**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 ÷ 1.672  
24.74 = one mark  
**IGNORE** 25 and look for working mark  
If units are given, they **must** be kg m–2 (or kg/m2)  
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 / Vmax;

**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;

‘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’

3

(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 ling between peaks  
for bracken and cotton grass (on horizontal axis);  
peak / highest point, for ling 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***

|  |  |  |  |
| --- | --- | --- | --- |
| *feature* | *DNA* | *RNA* |  |
| *number of strands* | two / double | one / single | ; |
| *bases present* | thymine / T (+ adenine + cytosine + guanine) | uracil / U (+ adenine + cytosine + guanine) | ; |
| *sugar present* | 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

1

(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) / CuSO4 + 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 / > 80oC **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



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) Prot**oct**ista / Prot**oct**ist(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; **R** if incorrect named bond  
glycosidic / correct bond drawn; treat ‘covalent’ = neutral  
addition of water / H2O; max 2

[2]

**39.** *accept*  *= yes = no  
each correct row = I 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;substate molecule no longer fits active site;(may be) irreversible so reaction/ protein production stops; **A** fungusdestroyed

[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  
Protoctista; **A** protoctists / 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; max4

[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/ORA;  
coronary event may not be CHD;  
not all (coronary) events cause, mortality/death;  
higher standard of health care (can prevent deaths)/AW/ORA;  
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 (705715)  
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) 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**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *statement* | | | | | |
| *substance* | ***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 chronicTB / 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;  
ensure enough medical personnel are available;

**9** qualified ref to education of population;

**10** prioritising diseases;

**11** target screening;

**12** 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 / Tk / Tc;helper / T helper / Th;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**; 1  
 *award the QWC mark if three of the following are used in correct context* *and explained*

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

[8]

**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 Vmax; **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*** 1

(b) (i) (α) helix; **R** double helix 1

(ii) (β) pleat(ed) (sheet); 1

(c) tertiary / 3°; 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** adrenalinereleased;

**n3** increases heart rate;

**n4** reduced circulation to extremities / vasoconstriction; **R** contract **A** narrowlumen

**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 cellsstimulated/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

[11]

**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)*

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

[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 Vmax;increasing substrate concentration has no effect (on the rate); 3 max

[3]

**114.** (a) **R** *first reference to 15N 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 14N and 15N;

**4** one strand with**,** ‘heavy’ N / 15N; **R** *molecule*

**5** one strand with**,** ‘light’ N / 14N; **R** *molecule*

**6** no molecules with only**,** 1 isotope / 14N / 15N;

*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 14N and 14N/15N only;thick for 14N and thin for 14N/15N; 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 ofexercise 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** fibrilcovalent 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); / beta; **A** Bglycosidic; **NOT** glucosidic180;straight; **A** polysaccharide / unbranched / linearhydrogen / 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 / thyamine

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 Q10 = 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** hexosesame formula; **R** similar / moleculering / 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

[6]

**145.** (a) nicotine; 1

(b) *any two from*

carbon monoxide / CO;binds to haemoglobin / forms carboxyhamoglobin;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)

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 lumenvitamin E atherosclerosis antioxidantsblood pressure plaque hypertensionendothelium thrombus thrombosisangina 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 × 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** thiamineDNA is,made of two chains / double helix; **R** double moleculelonger; 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  1 amino acid;sequence ofbases / triplets, determines,sequence of amino acids /  
primary structure;coiling /  helix / -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

[10]

**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 / ) 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

(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 /

/ 83.53 / ;



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 insectides 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;(-) helix;(-) 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 max3

(b) rate increased;greater chance of substrate binding with, active site / enzyme; ora  
more, product formed / substrate converted;

will reach Vmax / rate unaffected,if great excess of succinate;

AVP;e.g. graph of rate against substrate concentration  
 effect of time (using up substrate) max3

[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** Tc / 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]