, then 1 **R** mark;

*It should be clear that candidate realises that the sequence is S,
 then N then R - even if not written in that order*

DO NOT CREDIT if any ref to transcription / translation

1

[7]

20. (i) polypeptide / protein / primary structure / a sequence of amino acids;
 DO NOT CREDIT 'codes for an amino acid'
 IGNORE enzyme / named protein

1

- (ii) different, sequence of amino acids / primary structure / AW;
 different protein / protein folds up differently / different tertiary structure;
 (product) no longer functions / different function;

DO NOT CREDIT 'product' or incorrect biochemical (e.g. carbohydrate)

ACCEPT suitable example, e.g. active site of enzyme no longer complimentary to substrate

2 max

[3]

21. (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]

22. double helix;
 anti-parallel;
 sugar-phosphate;
 hydrogen;

[4]

23. (i) percentages / amount, C & G similar (in all organisms);
 percentages / amount, A & T similar (in all organisms);
different / named, organisms have different proportions of,
 bases / named base / AW;
 greatest similarity between human and grasshopper;
 least similarity between *E coli* and the other three;
E. coli has similar proportions of all bases /
E.coli has slightly more CG than AT /
 (named) eukaryote has more AT than CG;

mp 1 & 2 DO NOT CREDIT ref to a single organism

mp 1 & 2 IGNORE ref to complementary

DO NOT CREDIT statements in context of organism size

e.g. statement that human has more A than E. coli /

human has the most AT / E. coli has the most CG

This mark is for a general statement

comparative figs with units to support any statement;

e.g. human C = 19.8% and G = 19.9%

human A = 30.9% and E. coli A = 24.7%

'human has more A (30.9%) than wheat (27.3%)' = 2

(mp 3 & 7)

3 max

- (ii) (suggests) A, bonds / pairs / links / connects / joins, to T;
 (suggests) C, bonds / pairs / links / connects / joins, to G;
 (suggests) purine bonds to pyrimidine;
 (evidence for) complementary base pairing /
 which bases pair with each other / base pairing rules;
 suggests bases point 'inwards' rather than 'outwards';

IGNORE *A – T or A = T unqualified*

IGNORE *C – G or C = G unqualified*

ACCEPT *'bond' instead of 'pair'*

2 max

[5]

24. Award 1 mark per correct row

<i>feature</i>	<i>DNA</i>	<i>RNA</i>
<i>number of strands</i>	two / double	one / single
<i>bases present</i>	thymine / T (+ adenine + cytosine + guanine)	uracil / U (+ adenine + cytosine + guanine)
<i>sugar present</i>	deoxyribose	ribose

If a choice of answers is given, do not credit unless both answers are valid (e.g. two and double strands for DNA / ribose and pentose sugar)

ACCEPT letters instead of names of bases

Names of bases must be unambiguous, so

DO NOT CREDIT adenosine / thiamine / cysteine / etc.

If more bases mentioned than T and U, then all bases must be included

DO NOT CREDIT dioxyribose / oxyribose / hexose / sugar

IGNORE pentose

[3]

25. carries / transfers, the (complementary DNA),
code / genetic information / copy of gene;
out of the nucleus;
(transfers it) to the, ribosome / RER / site of translation;
for, protein / polypeptide, synthesis;

IGNORE transcription

DO NOT CREDIT ref to the whole DNA code / molecule

ACCEPT 'to make protein'

[2]

26. (a) (i) Plasmodium;

Look for correct spelling of generic name but do not penalise the use of lower case initial letter.

*We are not looking for specific name(s), so **IGNORE** species name.*

So e.g. Plasmodium falciparum should be credited

*but **NOT** P. falciparum / P. vivax / P. ovale / P. malariae*

- (ii) female *Anopheles*;

CREDIT phonetic spelling but genus must be correct

1

- (iii) hepatocyte / liver (cell);
erythrocyte / red blood (cell);

If a choice of answers is given do not credit unless both are valid.

DO NOT CREDIT 'RBC' as this is not a name

1 max

- (b) (i) humoral response;

- (ii) (B) cell / lymphocyte,
has antigen receptor / carries antibody on its surface;

- (iii) specific to / matches / complementary to, only one antigen;

- (iv) clonal selection;

- (v) selection / activation, of, appropriate / specific,
B lymphocyte / B cell;

- (vi) by, macrophages / antigen presenting cells / dendritic cells /
T helper cells / cytokines / interleukins;

- (vii) clonal expansion;

- (viii) (selected cell) divides by mitosis / clones;

- (ix) (B) cells, differentiate / specialise;

- (x) (B cells) form, plasma / effector, cells;

- (xi) (which) secrete / produce, antibodies;

ACCEPT 'forms antigen-antibody complex'

- (xii) antibodies are, specific / complementary, to antigen;

- (xiii) (B cells) form memory cells;

- (xiv) **Either** (memory cells) long-lived / remain in circulation /
remain in body / provide immunological memory
or (provides) secondary response
or faster / stronger, response to subsequent exposure
(of same antigen / pathogen / parasite);

DO NOT CREDIT ref to disease alone

7 max

QWC ~ correct sequence;

*Clonal selection, then clonal expansion, then differentiation
(stages named or described)*

*Use the QWC tool to indicate these in the correct
sequence and add 1 mark to the 7max for content when
all 3 stages have been addressed in the correct sequence.*

1

- (c) Assume that candidates are answering in terms of a person
leaving the malarial area (unless otherwise stated).

no repeat infections /

no further exposure (to antigen / pathogen / parasite);

no booster / lose immunological memory;

DO NOT CREDIT disease / malaria / bacterium / virus

limited life for memory cells / numbers of memory cells reduce

/ memory cells lost;

so no, secondary response / secondary response described;

CREDIT converse points if they answer the question in the
context of a person staying in the malarial area.

e.g. repeat infections;

maintain immunological memory;

memory cells present;

secondary response available;

2

- (d) different, strains / species / types (*of Plasmodium*);
different antigens;
due to, mutation / variation;

DO NOT CREDIT 'disease' or 'malaria' unqualified
Max 2 if they think it is a virus / bacterium

more than one stage in the life cycle (within human);
different stages have different antigens;

so will need, a different vaccine / components of vaccine,
for each, strain / stage;

'different strains will require different vaccines' = 2
(mp 1 & 6)

(parasite) concealed / hidden, in cells;
(parasite) only, exposed / in circulation, for short time;

CREDIT antigenic concealment

AVP;

e.g. antigenic, shift / drift
eukaryotes have greater capacity for variation
antigens (on parasite) change over time when in
human

3

[16]

27. (a) (i) A hydrogen;
B glycosidic;

DO NOT CREDIT 'H bond' as this is not a name
Correct spelling only.
IGNORE α or β or numbers

2

- (ii) hydrolysis / addition of water;

1

- (iii) β / beta, glucose;

Must be qualified as β or beta or B or b

1

- (b) enzymes are specific;
the, carbohydrate molecules / substrates,
are different shapes;

active site and substrate are complementary;
so that substrate will fit / formation of ESC;
lock and key / induced fit;

3 max

- (c) (i) pH much, higher / less acidic, than optimum (for enzyme 2);

*Needs idea of much greater or too high
DO NOT CREDIT just 'higher than' or 'above'
DO NOT CREDIT too / more, alkaline*

change in charge of active site;
hydrogen / ionic, bonds break;

tertiary structure / 3D shape / active site shape, altered;
enzyme / tertiary structure, denatured;

*DO NOT CREDIT peptide / disulphide, bonds break
DO NOT CREDIT in context of heat / vibration*

IGNORE ref to denaturing active site

IGNORE ref to denaturing active site

DO NOT CREDIT kill / die

substrate no longer fits active site / ESC does not form;

'substrate doesn't bind to enzyme' is not quite enough

3 max

- (ii) *Mark 1st response on each numbered line unless no answer on one line, then mark 1st 2 answers*

temperature;
substrate concentration;
enzyme concentration;

IGNORE ref to time

2 max

[12]

28. Marking points 2 – 6 can be applied to the standard solutions or the sample

- 1 using, standard / known, concentrations (of reducing sugar);
- 2 heat with, Benedicts (solution) / $\text{CuSO}_4 + \text{NaOH}$;
- 3 (use of) same volumes of solutions (each time);
- 4 (use of) excess Benedicts;
- 5 changes to, green / yellow / orange / brown / (brick) red;
- 6 remove precipitate / obtain filtrate;
- 7 calibrate / zero, colorimeter;

- 8 using, a blank / water / unreacted Benedicts;
 9 use (red) filter;
 10 reading of, transmission / absorbance;
 11 more transmission / less absorbance, of filtrate
 = more sugar present; **ora**
 12 (obtain) calibration curve;
 13 plotting, transmission / absorbance,
 against (reducing) sugar concentration;
 14 use reading of unknown sugar solution and read off graph
 to find conc.;

e.g. serial dilutions

ALLOW boil / > 80°C **DO NOT CREDIT** warm
DO NOT CREDIT amount / quantity

CREDIT description of method
e.g. filtering / centrifuging & decanting

ACCEPT 'measure how much light, does / does not,
 pass through'

*If precipitate is **clearly indicated** as being present in
 sample, **ALLOW** 'less transmission / more absorbance,
 = more sugar present'*

[6]

29. (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]

30. (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]

31. 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]

32. 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]

33. (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]

34. (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]

35. 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]

36. (i) named component of cigarette smoke
 (correctly linked to a stated problem);
tar, hydrogen cyanide, carbon monoxide (but NOT in context of Hb), ammonia, sulphur dioxide
 destroy / paralyse, cilia;
 mucus not removed;
tar
 over-active goblet cells / extra mucus produced;
 (accumulation of mucus) leads to, infections / bronchitis;

e.g. 'tar destroys cilia' = 2

(1 for this mark, linking the component with a stated problem, and also the mark for destroying cilia)

DO NOT CREDIT tar more than once

IGNORE nicotine

neutrophils / phagocytes / macrophages / monocytes (invade);
 secrete, enzyme / elastase;
 elastin / elastic fibres, digested / destroyed;
 low(er) level of, elastase inhibitor / α antitrypsinase;
 alveoli fail to recoil;
 constriction of (terminal) bronchioles;
 (so) coughing / forced expiration, causes alveoli to burst;
 reduced surface area;

ALLOW white blood cells

DO NOT CREDIT lymphocytes

CREDIT formation of scar tissue / fibrosis

5 max

QWC;

Award if at least 1 mark has been given from each of the mark scheme sections for this question.

Use the **QWC** symbol and add to the content mark(s).

1

- (ii) shortness of breath / shallow breathing /
 strained breathing / hard to breathe out / wheezing;
 barrel chest;
 fatigue / extreme tiredness / cannot exert themselves;
pulmonary hypertension / high blood pressure to lungs;
 enlargement of right side of heart;
 heart failure / congestive cardiac failure / fluid buildup in lungs;
 cyanosis / skin with blue tinge;

DO NOT CREDIT difficulty in breathing / heavy breathing /
 hard to breathe in

e.g. cannot walk far

DO NOT CREDIT heart attack / MI / CHD / COPD

ALLOW grey / ashen

DO NOT CREDIT pale unqualified

2 max

- (iii) long term / lifelong / persistent;
 slow onset / takes time for the symptoms to show;
 (usually) degenerative / gets (progressively) worse;

ALLOW no cure / irreversible

IGNORE ref to death

2 max

[10]

37. (i) rises in both, initially / until age 15;
 (always) lower in smoker / higher in non smoker;
 gap / difference, increases with age;
 in non smoker, plateaus / flattens / increase slows,
 after 17 / at 18 or 19;
 in smoker falls after, 15 / 16;
 in smoker, trough / fall then rise / minimum / anomaly, at 17;
 figs to compare;

*Two sets of x and y figures with **units for peak flow rate**
at least once – **must compare**
either peak flow of smoker and non-smoker at same
 stated age
or peak flow at two different stated ages for same person
 Could be in the same place or in different parts of the
 answer*

4 max

- (ii) (initial increase as) lungs grow with age;
 loss of, elastin / elastic fibres, in alveoli;
 reduced / no, recoil;
 decreased diameter of / thicker smooth muscle in /
 scar tissue in / inflammation of /
 blockage due to mucus of, (named) airways;
 increase in resistance to air flow;
 suitable explanation for, low / anomalous, reading at 17;

*e.g. infection / unreliable (procedure) / asthma
IGNORE ref to increased smoking*

2 max

- (iii) more individuals (male) should be used;
 replicates / repeat measurements (at one time);
 calculate, mean / average;
 identify / deal with, anomalous results;
 take measurements at more frequent intervals;
 controlled variable;

e.g. every 6 months

*Suitable examples include but are **not** limited to
 make sure that ...*

- *same number of cigarettes smoked*
- *same type of cigarette*
- *similar level of fitness*
- *similar, build / body size*
- *exclude individuals with other respiratory problems
 (e.g. asthma / bronchitis)*
- *same exposure to,
 passive smoking / environmental pollution*

DO NOT CREDIT *ref to females / (general) health /
 occupation unqualified / lifestyle*

3 max

[9]

38. breaking (glycosidic) bond;
 glycosidic / correct bond drawn;
 addition of water / H₂O;

R if incorrect named bond
 treat 'covalent' = neutral

max 2

[2]

39. accept ✓ = yes ✗ = no
each correct row = 1 mark

	gum arabic	amylase	cellulose	glycogen
branched structure		no;		yes;
heteropolysaccharide		no;		no;
found in animals/plants		plants;		animals;
function in organism		storage / reserve; R 'energy' alone	structural / strength / stops bursting / cell wall / support / gives cell shape; R protects rigid = neutral	

[4]

40. (i) crush (small amount of) seed pod;
add (small volume of) biuret, A / NaOH, and biuret, B / CuSO₄;
positive = colour change from blue to, mauve/purple;

max 2

- (ii) *preparation - allow 2 marks max:*

- 1 crush, samples / leaves and seed pods, separately with water;
- 2 use same mass of each / AW and use same volume of water;
- 3 filter;

method - allow 4 marks max:

- 4 add benedict's reagent to filtrate; **A** CuSO₄ in alkaline solution
- 5 excess reagent used / stated volume;
- 6 same volume added;
- 7 heat in a water bath/ at near boiling;
- 8 for stated time (up to 5 min);

analysis - allow 2 marks max:

either

- 9 colour change from blue to green / yellow / orange / red;
- 10 shows increasing concentration of reducing sugar;

or

- 11 use of centrifuge to remove precipitate;
- 12 use of colorimeter to compare intensity of blue colour in liquid portion;
- 13 red filter used in colorimeter;

8

- (iii) humans eat only the seeds so do not gain, nutrition / energy, from, leaves / pods;
 seeds maybe deficient in (some) essential amino acids;
 cattle better at digesting, plant matter / seeds / leaves / pods, than humans / AW;
 meat (from cattle) provides more essential amino acids for humans (than plant material)/AW;
 cattle also produce milk;
 AVP; e.g. cattle naturally roam to find food / intensive labour needed for human collection of plant material;

max 3

[13]

41. (i) deoxyribose sugar;
 a nitrogenous/ nitrogen containing, base / named base; ecf for thiamine phosphate group;
 AVP; e.g. deoxyribose is a pentose sugar/correct diagram of same
accept A, T, G and C in place of names.

max 3

- (ii) hydrogen bonds between bases;
complementary base pairing;
 purine to pyrimidine;
 A to T and G to C;
 AVP; further detail e.g. 2 H bonds between A and T / 3 H bonds between C and G
 DNA polymerase

max 4

[7]

42. ribose (instead of deoxyribose);
 uracil / U, replaces thymine;
 single stranded (instead of double stranded);
 smaller molecule / different 3-D structure to DNA;

[3]

43. (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]**
44. (a) *award two marks if correct answer (12) is given*
 6/30 / 6/0.5 × 60;
 12; 2
- (b) *assume candidates are referring to the initial rate unless otherwise stated.*
 concentration of, substrate / H₂O₂, molecules, high / higher at start;
 more chance of, substrate/ H₂O₂, molecules entering active site;
 all / most, active sites occupied; 3
- [5]**
45. *at optimum temp - max 3 marks*
 molecules in culture have kinetic energy;
 (frequent) collisions between enzyme and substrate molecules;
 more enzyme-substrate complexes formed;
 max rate of reaction / protein production achieved;
- at higher temp - max 5 marks*
 (at higher temperature) molecules have more kinetic energy / collisions occur more frequently and with more energy;
 molecules vibrate and, bonds/ hydrogen bonds, broken;
 tertiary structure / 3D shape, of enzymes altered;
 active site loses, precise / complementary, shape;
 enzymes are denatured;
 substrate molecule no longer fits active site;
 (may be) irreversible so reaction/ protein production stops; A fungus destroyed
- [8]**

46. (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]
47. (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]

48. Animalia / animal(s);
Phylum; **A** phylum
Order; **A** order
Panthera;
species;
- [5]
49. Fungi; **A** fungi
Protocista; **A** protocists / protista / protists
- [2]
50. 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]
51. (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]

52. (i) *any three from following:*
 education on HIV / AIDS less effective;
 sexual attitudes / number of partners;
 availability of condoms;
 poverty / poorer / less money;
 sex industry;
 less primary health care / less likely to be diagnosed;
 AVP; e.g. ref to unscreened or untreated blood
 unsterilised needles or surgical apparatus
 civil war / rape
 no alternative to breast feeding
 R access to drugs for treatment
 R no vaccine
 R ref to intravenous drug addiction 3

- (ii) *any three from the following:*
 to find out where rates, are highest / people are most at risk;
 to keep track of infection rates over time/ AW;
 to see where disease is likely to spread / where epidemic most likely;
 to help research (into how it is spread / into effectiveness of drugs);
 to allow organisations to provide, aid / health care, where it is needed most;
 to allow organisations to provide education (about disease) where it is
 needed most;
 AVP; e.g. tourist industry 4

[7]

53. find person who is immune and isolate gene that provides immunity;
 use gene to find shape of protein that provides immunity and manufacture
 protein to use as vaccination / cure;
 find shape of CD4 receptor;
 develop drug to block receptor; max 2

[2]

54. (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]

55. 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]

56. (a) (i) *Mark the first 2 types of biological molecule stated. Absence = neutral
 protein; **A** casein/polypeptide **R** amino acid
 reducing sugar(s); **A** correctly named reducing sugar(s)
 [but only lactose/galactose/glucose]*

2

(ii) *Mark the first 3 types of biological molecule stated. Absence = neutral
 protein; **A** casein/polypeptide **R** amino acid
 reducing sugar(s); **A** correctly named reducing sugar(s)
 [but only lactose/galactose/glucose/fructose]
 non-reducing sugar; **A** sucrose*

3

(b) Assume 'it' = 'Health-Milk'
 'Health – Milk' has
 less reducing sugar(s); **A** *correctly named reducing sugar(s)*
[but only lactose/galactose/glucose/fructose]
 less non-reducing sugar; **A** *sucrose*
 "less sugar" = 1
 credit converse statements relating to 'Energy – Boost'. 2

(c) states 'no added sugar'/implies low sugar;
 contains more sugar than (fresh) milk/high in sugar;
 more reducing sugar (than milk); **R** *'none in fresh milk'*
 has non-reducing sugar (compared to none in milk);
 fruit (extract) must contain (hidden) sugar; 3 max

(d) milk/drinks, already,
 milky/cloudy/white/opaque/'not see through'/emulsion;
A *'positive result would not show up'* **R** *precipitate* 1

[11]

57. (i) **R** *statements linked to amylose/starch*
max 3 if stated that glycogen is amylopectin
 polymer/polysaccharide/described;
 (made of) α -glucose;
 joined by 1,4 links;
 glycosidic;
 (chain is) branched;
 1,6 links where branches attach;
 AVP; e.g. compact
 detail of glycosidic bond 4 max

(ii) condensation; **A** *polymerisation* 1

[5]

58. (i) 37 °C; **A** any figure in the range 35 – 40 1
- (ii) (enzyme) increases in kinetic energy; **A** ‘too much kinetic energy’
 enzyme vibrates too much;
 breaks bonds;
 named eg;
 changes, tertiary/3-D, structure/shape, of enzyme;
active site changes, shape/AW;
 substrate will not fit/no enzyme-substrate complex formed;
 enzyme denatured;
 will, decrease rate/stop reaction; 4 max

[5]

59. 1 mark per correct row

Look for both ticks and crosses.

If a table consists of ticks ONLY or crosses ONLY, then assume that the blank spaces are the other symbol.

If a table consists of ticks, crosses and blanks then the blanks represent no attempt at the answer.

Nucleotides line up along an exposed DNA strand.	✓	✓;
The whole of the double helix ‘unzips’.	✓	✗;
Uracil pairs with adenine.	✗	✓;
A tRNA triplet pairs with an exposed codon.	✗	✗;
Both DNA polynucleotide chains act as templates.	✓	✓;
Adjacent nucleotides bond, forming a sugar-phosphate backbone.	✓	✓;
The original DNA molecule is unchanged after the process.	✗	✓;
Adenine pairs with thymine.	✓	✓;

[8]

60. (a) (clinically) obese/obesity; **R** morbidly obese 1
- (b) **Diet B**
 essential fatty acids/linoleic acid/linolenic acid/fat soluble
 vitamins/A/D /E/K;
Diet C
 sugars/named sugar/starch; **A** vitamin C 2
- (c) (i) B;
 energy intake (of B) is lower ORA; 2

(ii) energy intake is less than energy used ORA; 1

(d) (no fruit may mean) scurvy/described; **R** *vitamin C deficiency unless qualified*

raised, cholesterol/LDL, levels in blood; **R** *intake*
 fatty substances deposited in artery walls/atherosclerosis;
coronary arteries;
 narrows lumen;
 reduces, blood/oxygen, delivered to heart muscle;
 CHD/heart attack/angina;
 thrombosis/clot;
 raised blood pressure/hypertension;
 stroke;

stress on liver;
 stress on kidney;
 due to excess protein/amino acids/urea;

AVP;

AVP; e.g. deposition of subcutaneous fat/AW
 obesity
 stress on joints
 anorexia/bulimia/obsession on diet
 constipation
 bowel cancer
 hypoglycaemia
 giddiness
 lethargy/fatigue/tiredness [*but R 'lack of energy'*]

3 max

[9]

61. physical;
 disease/illness/sickness;
 carbohydrates;
 animal/saturated;
 20; **A** *from 20 to 60*
 70;

6

[6]

62. (a) different methods of recording statistics;
 inaccurate recording of, cause of death/incidence of coronary events;
 poor diagnosis/ORAs;
 coronary event may not be CHD;
 not all (coronary) events cause, mortality/death;
 higher standard of health care (can prevent deaths)/AW/ORAs;
 smoking increases chance of death due to a coronary event (cf. Russia and Finland);

AVP; e.g. availability of, equipment/trained staff/drugs
 speed of medical response
 different levels of exercise/active lifestyle
 different levels of obesity
 different diet
 different genetic (predisposition)
 qualified ref to air pollution

3 max

- (b) no relationship between prevalence of smoking and incidence of coronary events; *A statement that country X (Russia) has high prevalence smoking and high incidence of coronary events while country Y (Scotland or Finland) has low prevalence and high incidence*

use of figures to compare;

e.g.: compare China **and** Russia (both about 68% prevalence of smoking but China has 90 (85-95) per 100 000 coronary events, while Russia has 480 (470-490) per 100 000 coronary events)

no relationship between prevalence of smoking and mortality from CHD; *A statement that country X (Russia) has high prevalence smoking and high incidence of mortality while country Y (Germany) has high prevalence and low incidence*

use of figures to compare;

e.g.: compare China **and** Russia (both 68% prevalence but China has 110 (105-115) per 100 000 deaths while Russia has 710 (705-715) per 100 000 deaths)

2 max

- (c) *mark comments on government strategy only, reject references to personal steps*

qualified reference to

education/advice;

improve diet of population; e.g. food labeling/‘five a day’

screening of population;

reducing levels of obesity in population;

increasing level of exercise in population;

provision of:

specialist paramedics;

more/better equipped, ambulances;

more resuscitation equipment; **A** *ref to funding for equipment*

specialist cardiac care in hospitals/AW; **A** *ref to funding for cardiac care*

improved training of medical personnel;

AVP; e.g. provide money for, equipment/training of first aiders,
in workplace

provide drugs/beta blockers/statins

anti-smoking adverts

tax on tobacco/cigarettes

anti smoking legislation [*eg ban smoking in public places*]

increase funding for research into reducing mortality

legislate to improve quality of food

3 max

[8]

63. (a) plasma/effector; **A B**, *lymphocyte/cell*

1

- (b) (i) bind/attach to antigen;

hold, shape/tertiary structure, of molecule;

hold (polypeptide) chains together/maintain quaternary structure; *max 1*

attach/bind to, phagocyte;

allow molecule to, bend/flex/bind with more than one pathogen/AW;

R *allow molecule to move*

4

- (ii) (different antibodies) have different amino acid sequence;

(different antibodies) have different shape;

(different antibodies) fit different antigens;

ref. to specificity/complementary; **A** *lock and key*

2 max

[7]

64. (i) *time taken for*
antigen presentation/AW;
clonal selection/AW;
clonal expansion/AW;
differentiation (of B cell into plasma cell);
production of antibodies;
there are no memory cells;
AVP; e.g. more detail of one of the above 2 max
- (ii) rise starts between day 31 and 35;
rise is steeper and rises higher (50au) than first response;
concentration declines, more slowly/with less steep gradient; 2 max
- [4]
65. (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]

66. (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]
67. (i) binary fission;
DNA replicates;
mitosis;
membrane forms/cytokinesis;
two cells produced;
genetically identical/clones; 2 max
- (ii) one parent only required/no need to find a mate;
no gametes/no energy wasted producing gametes;
large numbers of offspring/rapid reproduction;
spreads (quickly) before destroyed by host immune system/AW;
AVP; e.g. retain, advantageous alleles/adaptation to environment 2 max
- [4]
68. hydrolysis (of Hb);
by enzymes;
proteases;
breaks peptide bonds;
removal of haem group;
reference to, diffusion/active transport/pinocytosis/channel proteins;
AVP; 3 max
- [3]

69. (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]
70. (a) persistent chemical/AW;
builds up in food chains;
still used in other parts of the world; (and so can still enter ecosystems)
ref to global cycling;
AVP; max 2
- (b) to remove weeds from crops to increase yield/AW;
ref to decreased competition (in crops)/AW;
quicker and cheaper (than using labourers);
ref to size of target species;
ref to specificity of insecticides/ora;
ref to validity of data in study/ref to comparative data;
AVP; max 3
- [5]
71. Tau-fluvalinate;
less needed/ref to data with correct units; max 2
- [2]

72. *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]**
73. *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]**
74. (i) $\frac{105}{(1.7)^2}$; A 105/2.89
 BMI = 36; A 36.3 or 36.33 2
- (ii) BMI is 35 to 39.9; A *ecf*
 relative risk of dying is 1.45; A *number between 1.4 and 1.5*
 she is, 45%/nearly half as much again, more likely to die from
 cancer than non-obese person; max 2
- [4]**

75. one mark for each correct row

if only ticks, assume that spaces are crosses; if only crosses, assume that spaces are ticks

R hybrid ticks

substance	statement					
	use heat	use biuret reagent	use Benedict's reagent	boil with a dilute acid	a positive result is a blue-black colour	a positive result is an emulsion
lipid	✗	✗	✗	✗	✗	✓
protein	✗	✓	✗	✗	✗	✗;
starch	✗	✗	✗	✗	✓	✗;
reducing sugar	✓	✗	✓	✗	✗	✗;
non-reducing sugar	✓	✗	✓	✓	✗	✗;

4

[4]

76. (i) glycosidic; A covalent / C-O-C / oxygen bridge
R oxygen bond / 'glucosidic'

1

(ii) hydrolysis / hydrolytic; *if qualified, needs to be correct*

1

[2]

77. 1 no (suitable) enzyme (in gut) to digest sucralose /
sucrase will not act on sucralose / AW;

2 enzymes, are specific / only act on one substrate;

3 complementary shape;

4 idea that (C/ on sucralose instead of OH) gives different, shape / structure;

5 no ESC (enzyme substrate complex) / substrate will not fit into active site;

6 AVP; e.g. further detail of enzyme-substrate interaction

4 max

[4]

78. *read whole statement and decide*

inherited; **A** hereditary *treat "genetic" as neutral*
 result in a, gradual / progressive, decline of bodily, tissues /
 functions / **AW**; **R** ref to chronic
 TB / AIDS / cholera / cold / influenza / measles / mumps / malaria /
 chicken pox / cervical cancer / leukaemia / AVP;
A HIV/AIDS *treat "HIV" as neutral*
 mental / psychiatric / psychotic / neurotic;
treat "psychological" as neutral
 permanent or temporary damage to part of the body / any disease that is
 not mental; **A** harm *treat "wear and tear" as neutral*

5

[5]

79. *accept alternative wording that gives idea of each point*

- 1 identify location where disease is spreading *or* predict, where / when, epidemic may arise;
- 2 identify those at risk / contact tracing;
- 3 find a way to prevent spread / isolate / quarantine;
- 4 ref to targeting vaccination;
- 5 give (individuals) advice on, lifestyle / diet / other named risk factor;
- 6 qualified ref to targeting funding;
- 7 ensure sufficient, medicines / antibiotics / vaccines / facilities, are
- 8 available;
- 9 ensure enough medical personnel are available;
- 10 qualified ref to education of population;
- 11 prioritising diseases;
- 12 target screening;
- 13 assess effectiveness of treatment programme;

max 3

[3]

80. (a) (i) produce / secrete / release, mucus;
 prevent collapse of / hold open / support, airways;
A provide shape of bronchus
R gives wall, structure / strength

2

- (ii) cilia, destroyed / damaged; **R** cilia not working
(epithelium replaced by) scar tissue / scarring;
(smooth) muscle becomes thicker;
mucous glands enlarge / larger goblet cells / more goblet cells;
R more mucus secreted
inflammation of connective tissue;
AVP; idea of tumour if it describes a structural change max 2
- (b) stretch, as air is inhaled / allow alveoli to expand during inhalation;
to increase lung volume / surface area;
prevents alveoli bursting;
(elastic fibres) recoil, as exhale; **R** contract
more, complete / rapid, expulsion (from the alveoli); **A** expel more air max 2
- (c) tidal volume is reduced / less air inhaled and exhaled / residual
volume is larger / air trapped in alveoli / vital capacity smaller;
more difficult to exhale;
(as) alveoli cannot, stretch / recoil;
rapid / shallow, breathing / breathlessness / wheezing;
alveoli may burst;
leaves gaps in tissue / larger air spaces / AW;
less surface area (for gaseous exchange);
blood / haemoglobin, less well oxygenated / less carbon dioxide
removed;
R less able to do exercise / need to use oxygen max 4
- [10]**
81. (i) coronary; 1
- (ii) high concentration of, cholesterol / LDL, in blood;
endothelium / lining damaged;
deposition (fat / cholesterol) in wall of artery; **R** “on artery”
ref to plaque / atherosclerosis / atheroma; max 2
- [3]**
82. (i) ref to suitable drug; e.g. anticlotting, blood pressure reducing, diuretic
bypass operation;
stents fitted;
angioplasty / balloon on catheter;
AVP; e.g. name of drug
extra detail about a named drug or one of above procedures max 2

- (ii) avoid, saturated / animal, fats; **A** cholesterol
eat, unsaturated fats / polyunsaturated fats / plant oils / fish oils;
qualified ref to, more / regular, exercise;
avoid smoking;
avoid stress;
eat more, fruit / vegetables / antioxidants; **A** moderate intake of red wine
reduce weight;
reduce alcohol intake;
eat more soluble fibre;
ref to vitamin D production / exposure to sunlight; max 2
- [4]
83. (a) *treat fibre / water as neutral*
carbohydrates / sugars / polysaccharides;
vitamins; 2
- (b) (i) those that must be ingested;
those that cannot be synthesised (by the human body); max 1
- (ii) to make, protein / polypeptide / named protein;
to make, other / non essential, amino acids;
R use in deamination and respiration
treat growth / repair as neutral max 2
- (c) (i) muscle wasting;
oedema / described;
moon face;
swollen, abdomen / liver (**R** stomach) / extremities / hands
/ feet / other named part;
dry / brittle / red / sparse, hair;
skin dry / flaky;
low body weight;
irritability;
apathy;
diarrhoea;
fatty liver;
loss of appetite;
tooth decay;
AVP; e.g. increase in infections, poor immune system,
loss of muscle strength
xerophthalmia / poor night vision max 3

- (ii) age they are weaned *or* younger (than 6-18 months),
 fed on milk / breast-fed;
 milk contains proteins;
 food eaten, cereal / starchy / may have less protein /
 poor quality protein;
 AVP; e.g. weaned early as second child on way / AW
 growing quickly so need lots of protein

max 2

[10]

84. low % infected in, Western Europe / North America;
 high % infected in Sub-Saharan Africa;
 highest % increase in Eastern Europe and Central Asia;
 high % increase in, North Africa / Sub-Saharan Africa / East Asia;
 low % increase in, Western Europe / North America;

figures to illustrate a comparison;

max 2

[2]

85. *HIV/AIDS difficult to prevent because...*

- 1 no cure;
- 2 no vaccine;
- 3 high mutation rate / antigenic, shift / drift / change;
- 4 cannot be treated with antibiotics;
- 5 symptomless carriers / long incubation period;
- 6 HIV is transmitted by, unprotected sexual contact / unscreened blood products / across placenta / in breast feeding / blood to blood contact / mixing of blood / reusing needles;

- 7 people reluctant to be tested for HIV;

Higher rate increase in LEDC because...

marking points below refer to LEDCs

Accept reverse argument in each case

- 8 poverty;
- 9 less education about, means of transmission / disease;
- 10 sexual attitudes / promiscuity / more partners / ref to sex industry;
- 11 lower availability of condoms;
- 12 religious / cultural, reasons;
- 13 denial / superstitious beliefs;
- 14 fewer, medical personnel / clinics / facilities / hospitals / (effective) drugs, (to treat infected people);

- 15 less, screening of blood products / testing of people;
 16 ref to government financial constraints;
 17 (enforced) migration / refugee camps;
 18 more infected mothers breast feed;
 19 more cases of rape;
 20 more intravenous drug abuse;
 21 more use of, shared / unsterilised, needles;
 22 AVP; e.g. lack of contact tracing
 23 AVP; HIV inside cell so hidden from immune system /
 antigens concealed max 7

QWC – legible text with accurate spelling, punctuation and grammar; 1

[8]

86. (a) *Plasmodium*;
 antigens;
 cytotoxic / killer / T killer / T_k / T_c;
 helper / T helper / T_h;
 cytokine / lymphokine;
 memory; 6
- (b) antibodies / immunoglobulins; 1
- (c) 1 several, strains / species, of malarial parasite;
A *P. falciparum* is not the only malarial parasite **R** disease
 2 parasite is a, protist / protoctist / eukaryote;
 3 many surface, proteins / antigens; **A** more than one stage in human
 4 mutation;
 5 ref to antigenic drift / antigens may change;
 6 ref to antigenic shift;
 7 much of life cycle inside, host cells / red blood cells / hepatocytes;
 8 hidden / protected, from immune system;
A ref to antigen concealment
 9 AVP; e.g. qualified ref to economic argument
 low antigenicity max 3

[10]

87. (a) (i) 1 mutation;
 2 random / spontaneous / chance / pre-existing;
 3 natural selection;
 4 drug / insecticide, is, selective agent / selective pressure;
 5 resistants have selective advantage;
 6 resistants survive / susceptibles die;
 7 pass, allele / mutation, to offspring; **R** gene / resistance
 8 allele frequency increases;
 9 rapid because, multiplicative phase / short generation time / large
 10 numbers offspring / many breeding sites; max 5
- (ii) *Plasmodium* inside, liver cell / red blood cell;
 antibodies cannot reach target / cannot be detected by immune system;
 large genome;
 antigenic variation / AW;
 variation from meiosis;
 detail; e.g. independent assortment / crossing over
 parasite switches between different versions of proteins;
 ref *var* gene; max 3
- (b) (i) *marks in pairs - one pair only*
 mutation; with lack of production;

examples
in, promoter / 'on' switch; so not transcribed;
to give premature stop codon; so, no useful / shortened, product;
deletion; with loss of allele / different product;
frameshift; so, different / no useful, mRNA / product;
in initiation codon; so mRNA not translated;
AVP mutation; AVP lack of production; max 2
- (ii) *marks in pairs - one pair only*
 no, membrane receptor / AW; so no, binding / internalisation;
 no, channel / carrier / pump; so lack of essential, nutrient / ion;
 do not multiply in liver; so not available to infect red blood cells;
 AVP protein; problem; max 2

- (c) 100% protection with 2 boosters;
 irrespective of dosage;
 70% with 1 booster;
 no evidence with 50 000 whether works with one booster;
 ref to memory cells;
 needs large numbers of parasite / ref 10 000 x 3;
 safe / will not cause disease / does not kill mice;
 might mutate back to wild type;
 can infect liver cells even if no further development;
 may need drug to remove from liver;
 data relates only to mice / may not be applicable to humans;
 AVP; e.g. no data comparing results with standard antigenic (AW)
 vaccine
- max 3
- [15]**

88. 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]**

89. *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;
award the QWC mark if three of the following are used in correct context and explained

1

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

[8]

90. 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]

91. (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]

92. (i) decreased (invertebrate) food / AW;
 seeds coated with pesticide eaten by birds / AW;
 food chain accumulation;
 concentrated in fatty tissue / fat soluble / slow to degrade;
 ref to, egg shell thinning / decreased reproductive rates;
 AVP; e.g. fungicides on seed coats / food for young nestlings

max 3

- (ii) predators might eat other food;
 disease;
 habitat change;
 farming changes likely to affect all bird species;
 accept general reference to predator prey relationship;
 AVP; e.g. detail on any of the above

max 2

[5]

93. 1 hydrogen bonding;
 2 detail; e.g. (electro)negative oxygen atom can hydrogen bond to
 (electro)positive H atom/ one water molecule hydrogen bonds with
 up to 4 others / H bonds individually weak / large collective effect
 of many hydrogen bonds

coral algae

- 3 (high) thermal stability / temperature remains fairly constant;
 4 water has high specific heat capacity;
 5 much energy needed to break hydrogen bonds;

polar bears

- 6 cooling allows maximum number of hydrogen bonds to form;
 7 water molecules space out to allow this;
 8 water expands as it freezes / ice is less dense than water;

mussels, filter-feeders and sessile animals

- 9 water is transport medium for, food particles / gametes;
 10 (tentacles / appendages / cilia) create currents bringing food;
 11 ref. tides / ocean currents;
 12 medium for, male gametes to swim / external fertilisation;
 13 no desiccation of gametes;
 14 ref to low viscosity / AW;

corals

- 15 minerals / ions, are soluble in water;
 16 water is polar / detail of electrostatic attraction; A AW

seaweeds, fish eyes

- 17 water is transparent to light;
 18 photosynthesis possible (in shallow water);
 19 wavelength of light varies with depth;

whales, jellyfish

- 20 cohesion / water molecules stick to each other;
 21 water not easily compressed;
 22 gives support to large bodies / detail of upthrust or relative density;
 23 acts as hydrostatic skeleton;
 24 AVP; e.g. zonation / pigments
 25 AVP; e.g. solubility of named gas linked to use in named organism 7 max

QWC – legible text with accurate spelling, punctuation and grammar 1

[8]

94. (i) not enough points plotted / experiment not carried out at enough (different) pH values;
 only 1 point between 3 + 4.3 / no points between 3.25 + 4.3;
 don't know / uncertainty of, rate between those points / where peak should be / where optimum is;
 3.25 reading might be anomalous;
 cannot draw, curve / line of best fit;
 rises to, 3 / 3.25, and falls after 4.3; 2 max

- (ii) *note ~ enzyme is completely inactive at pH 7*
 loss of tertiary structure / loss of 3D structure / (enzyme) denatured;
 (change in pH/[H⁺]) alters charge distribution on (enzyme) molecule;
 hydrogen / ionic, bonds affected;
 changes (shape of) active site;
 enzyme substrate complex cannot be formed /
 substrate not attracted to active site /
 substrate cannot bind to active site / AW; 2 max

[4]

\$ \$95. mark each section (E, S and C) to max shown

E enzyme concentration ~

- 1 reaction (rate) increases with increased enzyme; A high / low
 2 more active sites available;
 3 in excess substrate / as long as enough substrate (molecules available to occupy active site);
 4 (as reaction progresses) the rate will decrease as substrate, used up / becomes limiting; R plateau

E
 (3 max)

S *substrate concentration* ~

- 1 reaction (rate) increases with increased substrate; **A** high / low
- 2 more, molecules available to enter active site / ESC formed;
A more successful collisions
- 3 reaches point where all active sites occupied;
- 4 no further increase in rate / reaches V_{max} ; **A** plateau / levels off
- 5 enzyme conc. becomes limiting / unless add more enzyme;

S
(3 max)

C *competitive inhibitor* ~

- 1 inhibitor has similar shape to substrate;
- 2 can, fit / occupy, active site;
- 3 for short time / temporary / reversible;
- 4 prevents / blocks, substrate from entering active site;
- 5 rate determined by relative concentrations;
- 6 little inhibition / rate little reduced, if substrate conc. > inhibitor conc.; *ora*
- 7 ref to chance of, substrate / inhibitor, entering active site;
- 8 effects can be reversed by increasing substrate conc.;

C
(5 max)

general points ~

- 10 drawing a suitable graph to illustrate point made with labelled axes;
- 11 ref to optimum (rate);

9 max

QWC ~ legible text with accurate punctuation, spelling and grammar

1

[10]

96. (a) protein / polypeptide, with,
carbohydrate (chain) / polysaccharide / sugar / glucose;
(R) glycogen
- (b) (i) (α) helix; **R** double helix
- (ii) (β) pleat(ed) (sheet);
- (c) tertiary / 3°;

1

1

1

1

[4]

97. solvent;
 liquid; **A** same
 dense;
 insulates; **A** keeps warm **R** protects / warms
 hydrogen; **A** H / weak **R** H⁺ / H₂
 surface tension / cohesion; 6

[6]

98. (a) *mental*
 Alzheimer's / schizophrenia / phobia / anorexia / depression / Parkinson's /
 Huntington's / CJD / AVP;
self-inflicted
 alcoholism / cirrhosis / smoking addiction / drug addiction / lung cancer /
 obesity / CHD / anorexia / AVP; **R** unnamed cancer
inherited
 sickle cell / haemophilia / cystic fibrosis **A** CF / diabetes / Huntington's /
 Down's syndrome / AVP; 3

- (b) (i) to find out where, rates are highest / people are most at risk;
 to keep track of infection rates over time;
 to see where, disease is likely to spread / epidemic most likely;
 to help research (into how it is spread / into effectiveness of drugs);
 to allow organisations to provide aid where it is needed most;
 to allow organisations to provide education (about disease)
 where it is needed most;
 AVP; e.g. tourist industry
 e.g. limit potential spread by migration or imports 3 max

- (ii) education on HIV/AIDS less effective in Africa;
 sexual attitudes / number of partners;
 availability of condoms; **R** general reference to contraceptives,
 not used / refused
 poverty / poorer / less money;
 sex industry;
 less primary health care / less likely to be diagnosed;
 AVP; e.g. ref. to unscreened or untreated blood
 unsterilised needles or surgical apparatus
 civil war / rape
 no alternative to breast feeding
R access to drugs for treatment
R no vaccine
R ref to intravenous drug addiction 2 max

- (c) find person who is immune;
isolate gene that provides immunity;
identify protein (receptor) that provides immunity;
develop drug (to fit normal receptor) that provides immunity;

(gene used to) manufacture, drug, protein / antibody / immunoglobulin,
giving immunity;
protein used as, vaccination / cure / AW;
gene therapy used in at risk groups / AW;

AVP;
AVP; 2 max [10]
99. (i) phagocyte / macrophage / dendritic cell; **A** antigen presenting cell / APC
R white blood cell / lymphocyte / neutrophil 1
- (ii) bacteria in vacuole / phagosome; **A** lysosome
bacterium, cut up / partly, digested / partly broken down / AW
(so antigens still whole);
enzymes / lysins / lysozyme;
AVP; e.g. hydrolysis / hydrolases 2 max
- (iii) receptors / binding sites;
on cell surface membrane (of T helper cell);
complementary to antigen; **R** matching **A** analogy to lock and key 2 max
- (iv) mitosis; **R** cloning 1
- (v) produced during, primary / first, immune response / exposure to antigen;
remain in body; **A** blood / tissue fluid etc
(memory cell or antibody) specific to antigen;
produce secondary response;
more quickly / no symptoms;
divide / clone, to make plasma cells;
(plasma cells) manufacture antibodies;
more antibodies made / antibodies accumulate faster;
gives long term immunity / immunological memory / AW; 4 max [10]

100. variable region binds to, antigen / pathogen; **A** antigen-binding site
 variable region specific to, antigen / pathogen; **A** antigen-binding site
 agglutinate pathogens / stick pathogens together;
 immobilise pathogens / attach to flagellum (of pathogen);
 combine with pathogen to stop entry to cell;
 break wall of bacterium open / lysis;
 constant region, attracts phagocytes / makes it easier to engulf bacterium;
 AVP; e.g. ref to hinge region in context

2 max

[2]

101. (a) *Mycobacterium tuberculosis* / *Mycobacterium bovis*;
A *M. tuberculosis* / *M. bovis* / *Mycobacterium*
R *Microbacterium* / *Myobacterium*

1

- (b) short of breath / breathless / less easy to inflate lungs *or* breathe;
 due to less surface area for gaseous exchange;
 less oxygenation of, blood / haemoglobin; **R** oxidation
 coughing due to irritation in lungs (alveoli filled with some substance);
 coughing up blood;
 longer diffusion pathway;
 as alveoli walls thicker;
 AVP; e.g. destruction / loss of, alveoli and blood vessels
 AVP; weight loss
 chest pain when coughing

2 max

- (c) opportunistic disease / immune system already weakened;
 long course of treatment not always completed;
 drug / antibiotic, resistance; **R** strand **R** mutation alone
 vaccine is less than 100% effective / no vaccine for mutated strains /
 more effective in some parts of world;
 symptomless carriers / dormant in body;
 lack of education about TB;
 overcrowding (in poorly ventilated accommodation);
 Less Economically Developed Countries cannot afford, treatment /
 drugs / vaccines;
 A lack of access
 malnutrition;
 untreated milk / uncooked meat;
 breakdown of treatment programmes due to, war / civil unrest;
 migration of carriers / refugees / tourists / AW;
 AVP; e.g. link to HIV/AIDS
 AVP; ref badgers as carriers
 spitting / in sputum
 poverty, increased homelessness
 vaccine, refused / not wanted

5 max

[8]

102. (a) (chronic) bronchitis;
 emphysema;
 COPD;
 heart disease;
 stroke;
two marks available for the following
 lung / mouth / throat / breast / bladder / oesophagus / prostate other
 named cancer;;
 AVP; e.g. gangrene, erectile dysfunction
 AVP;

2 max

- (b) *max 3 for each named component*
carbon monoxide (no mark)
- c1** binds to haemoglobin / forms carboxyhaemoglobin;
c2 irreversibly / permanently; **A** greater affinity than for oxygen
c3 less effective oxygenation of haemoglobin; **R** oxidation
c4 shortage of breath;
c5 damages lining of arteries;
c6 AVP;

max 3

nicotine (no mark)

- n1** addictive;
- n2** adrenaline released;
- n3** increases heart rate;
- n4** reduced circulation to extremities / vasoconstriction;
R contract **A** narrow lumen
- n5** sticky platelets;
- n6** cause blood clotting / thrombosis;
- n7** AVP; e.g. ref to effect on synapse / brain function max 3

tar (no mark)

- t1** coats the (internal) surfaces of breathing system; **A** lungs
- t2** reducing efficiency of exchange;
- t3** irritation of mucous membranes;
- t4** goblet cells stimulated / over secretion of mucus;
- t5** inactivation of, cilia / ciliated epithelium;
A destroys / damages **R** kills
- t6** mucus not moved;
- t7** coughing;
- t8** carcinogenic / cancer-causing / causes mutations;
- t9** causes emphysema / described; **R** ref to elastin damage alone
- t10** AVP; e.g. ref to more infections / increased risk of chronic
bronchitis max 3

may be awarded anywhere

- AVP; strain on heart / heart disease
- AVP; raised blood pressure / hypertension 8 max

QWC – clear well organised using specialist terms; 1

award the QWC mark if four of the following are used in the correct context

haemoglobin	carboxyhaemoglobin	affinity
oxygenation	addictive	adrenaline
vasoconstriction	lumen	platelets
thrombosis	mucous membranes	goblet cell
cilia	epithelium	carcinogenic
emphysema	bronchitis	hypertension

103. Animalia / animal ;
 phylum ;
 class ;
 Panthera ;
 species ; **A** binomial name
- [5]
104. specific (antibodies) ;
 variable regions ;
 complementary shape ;
 to antigens on red blood cells ;
 attach to red blood cells ;
 agglutination ;
 AVP ; e.g. ref to rhesus factor
- 2 max
[2]
105. reduction in moisture content / dehydration ;
 freezing (-20 °C) ; **A** low temperatures
 growth of adult plants ;
- 2 max
[2]
106. (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]

107. cholesterol not soluble (in water) ;
 lipids / cholesterol, hydrophobic / non-polar ;
 glucose is (very) soluble (in water) ;
 glucose is, hydrophilic / polar ; 2 max

[2]

108. low (TC:HDL) ratio = low risk ; *ora*
 low (resting systolic) blood pressure = low risk ; *ora*
 data quote ;
 AVP ; e.g. if ratio is 3 high systolic pressure does not increase risk 3max

[3]

109. **A** correct formulae
R choice (if contradictory)

<i>type of molecule tested</i>	<i>reagents used</i>	<i>positive result</i>	<i>negative result</i>
<i>protein</i>	biuret / copper sulphate and sodium (or potassium) hydroxide;	purple / mauve / lilac;	<i>blue solution</i>
fat / lipid / oil / triglyceride; A phospholipid	<i>alcohol and water</i>	<i>white emulsion</i>	<i>clear liquid</i>
<i>starch</i>	iodine (in potassium iodide solution);	blue-black / black;	<i>yellow solution</i>

[5]

110. (i) **R** references to fruit juice

use same volume of glucose solution;
 use same volume of Benedict's solution;
 use same concentration of Benedict's solution; **A** strength / same batch
 boil for the same length of time; **A** heat
 calibrate colorimeter / AW; **A** same, filter / colorimeter 2 max

- (ii) 6.5; 1

- (iii) hydrolyse, filtrate / juice / bond / non-reducing sugar;

either

with acid, neutralise / add alkali

or

treat with, sucrase / invertase;

either, if started with filtrate ...

boil with Benedict's + test filtrate / repeat original procedure; **A** heat

or, if started with juice ...

boil with Benedict's + test filtrate / repeat original procedure, to measure difference in absorbance with original;

2 max

[5]

111. (i) haemoglobin / haem; **R** Hb 1

- (ii) iron / Fe²⁺ / Fe³⁺; **R** ion / Fe / Fe⁺ 1

[2]

112. (i) breaking a bond with the addition of water; **A** *named bond* 1
- (ii) fatty (acids produced);
[H⁺] increased / more acidic / products are acidic / acids produced;
'fatty acids produced' = 2 marks 2
- (iii) *do not credit, substrate used up / lack of enzyme / end product inhibition*
pH, too low / not optimum; **A** *too acidic*
enzyme denatured;
equilibrium reached;
further detail; 2 max
- [5]**
113. reduces rate; **A** *stops* **R** *inhibits*
fits into, allosteric site / site other than active site;
A '*fits into active site permanently*'
alters, shape / charge, of active site;
so substrate cannot, fit to active site / bind to active site / form ESC;
will not reach V_{\max} ;
increasing substrate concentration has no effect (on the rate); 3 max
- [3]**
114. (a) **R** *first reference to ^{15}N being radioactive*
semi-conservative replication would give
- 1 one, template / original / old / parent, strand and one,
new / daughter, strand;
- 2 complementary base pairing / joining of new nucleotides /
other detail of forming the new strand;
- data shows that*
- 3 two isotopes in molecule / molecule contains both ^{14}N and ^{15}N ;
- 4 one strand with, 'heavy' N / ^{15}N ; **R** *molecule*
- 5 one strand with, 'light' N / ^{14}N ; **R** *molecule*
- 6 no molecules with only, 1 isotope / ^{14}N / ^{15}N ;
- some points, particularly 4 and 5, could be awarded for a
correctly labelled or keyed diagram* 4 max
- (b) *correct answer only - do not accept from a selection*
- A;
C;
C and E; 3

- (c) 1 band = 0
3 bands = 0
- band drawn for ^{14}N and $^{14}\text{N}/^{15}\text{N}$ only;
thick for ^{14}N and thin for $^{14}\text{N}/^{15}\text{N}$; 2

[9]

115. (a) self-inflicted;
social; **A** non-infectious 1 max
- (b) many factors contribute to risks / many risk factors /
no one factor causes disease;
A if name two or more factors
A a number of causes
R many things 1
- (c) 1 (carbon monoxide / nicotine) increases heart rate;
2 (nicotine) constricts arterioles / vasoconstriction;
R arteries / blood vessels
3 (nicotine makes) platelets sticky;
4 blood clot / thrombosis, more likely;
5 increases blood pressure / hypertension;
6 increases deposition of, fatty substances / cholesterol,
in walls of arteries / formation of atheroma or plaque;
7 increases (risk of), atherosclerosis / hardening of arteries;
8 reduces lumen of artery;
9 reduces, blood flow / oxygen supply, to heart, muscle / tissue;
10 AVP; e.g. carbon monoxide damages, walls / lining, of artery 3 max
- (d) *high in some places because (accept ora)*
1 more, animal / saturated fats, in diet;
2 less, linolenic / linoleic, acids (in diet); **A** polyunsaturated
3 more salt (in diet);
4 high(er) incidence of obesity; AW
5 high(er) prevalence of smoking; AW
6 more alcohol abuse;
7 less exercise (is undertaken);
8 high(er) stress levels;
9 high(er) blood pressure;

- 10 high(er), cholesterol / LDL, concentration in blood;
 - 11 hereditary factors / ethnicity;
 - 12 'at risk', gene / allele, may be more common; A FHC gene
 - 13 ref to education;
 - 14 AVP; e.g. ref to differences in data collection
 - 15 AVP; e.g. ref specific dietary differences
 red wine / antioxidants
 ref to cholesterol-reducing drug(s) / food(s)
 ref to life expectancy (if low do not develop CHD)
 ref to maternal diet during pregnancy
 ref to diabetes
- 4 max

(e) *benefits to society*

fewer people have CHD / lower mortality due to CHD;
 fewer drugs used;
 fewer operations carried out / shorter waiting times;
 e.g. by-pass surgery / heart transplant;
 less, NHS / doctors', time taken up;
 lower cost to NHS / more money to spend elsewhere;
 fewer work days lost / less disability benefits paid out;

benefits to individual

better quality of life;
 live longer;
 awareness of harm to body;
 people eat, more healthily / less fatty food / less alcohol consumption;
 people, exercise more / more active;
 people do not smoke / less passive smoking;

AVP; e.g. lower levels of obesity
 AVP; e.g. stop people taking up smoking

3 max

[12]

116.

	pathogen;
	degenerative;
	aerobic; R aerobic respiration
	tidal;
	pandemic;

[5]

117. pathogen / bacterium, recognised as foreign;
antigens / pathogen is antigenic; AW
engulfed / phagocytosis / phagocytosis described / endocytosis;
in, vesicle / phagosome / vacuole;
lysosomes fuse to vesicle;
release, lysins / enzymes / named enzyme;
digest / break down, pathogen / bacterium / AW;
AVP; e.g. ref to presentation of antigen
hydrolysis
release of HCl *or* H₂O₂ *or* toxins *or* free radicals into vesicle 4 max [4]
118. (i) *increase in*
pollution;
certain crops (oil seed rape);
use of food additives;
diagnosis;
awareness;
use of antibiotics;
AVP; e.g. better hygiene, less breast feeding, multiple vaccinations 1 max
- (ii) 42 – 43 (%) 1 [2]
119. after a low carbohydrate diet athlete can exercise for, not long /
(no more than) one hour; **AW ora**
statement of trend observed; e.g. as carbohydrate in diet increases duration of
exercise increases / carbohydrate loading improves performance; **AW ora**
use of figures as a comparison; (look for 60, 125 – 130, and 185 – 190)
A two / three, times duration statements 3 max [3]
120. *penalise sugar once in the answer*
glycogen is, source / store, of, energy / carbohydrate;
glycogen converted to glucose / glycogenolysis / glucogenesis;
glucose used in respiration;
to supply, energy / ATP, for muscle contraction;
more glycogen stored will last longer;
AVP; e.g. using muscle glycogen may be more efficient than
transporting glucose from liver 2 max [2]
121. (i) human immunodeficiency (virus) / HI(V); 1

- (ii) *immune system unable to*
 reproduce (enough) T (helper) cells;
 release cytokines;
 stimulate B cells;
 make plasma cells;
 release antibodies;
 stimulate macrophages;
 stimulate T killer cells;
 no humoral response;
 make memory cells; 3 max

- (iii) unprotected sexual intercourse;
 reusing / sharing, needles; **R** dirty / unsterile, needles
 blood transfusion / mixing blood; **R** blood donation
 across placenta / child birth;
 breast feeding;
 needle stick;
 AVP; 3 max

[7]

122. 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]

123. (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]

124. (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]**
125. 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]**
126. *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]**

127. *classification in the plant kingdom - must be clear that feature shared with plants*
- 1 ref to, photosynthesis / photosynthetic pigments ; A autotrophic
 - 2 presence of chloroplasts in green alga ;
 - 3 presence of cell wall in, both / green alga and cyanobacterium ;
 - 4 cell wall in green alga is made of cellulose ;
- removal of green algae from plant kingdom to protoctist kingdom*
- 5 green alga unicellular, plants multicellular ; A green alga, filamentous / colonial
A green alga not multicellular
 - 6 green alga simple eukaryotes, plants complex ;
 - 7 lack of vascular tissue in green alga, plants, arevascular / possess xylem and phloem
- removal of cyanobacteria from plant kingdom*
- 8 cyanobacterium prokaryotic, plants eukaryotic ;
 - 9 cyanobacterium unicellular, plants multicellular ; A cyanobacterium not multicellular
allow idea once - check mark point 5
- 10 cell wall, contains murein not cellulose / similar to Gram negative bacteria ;
- cyanobacteria and green algae different kingdoms*
- 11 cyanobacterium prokaryotic, green algae eukaryotic ;
 - 12 cyanobacterium, no true nucleus / no nuclear envelope ; A membrane ora
A valid ref to a difference e.g. 'naked' / free / circular DNA (only)
 - 13 cyanobacterium, chlorophyll / photosynthetic pigments, in phycobilisomes
/ photosynthetic lamellae (green algae chloroplasts) ;
 - 14 cyanobacterium, (much) smaller than green alga / 2-3 μm compared to 35-40 μm ;
 - 15 AVP ; e.g. starch stored in alga and plant cells,
 - 16 AVP ; shared eukaryotic feature green alga and plant,
valid e.g. prokaryote, eukaryote differences (alga / plant v
cyanobacteria), DNA analysis shows differences,
no sexual reproduction shown, sexual reproduction in plants / AW
slime layer in cyanobacteria, lack of slime layer in plant cells /
slime layer qualified

contractile vacuole in *Chlamydomonas*, plant cells (permanent)
vacuole / contractile vacuole qualified

cyanobacterium smaller than plant cell
- 7 max
- QWC – legible text with accurate spelling, punctuation and grammar ;** 1

[8]

128. membrane, stability / fluidity ;
impermeability to, hydrophilic substances / AW ; ora
synthesis of, steroid hormones / named examples ;
waterproofs skin ;
synthesis of vitamin D ;
synthesis of, bile salts / named bile salt(s) ; R bile alone
AVP ; e.g. protects skin from absorbing (some) harmful chemicals
- 3 max

[3]

129. 1 (saturated) fats in diet ;
 2 converted to cholesterol / cholesterol in meal ;
 3 may affect concentration of, HDLs / LDLs ;
 4 ref to reliability of reading / AW ;
 5 AVP ;
- 2 max
- [2]
-
130. (i) polypeptide; **A** oligopeptide 1
 (ii) glycine; **A** proline / alanine 1
 (iii) *in this answer assume that*
chain = polypeptide
molecule = groups of 3 polypeptide chains
- A** ecf for named amino acid from (ii) but NOT a name of a base amino acids / glycine, small (to allow close packing);*
the small one is, every 3rd amino acid / at every level in the molecule;
chains, form a tight coil / lie close to each other;
held together by hydrogen bonds; ignore other bonds
- bonds form between R groups of lysines;*
*molecules form, fibres / bonds with adjacent molecules; **A** fibril*
covalent bond between, adjacent molecules / CO-NH groups;
fibres composed of parallel molecules;
ends of parallel molecules staggered;
prevents line of weakness;
- 2 max
- [4]
-
131. cell wall(s);
 β / beta; **A** B
 glycosidic; **NOT** glucosidic
 180;
 straight; **A** polysaccharide / unbranched / linear
 hydrogen / H; **NOT** H₂
- 6
- [6]

132. (i) 4; 1
- (ii) deoxyribose; **NOT** ribose
phosphate;
 nitrogen(ous) / organic / named, base; **A** purine / pyrimidine
NOT uracil
NOT letter
NOT thiamine / thymine
 take a correct base from a list unless that list includes uracil 3
- [4]**
133. 1 2, molecules / helices, (of DNA) produced;
 2 identical (molecules of DNA produced);
 3 (each made up of) 1, original / parent / old, strand;
 4 1 new strand;
 5 original / parent / old, strands, act as template / described;
 6 ref to (free DNA) nucleotides; 3 max
- [3]**
134. (i) (X) 10 / 900% (increase); **NOT** 10% increase
 ignore 1000% increase 1
- (ii) *candidates may use information from the passage*
e.g. typical [NOT average] = 20 units
threshold = 200 units
- 1 no increase, between 0 and 20 units / at low levels / well below
 threshold, of radon;
 2 radon increasing, from 20 to 200 units / towards threshold,
 increases risk;
 3 by 10X / 900%;
 4 high radon and smoking gives greatest risk;
5&6 other suitable quantitative risk statement;;
 7 consequence / relevant effect on cell; 2 max
- [3]**

135. (a) idea that arachidonate is substrate;
 phospholipid source in membrane;
 prostaglandin / product, can be, transported / stored;
 (S)ER for, lipid / steroid, synthesis / transport;
 AVP;
 AVP; e.g. separate from other reactions
 cytoplasm environment not suitable for, reaction / enzyme ora
 idea that prostaglandin isolated
 COX does not, damage / use phospholipids from,
 other membranes 2 max

(b) *ibuprofen*
 competitive;
 ibuprofen blocks / arachidonate cannot enter, channel; **A** substrate
 cannot reach active site;

aspirin
 non-competitive;
 changes shape (of) / blocks;
 active site;
 AVP; e.g. allosteric
 no ESC formed / AW; *allow once only* 4 max

(c) *A reverse argument as long as question is answered in terms
 of low temperature*

 slows, reaction / rate / activity of enzyme / AW;
 ref kinetic energy;
 molecules moving, slowly / less;
 few collisions / collisions less likely;
 few ESC formed / ESC less likely to be formed;
 reversible / enzyme not denatured / enzyme still works;
 ref activation energy;
 ref $Q_{10} = 2$; 4 max

[10]

136. (a) *Plasmodium / P. vivax / P. falciparum*;
Anopheles;
 infected;
 blood;
 vector; **R** carrier
 (blood) transfusion / shared needle / across placenta / at birth / AW;
R mixing blood unless qualified 6

- (b) *reduce mosquito numbers*
 stock ponds with fish (*Gambusia*) to eat larvae; **R** kill mosquitoes
 oil on surface;
 spray bacteria (*Bacillus thuringiensis*) to kill mosquito larvae;
 DDT / pesticide spray;
 release of sterile male mosquitoes;
 draining, ponds / bodies of water;

avoid being bitten by mosquitoes
 wear insect repellent;
 long sleeved clothes;
 sleep under nets;
 nets soaked in, insecticide / repellent;
 sleep with, pigs / dogs;

use drugs to prevent infection
 use, prophylactic drug / quinine / chloroquine / larium / artimesinin /
 vibrimycin / tetracycline / antimalarial;
 use malaria vaccine;
- 2 max
- [8]
137. acts on, genes / chromosomes / DNA;
 causing, mutation / change in genetic code;
 of genes that control cell division / oncogenes;
 cells divide out of control / AW; **R** rapidly **R** grow
 AVP; e.g. detail of change / substitution / deletion / insertion /
 chromosome abnormality
 cells do not undergo apoptosis
- 3 max
- [3]
138. shortage of breath / difficult to breathe / AW; **R** wheezing
 persistent / constant, cough; **R** smoker's *or* severe cough
 coughing up blood;
 chest pain / pain when breathing;
 swollen / painful, lymph glands;
 weight loss;
- 2 max
- [2]

139. (i) (antigens) injected / taken orally; ora ('not caught') **R** vaccination 1

(ii) **1** injection of antigen *or* attenuated / weakened / dead / similar, pathogen; **R** disease

2 immune system activated / causes immune response;

3 attacked / engulfed, by, phagocytes / macrophages;

4 ref antigens presented;

5 selection / production, of active T, cells / lymphocytes;

6 T cells, clone / divide / mitosis;

7 secretion of cytokines;

8 activation of B cells;

9 B cells, clone / divide / mitosis;

10 production of, plasma / effector, cells;

11 production of antibodies (by plasma cells);

12 production of memory cells;

13 memory cells remain in body;

14 (secondary) response to infection quicker;

15 (secondary) response to infection greater;

16 no symptoms when infected / AW;

4 max

(iii) herd vaccination;
vaccinate, most / all, people;
stops infection spreading (within population) / lack of people to pass infection on to;

ring vaccination;
vaccinate all people around victim;
contains spread (within ring);

surveillance / spotting and reporting victims;
isolation of victim;

trace contacts;
isolation of contacts;

ref to making it notifiable;

travel restrictions;

AVP; e.g. if notified can organise ring vaccination

3 max

[8]

140. increasing availability of phosphate increases growth of all three species;
greatest effect on nettle;
linear effect / increases proportionally / steadily / AW (on nettle);
slow increase / small increase, in growth of wavy hair grass;
levels off at higher phosphate concentrations;
high levels decrease growth of small scabious / ref to increase and then
decrease in growth of small scabious;
small scabious increases steeply / AW (at low phosphate concentrations);
- max 4
- [4]**
141. *similar ~ allow valid similarities such as*
- same number, carbon / oxygen / hydrogen (atoms) / OH (groups); **A** hexose
same formula; **R** similar / molecule
ring / ring with O (atom) in it;
correct ref CH₂OH;
contain C, H and O;
- 1 max
- different ~ assume candidate is writing about fructose unless told otherwise
allow valid differences such as*
- (fructose has) 5-membered ring / glucose has 6-membered ring; **R** pentose
(4 C in ring v. 5C in ring / furanose v. pyranose in glucose)
(in fructose) 2 CH₂OH side chains / 1 CH₂OH side chain in glucose;
different angles between C atoms;
ref alignment of H and OH groups (on carbon 3 / carbon 4);
(in fructose) carbon 1 not in ring / carbon 1 in ring in glucose;
- 1 max
- [2]**
142. (i) glycosidic; **NOT** *glucosidic* 1
- (ii) **1** carbon positions 1 and 2 on glucose and fructose;
2 formation of, water / H₂O, from 2 OH groups (plus separation);
3 oxygen bridge / – O –, shown;
- 2 max
- [3]**
143. (i) add / use, Benedict's (reagent);
heat; **NOT** use water bath alone
(blue to) green / yellow / orange / brown / red (precipitate);
- 3
- (ii) hydrolysis;
boil / heat, with (dilute), acid / HCl; **A** (dil) NaOH
(add) hydrolytic enzyme / sucrase / invertase;
- 1 max
- [4]**

144. (a) active site correctly labelled; 1
- (b) C; 1
- (c) shape of active site;
complementary;
 correct shape / correct molecule / correct substrate / C, will, fit /
 form ESC;
 any other shape / any other molecule / any other substrate /
 A / B / D / E, will not;
award 2 marks if candidate writes 'only correct ') 3 max
- (d) *look for points relating to the substrate changing shape*
ignore refs to enzyme changing shape
 puts strain on the bonds in the substrate / bonds break more easily;
 A weakens bonds
 lowers activation energy;
 AVP; e.g. referring to anabolic reaction 1 max
145. (a) nicotine; 1
- (b) *any two from*
 carbon monoxide / CO;
 binds to haemoglobin / forms carboxyhaemoglobin;
 Hb has greater affinity for CO / CO binds more strongly than oxygen;
 A irreversibly reduces oxygen carrying ability / amount of oxygen
 that can be carried; (3 max)
- tar;
 accumulates, in lung / on alveolar surface;
 increases, diffusion barrier / thickness of barrier between air and
 blood / AW;
 reduces rate of diffusion / gaseous exchange more difficult / AW;
 causes cancer / carcinogenic;
 paralyses / damages cilia; R kills cilia
 increases mucus production / AW;
 increases chance of infection;
 production of scar tissue;
 reduces elasticity of the airway / (oxidants) increase activity of
 elastase (emphysema); (3 max)

[6]

carcinogen;
 causes cancer;
 changes DNA / mutation;
 uncontrolled mitosis / no programmed cell death / no apoptosis;
 tumour; (3 max)

AVPs (2 × 3 max)

e.g. arsenic;
 interferes with cytochromes in respiratory chain;
 prevents ATP production;
 replaces phosphate group in ATP;

 benzpyrene;
 adheres to surfaces;
 cancer-causing;

A nicotine if not given in (a)

5 max

[6]

146. (i) % heavy smokers rises from, professional / gp 1, to, unskilled manual workers / gp 6 / AW; A statements comparing groups 1 and 6 ref to figures used as a comparison;

2 max

(ii) as % heavy smokers increases so does number of people suffering long-standing illness;
 the relative increase in smoking is far greater than the relative increase in long-standing illness / not a proportional increase / AW;
 use of figures to illustrate;
 e.g. smoking increases more than 6 fold while long-standing illness increases less than 2 fold
 smoking increases from 3% to 19% while long-standing illness increases from 290 to 420 (per 1000)

AVP; e.g. ref to anomalous point

2 max

(iii) *qualified ref to*

medical services;
 working environment;
 living conditions;
 income;
 education (about diet / possible relief from long-term illness);
 diet;
 work-related injury;
 alcohol intake;
 (work related) stress;
 (aerobic) exercise;

2 max

[6]

147. (a) eating too much;

high, fat / sugar / carbohydrate / alcohol (in diet);
 energy intake greater than use;
 insufficient exercise;
 AVP; e.g. genetic predisposition
 underactive thyroid

2 max

(b) decrease in % underweight;
 decrease in % acceptable;
 increase in % overweight;
 large / great / dramatic / significant, increase in % obese;
 use of figs to illustrate one change;

4 max

[6]

148. 1 high level of saturated fat in diet;
 2 animal fat / red meat / dairy products;
 3 high cholesterol (in blood / body);
 4 lack of, vitamin E / antioxidants;
 5 high salt in diet;
- 6 obesity linked to, high blood pressure / hypertension;
 7 damage to artery, walls / endothelium;
 8 cholesterol transported in lipoproteins;
 9 cholesterol deposited in artery walls;
 10 in coronary arteries;
- 11 atherosclerosis / atheroma;
 12 formation of, plaques / fatty streaks;
 13 hardening / loss of elasticity (of artery wall);
 14 roughens lining / increases friction;
 15 clot formation / thrombosis / thrombus;
 16 narrows / restricts, lumen;
 17 reduced / restricted, blood flow / oxygen, to heart muscle;
 18 heart (muscle), under stress / works harder;
 19 angina / heart attack / myocardial infarction / heart failure /
 hypertrophy; **R** CHD
- 20 AVP; e.g. aneurism in aorta
 21 AVP; low density lipoproteins (LDL) associated with deposition
 high density lipoproteins (HDL) associated with less deposition

7 max

QWC – clear well organised using specialist terms;

1

award the QWC mark if four of the following are used in correct context

saturated	coronary	cholesterol	lumen
vitamin E	atherosclerosis		antioxidants
blood pressure		plaque	hypertension
endothelium		thrombus	thrombosis
angina	myocardial infarction		atheroma
(low density / high density) lipoprotein			

[8]

149. (i) R; 1

(ii) **R** / binding site / variable region, has specific, amino acid sequence / primary protein structure;
R / binding site / variable region, has specific shape;
 complementary to / matching (part of), antigen **A**; **A** lock and key idea 2 max

[3]

150. (i) *award two marks if correct answer (17.2 / 17) is given*
award one mark for calculation – if answer incorrect or left at 82.8

$92/100 \times 90 = 82.8$ $100 - 82.8;$
 17.2; **A** 17%

2

(ii) difficult to diagnose;
 not all / enough, of population vaccinated; **A** need 93-95% vaccination
A ref to herd, vaccination / immunity

poor response to vaccine / only 90-95% vaccinated people have protection; *ora*

boosters needed / difficult to trace those who need boosters; *ora*

migrants can (easily) bring measles into a community;

AVP; e.g. length of time vaccination remains effective / *ora*

AVP; measles mutates more frequently / *ora*

people less worried about measles so don't get vaccinated / *ora*

concerns about link of MMR to, side effects / autism

2 max

[4]

151. (a) (existence of many) different species;
 with (a wide range of) different, genes / alleles;
 live / co-exist, in (many different), habitats / ecosystems; **A** environment max 2

- (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]

152. enzymes (of microorganisms) work in low temperatures;
enzymes used in stain removal / AW;
 can be used for cool washes;
 saves energy;

2 max

[2]

153. *marking points 1, 4, 8, 14, 19, 20 and 22 relate to the bullet points in the question*

- 1 liquid at normal temperatures;
- 2 hydrogen bonding between water molecules;
- 3 molecules more difficult to separate;
- 4 ice floats on water / water freezes from top down;
- 5 insulates water beneath;
- 6 large bodies of water don't freeze completely / animals can still swim etc.;
- 7 (change in density with temperature) causes currents to circulate nutrients;
- 8 solvent for, polar / ionic, substances;
- 9 solubility of gases in environment;
- 10 allows reactions to take place;
- 11 transport medium;
- 12 e.g. (of substance carried in what);
- 13 transport medium for, gametes / blood cells;
- 14 water slow to change temperature;
- 15 lakes / oceans / large volumes, provide thermally stable environment;
- 16 internal body temperature changes minimised;
- 17 used for cooling;
- 18 e.g. (sweating / panting / transpiration);
- 19 large amount of energy must be removed for water to freeze;
- 20 organisms can use surface of water (as habitat);
- 21 e.g.; (of organism)
- 22 can form (long / unbroken) columns of water;
- 23 ref. to vascular tissue / xylem;
- 24 reactant (photosynthesis);
- 25 role in, hydrolysis / condensation;
- 26 AVP; e.g. transparency
- 27 AVP; plants can photosynthesise under water
 incompressible
 hydrostatic skeleton / turgor
 buoyancy
 guard cell mechanism
 support for large organisms on ice (penguins / polar bears)
 further detail of any point

9 max

QWC – legible text with accurate spelling, punctuation and grammar;

1

[10]

154. deoxyribose in DNA;
 thymine in DNA; **R** thiamine

DNA is, made of two chains / double helix; **R** double molecule longer;

2 max

[2]

155. (i) *answer has to relate to DNA nucleotide*

monomer unit;

deoxyribose;

nitrogenous base / named base(s); ecf for thiamine

phosphate;

AVP; e.g. deoxyribose is a pentose sugar / correct diagram

3 max

(ii) hydrogen bonds between bases;

complementary (base pairs);

purine to pyrimidine;

A to T and C to G;

2 H bonds between A and T / 3 H bonds between C and G;

DNA polymerase;

3 max

[6]

156. DNA codes for, protein / polypeptide;
transcription and translation (or described);

enzyme is globular (protein);

3 bases \equiv 1 amino acid;

sequence of bases / triplets, determines, sequence of amino acids /
primary structure;

coiling / α helix / β -pleated sheet / particular secondary structure;

determines projecting side groups;

folding / bonding, for tertiary structure;

3-D structure is tertiary structure;

AVP; e.g. ref. active site related to shape

2 or more genes produce quaternary structure

4 max

[4]

157. (i) *look for prokaryote feature*
 no nucleus / no nuclear membrane / no nucleolus / DNA free
 (in cytoplasm); **R** DNA moving
 naked DNA / DNA not associated with proteins / no chromosomes;
 circular / loop, DNA;
 no, membrane-bound organelles / e.g.;
 smaller / 18nm / 70S, ribosomes;
 no ER;
 cell wall, not cellulose / polysaccharide and, amino acids / murein;
 AVP; e.g. mesosomes / plasmids 1 max
- (ii) glycosidic (link) and peptide (bonds) (in correct context);
 condensation;
 ref. OH groups;
 ref. NH₂ and OH group;
 water, removed / produced / by-product;
 enzyme;
 AVP; e.g. energy required 3 max
- (iii) iron / Fe; *ignore pluses / minuses* 1
- (iv) *treat enzyme as neutral*
 nitrogenase;
 leghaemoglobin;
 haemoglobin; 2 max
- (v) (nitrogen) fixation; **A** reduction 1
- (vi) type of inhibition (competitive / non-competitive / reversible / irreversible);
 basic mode of action (e.g. binds to active site);
 detail;
 consequence (e.g. prevents, substrate / nitrogen, from binding); 2 max
158. (a) cannot be made within the body; **R** ref. to amino acids
 no enzyme(s);
 not able to form a double bond between final (omega / ω) carbon and
 existing double bond;
 ref. to deficiency, disease / condition;
 required for cell membrane (phospholipids); **A** lipid membrane / lipid
 bilayer
 required to make, signaling molecules / prostaglandins;
 required for, immune system / renal system / blood clotting; 1 max

[10]

- (b) *award two marks if correct answer (84) is given – must be rounded up
award one mark for calculation e.g. showing that 35% should be
calculated / dividing by 37*

35% of 8 830 / 3 090.5 /

$$\frac{3\,090.5}{37} / 83.53 / \frac{x}{37};$$

84;

2

- (c) saturated fat, raises concentration of LDLs in the blood;
raises (blood) cholesterol;
(increases risk of) atherosclerosis / described; **A** atheroma / plaque /
fat *or* cholesterol in wall of artery;
raises blood pressure;
(increases risk of) blood clots / thrombosis;
(coronary) heart disease / heart attack / heart failure / MI / angina / CVD;
stroke;
overweight / obesity;
increase body mass index (BMI);
AVP;; e.g. obesity-related diseases such as arthritis, named cancer
(**R** lung), gall stones, diabetes, hypertension, hernia,
varicose veins, haemorrhoids, joint / knee damage,
depression (**R** mental health problems)
ref. to surgery being difficult
ref. to adipose tissue

4 max

- (d)
- 1 any two references to differences in quantities;
A rich / richer / good source of
 - 2 use of figures to make a comparison between quantities for any one nutrient;
 - 3 protein needed for, repair / replacement / ref. pregnancy / ref. lactation / AW;
 - 4 vitamin A, ref. to function *or* deficiency;
rods / retina / night vision / xerophthalmia / ref. epithelia / immune system
 - 5 vitamin D, ref. to function *or* deficiency;
absorption *or* deposition of calcium / osteomalacia **R** rickets
 - 6 calcium, ref. to function *or* deficiency;
skeleton / teeth / bones / fetal growth / muscles / nerves
 - 7 iron, ref. to function *or* deficiency;
haemoglobin / anaemia / menstrual loss / red cells
 - 8 other foods needed to provide iron *or* calcium / need to take supplements;
 - 9 AVP; consequences of deficiencies, e.g. osteoporosis, fatigue
 - 10 AVP; any ref. to RNI for any one of these nutrients
ref. to polyunsaturated fatty acids in 'oily fish'
idea that one food does not make a diet
- 4 max

[11]

159. (a) (i) passive; 1
- (ii) cross the placenta; *treat breast milk as neutral* 1
- (b) B / plasma; A B effector cells *treat white blood cell(s) as neutral* 1
- (c) antigen presentation;
correct ref. to T helper cells;
clonal selection / selection of appropriate clone / AW;
ref. to (surface / glycoprotein) receptors / binding sites;
ref. to specificity (of cells / receptors to antigen / antibody to antigen);
clonal expansion / described; e.g. more B cells must be made
mitosis / division, of B cells; A replicate / multiply
formation / differentiation, of, plasma cells / effector cells;
any detail; e.g. development of ER / ribosomes
ref. to time taken for, making antibodies / protein synthesis; 3 max

(d) memory cells / immunological memory;
 constant exposure to, measles / virus / antigen;
 fast, secondary response / antibody production;
 A works before symptoms develop
 greater, secondary response / antibody production;
 AVP; e.g. not necessary to increase number of specific cells / AW
 ref. to clonal selection quicker / AW

2 max

(e) ref. to antibodies (from mother); A (passive) immunity from mother
 remove / combine with, measles antigen / vaccine;
 no immune response / no primary response / AW;
 immune system not yet fully functioning / AW;
 malnutrition;
 lack of protein / energy, to make, antibodies / cells;
 ref. to children who were born premature;
 AVP; e.g. mutation involved in lymphocyte development

2 max

[10]

160. (a) *Plasmodium*;

Accept

P. falciparum / *P. ovale* / *P. vivax* / *P. malariae*;

1

(b) bitten by mosquito carrying malarial parasite; A 'infected'
 (genus) *Anopheles* / female;
 injects parasites with, saliva / anticoagulant;
 ref. to vector;
 (mosquito) fed on / bit / took a blood meal from, an infected person;
accept transmission by needle
 injected into blood;
 after use by someone with malaria;
 (needle) shared / reused / used but not sterilised;
 A transmission across the placenta;
 A blood transfusions;

3 max

- (c)
- 1 resistance of, *Plasmodium* / pathogen, to drugs;
 - 2 eukaryote / protoctist, has many genes;
 - 3 many surface antigens / antigenic variation; **A** ref. to mutation
 - 4 inside red blood cells / in liver cells / antigen concealment;
 - 5 difficult for immune system to operate / idea;
 - 6 dormant / in body for a long time / symptomless carriers / long incubation;
 - 7 different stages in life cycle in the body;

 - 8 resistance of, vector / mosquito, to insecticides; **A** mutation / selection
 - 9 mosquito, breeds in small areas of water; **A** implications
 - 10 breeds quickly;
 - 11 mosquitoes, spread over large area / widely distributed / fly a long way;
 - 12 mosquito control programmes disrupted by war etc;
 - 13 lack of infrastructure (for control programmes);
 - 14 problems with sleeping nets, described;
 - 15 more effective when soaked in insecticide;
 - 16 no vaccine;
 - 17 people lose immunity if, malaria eradicated / move to non-endemic area;

 - 18 poor primary health care / few doctors or other medical personnel;
 - 19 ref. to poor housing / slums / shanties;
 - 20 ref. to remote rural areas;
 - 21 ref. to cost of control programmes;
 - 22 ref. to travel / migration;
 - 23 ref. to change in climate;
 - 24 ref. to education;
 - 25 ref. to problems of biological control;

 - 26 AVP; e.g. effects of insecticides on, ecosystems / humans
 - 27 AVP; side effects of drugs
 Impossible to isolate infected people
 ref. to sterilising male mosquitoes
 opening new areas of tropics
 different, species / strains, of malaria
 cost to individual
 ref. to detection in bloodstream
 blood transfusions
 mother to fetus across placenta

8 max

QWC – legible text with accurate spelling, punctuation and grammar; 1

[13]

161. (a) high death rate;
 preventable / avoidable, deaths;
 premature deaths / younger than life expectancy / people of working age;
 AVP; e.g. cost of care / medical facilities

1 max

(b) *Mark (i), (ii) and (iii) together to max 5*

(i) data support hypothesis (no mark)

death rates (for both men and women) are lower;
ref. to any two figures from the table to show a comparison
(e.g. Spain v Latvia);

(ii) data support / do not support hypothesis (no mark)

support – all figures for men (in 35-74 age range) are higher than those for women;

do not support – no data for men and women over 74 / only applies to 35-74 age range / no data for men and women under 35 / smoking-related not gender-related;

ref. to any two figures from the table to show a comparison
(e.g. men and women in the same country);

(iii) data do not support / do support (no mark)

idea that

prevalence of smoking is, higher / no lower, in, Mediterranean countries / named country, than in some countries with higher death rates from CHD;

ref. to men in Latvia and Russian Federation who show high prevalence of smoking and have high death rates from CHD;

A no correlation between prevalence of smoking and mortality from CHD

ref. to any figures from the table to show a comparison;

5 max

[6]

162. *reward any appropriately worded statements, e.g.*

lifestyle increases susceptibility to degenerative diseases;

e.g. diabetes, CHD, atherosclerosis;

smoking increases risk of developing, (lung) cancer / COPD / CHD;

no signs of symptoms of disease, may be developing or increasing risk of developing (non-infectious) diseases;

father's heart attack, may mean that there is a genetic predisposition to heart disease;

not a balanced diet;

little fresh fruit and vegetables, little, dietary fibre / antioxidants / vitamins;

little (aerobic) exercise;

except on one occasion a week, may put strain on heart /AW;

health risks associated with, binge drinking / alcohol;

AVP;;; e.g. social well-being

3 max

[3]

163. active site;

1

[1]

164. activation (energy); 1 [1]

165. gene / allele; **A** cistron **R** genes / alleles / operon / intron 1 [1]

166. (a) (i) add / mix with, alcohol / ethanol / propanone / (suitable)
organic solvent;
then, add to / add / mix with, water;
water alone = 0
R heat 2

(ii) emulsion / milky colour / cloudy / AW; **R** precipitate 1

(b) *phospholipids have*

1 less fatty acid (residue) / 2 fatty acid (residues) not 3; **A** hydrocarbon
1 less ester bond / 2 ester bonds not 3;
phosphate;
choline / base / nitrogen;
hydrophilic / polar, end / head; max 3

(c) (i) add, copper sulphate (solution) and sodium hydroxide (solution) /
biuret (reagent);
R Biuret test unqualified
R heat 1

(ii) purple / mauve / lilac; **R** blue 1

[8]

167. *primary*
sequence / order, of amino acids (in a polypeptide); A R groups 1
- secondary*
 coiling / folding, of the,
 polypeptide / chain of amino acids / peptide chain / primary structure;
 (α -) helix;
 (β -) pleated sheet;
 hydrogen bonds;
 between amino acids in (same) chain;
 (between) $-NH$ and $-CO$;
 AVP; e.g. random coiling max 4 **[max 5]**
168. (a) (malonate) same / similar, shape as, succinate / substrate;
 A idea that inhibitor is complementary to active site
 binds to / fits / blocks, active site;
 for a limited time / reversible / may leave / AW;
 R does not bind permanently
 prevents, formation of ESC / substrate from binding; AW
 no / less, product formed; A suitable ref. to conversion of succinate max 3
- (b) rate increased;
 greater chance of substrate binding with, active site / enzyme; ora
 more, product formed / substrate converted;
 will reach V_{max} / rate unaffected, if great excess of succinate;
 AVP; e.g. graph of rate against substrate concentration
 effect of time (using up substrate) max 3 **[6]**
169. (chronic) bronchitis;
 emphysema;
 COPD; max 2 **[2]**

170. (a) damage to, artery wall / lining / endothelium;
A scarring **R** damage to artery / damage in artery
 invasion by phagocytes;
 cholesterol / fat / LDLs, deposited / accumulates, in artery wall;
 growth / proliferation of, smooth muscle / fibrous tissue;
 wall thickens / lumen becomes narrow / reduces blood flow;
 rougher surface / AW; **A** 'stickier' / more friction
 platelets secrete clotting factor(s);
 endothelial cells secrete less, anti-clotting factor(s) / prostaglandins;
 AVP; e.g. atheroma, breaks open / bursts through wall
 loss of elasticity/ 'walls do not stretch as much' max 3

(b) *nicotine*
 increases, heart rate / blood pressure (possibly leading to damage to
 artery walls); **A** ref to hypertension
A for CO as well – but only once in answer
 decreases width of arteries / lumen smaller / reduces blood flow;
 increases number of platelets / makes platelets more 'sticky';
 decreases antioxidants;

CO
 damages walls of arteries;
 reduces oxygen carrying capacity of blood / binds with haemoglobin /
 forms carboxyhaemoglobin;

both
 increase development of, plaque / atheroma;
 stimulate production of, fibrinogen / clotting factors;
 reduces production of enzymes that remove clots;
 increase blood cholesterol (concentration);
 AVP; e.g. ref to nicotine and adrenalin max 3

[6]

171. bone marrow; **R** marrow on own
 phagocytes / neutrophils / PMNs / monocytes / macrophages;
 thymus;
 plasma cells / effector cells;
 antibodies;

5

[5]

172. 1 ref to antigen presentation / described;
 2 receptors on T cell (surface) are complementary to antigen;
R same shape
 3 ref to specificity (in context of T cells);
 4 clonal selection / described;
 5 clonal expansion / clonal proliferation / T cells divide by mitosis;
R 'T cells clone' unqualified / 'reproduction' / 'replication'
 6 T helper cells release, cytokines / lymphokines;
 7 stimulate B cells to, divide / clone / differentiate (into plasma cells);
 8 stimulate macrophages to carry out phagocytosis (more actively);
 9 T_c / cytotoxic / killer (T) cells, search for / kill / attach to,
 infected (host) cells;
 10 secrete, enzymes / toxins;
 11 named enzyme / toxin;
 e.g. hydrolytic / protease / nuclease / H₂O₂ / free radicals / perforin
 12 active immunity;
 13 memory (T) cells / immunological memory;
 14 ref to secondary response; e.g. more rapid / greater
 15 AVP; e.g. suppressor cells
 16 AVP; e.g. function of suppressor cells
 cell mediated response max 7

QWC – clear, well organised using specialist terms; 1

[8]

173. shared needles *or* surgical instruments / needles, reused without sterilisation;
A contaminated needles reused
 (mother to child) across placenta / at birth;
 breast milk / breastfeeding;
 blood products / blood transfusion;
 needle-stick / described;
 AVP; e.g. blood to blood, blood to wound max 3

[3]

174. *mark this question to max 6*

- (i) decrease;
 increase / remain constant / fluctuate;
 correct use of figures to show a change;
A 'approx / nearly / about / no greater than' to describe numbers
 e.g. 1985, 2050 1988, 1300 1991, 1680 2001, 1400

- (ii) earlier diagnosis;
use of drugs / named drug e.g. zidovudine / AZT / retrovir;
A highly active anti-retroviral therapy / HAART
stops replication of virus / controls HIV spread through the body;
(drug) delays onset of AIDS;

control of, secondary / opportunistic, infections; **A** bacterial / fungal
by antibiotics;
- (iii) similar number diagnosed each year / ref to figures to make this point;
fewer dying / developing AIDS, each year;
idea that symptomless carriers increase chance of spread;

[max 6]