UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

9700 BIOLOGY

9700/21 Paper 2 (AS Structured Questions), maximum raw mark 60

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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1 (a) (i) glycosidic ; [1]

(ii) hydrolysis / hydrolytic ; [1]

(iii) *assume that the answer refers to within the cell unless told otherwise*
accept any two relevant examples, e.g.
solvent / medium for reactions ;
transport medium ;
maintaining turgidity / keeping firm / prevents flaccidity / AW ;
(raw material / reactant for) photosynthesis / photolysis ;
expansion / elongation / growth ;
maintains, hydrostatic pressure / pressure potential ;
maintains water potential (gradient) ;
A maintains osmotic gradient / prevents plasmolysis
stomatal opening ;
hydrophilic interactions of membranes ;
(in vacuole) pushes chloroplast to edge of cell ;
R hydrogen bonding unqualified by ref. to membranes [2 max]

(b) spherical / ball-shaped / AW ;
has a tertiary structure ; **ignore** quaternary
hydrophilic / polar, groups on outside ;
water soluble ;
ignore 'more than one polypeptide' [2 max]

(c) (i) active site ; **ignore** binding / catalytic [1]

(ii) 1 (shape of) **U** / active site, gives specificity ; **A** *ecf* from **(i)**
2 substrate, fits into / binds with, active site / **U** ; **A** *ecf* from **(i)**
3 complementary (shape) / matching shape ;
A 'lock and key' / induced fit **R** 'same shape'
4 further detail of substrate binding to active site ;
5 forms, enzyme-substrate / E-S, complex ;
6 causes stress in substrate / AW ;
7 lowers activation energy / reactions occur at low(er) temperatures ;
8 not used up in reaction / remain unchanged / reusable ;
9 high turnover number / catalyse many reactions per unit time ; [4 max]

[Total: 11]

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2 (a) *award two marks if correct answer (29) or (28) is given*
allow +/– 1 mm in reading the line
100 000 µm / 3 500 = (28.57)
or (28.29 if measured 99 mm) or (28.86 if measured 101 mm)
29 ;; **A** 28 only if 99 mm measured
award one mark if correct measurement is divided by the magnification or if answer is given to one or more decimal places [2 max]

(b) (i) stretch / expand / lengthen, on inspiration and, recoil / shorten, on expiration ;
A alternatives for inspiration and expiration but **R** contract and relax
(stretch) to increase, surface area / volume of air, for, diffusion / gas exchange ;
(recoil) to (help), expel air / force air out ; **ignore** contract
prevent alveoli, bursting / breaking / AW ; **R** collapsing [2 max]

(ii) *ignore moist*
correct ref. to diffusion of, carbon dioxide / oxygen ; **A** absorb / lose / AW
(many alveoli) large surface area ;
surrounded by, (many) capillaries / capillary network / AW ;
short diffusion distance (between air and blood) ;
blood maintains concentration gradient ;
epithelium / alveolar wall / AW, thin / squamous ; **A** alveolus one cell thick
A alveolus has a thin wall
R cell wall e.g. alveolar cell wall is thin
idea that very little between, epithelium and endothelium / AW ;
e.g. alveolus and capillary are close together [4 max]

(c) (i) *assume answers are about person with emphysema, accept ora if clear*
fewer alveoli / (large) 'holes' ;
A alveolar walls broken down / fewer air sacs / alveoli burst / destroyed
less / destroyed / broken, elastic tissue / elastin ; **ignore** damaged
R no, elastin / elastic fibres
small(er) surface area ;
fewer capillaries ;
named change(s) to bronchial tissue ; e.g. enlarged goblet cells, more mucus, scar tissue, scarred, narrow lumen in airways, inflammation, damaged / no, cilia
ref. to tar deposits ;
R collapsed lung tissue [2 max]

(ii) shortness of breath (when exercising) / breathlessness ;
A breathing difficulty
wheezing / AW (on inspiration) ;
rapid breathing rate / hyperventilation / decreased ability to hold breath ;
R heavy breathing
chest, tightness / pain ;
cyanosis / bluish appearance to the skin / AW ; **A** pale
fatigue / tiredness / lethargy / weakness / dizziness / AW ;
coughing / coughing up blood ;
lots of mucus produced / much phlegm ;
expanded / barrel, chest ;
R ref. to oxygen concentration of the blood
R small vital capacity [2 max]

[Total: 12]

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3 (a) (i) right ventricle ;
pulmonary vein ; [2]

(ii) *ignore close to prevent backflow – allow ref to one side only*
valve opens to allow blood from atria to ventricles ;
when ventricles contract, valves close (to stop backflow) ;
A valves close when blood is pumped out of the ventricles
ref. to pressure difference between chambers ; [2 max]

(b) 1 ;
5 ;
2 ;
4 ; [4]

(c) 1 SAN sends out, wave of excitation / impulses ; **A** electrical (im)pulses
R once only - nervous impulse(s) / pulse(s) / signal(s) / wave(s)
R if brain stimulates SAN to send out impulses
2 spreads across atria ;
3 atria contract / atrial systole ;
4 fibrous ring / non-conducting tissue / insulating tissue ;
5 prevents, it reaching the ventricles / ventricles contracting at the same time (as atria) ;
6 AVN sends on wave of excitation to ventricles ;
A *in context – impulse reaches AVN and is passed on to ventricles*
7 (therefore) time delay to allow, atria to empty / atria to complete contraction / ventricles to fill / atria and ventricles do not contract at the same time ;
8 time ref. 0.1–0.2 seconds ;
9 Purkyne tissue conducts, excitation / impulses, to base of, septum / ventricles ;
A apex of heart
10 spreads upwards in ventricle (walls) ;
11 (so) ventricles contract from base upwards / ventricles force blood up from base ;
[5 max]

[Total: 13]

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4 **(a)** caused by pathogen, transmissible / communicable / contagious / transferable / passed from one person to another ;
A for pathogen – microorganism / any two named types of microbe
R parasite unqualified [1]

(b) **R** virus or bacteria once in the answer
female, *Anopheles* (mosquito) ;
takes blood (meal) from an (infected) person, feeds on an (uninfected) person ;
R 'bite' unless qualified with blood
Plasmodium / parasite, transmitted in (mosquito's) saliva ;
Plasmodium / parasite, blood transfusion / shared needles / across placenta / at birth ;
[2 max]

(c) *max 3 for malaria max 3 if pathogen(s) is virus or bacterium*

1 *Anopheles* / mosquito / vector, survives / breeds / lives, within the tropics / in hot and humid areas ; ora
2 *Plasmodium* / pathogen / parasite, needs to reproduce within the mosquito (at temperatures above 20°C) ;
3 eradicated in some countries outside the tropics ;
4 ref. to LEDCs and, poor / non-existent, mosquito control programmes ;
5 mosquitoes resistant to, DDT / insecticides / pesticides ;
6 *Plasmodium* resistant to, drugs / chloroquine / other named drug ;
7 TB is transmitted, by, droplets / coughing / sneezing ; **A** in the air
8 no vector / no mosquito / no requirement for hot or humid conditions ;
9 ref. to, HIV infection / lower immunity / immunocompromised ; [4 max]

(d) 1 active immunity ;
2 vaccine contains, antigen(s) / pathogen / microorganism / named type ;
3 (primary) immune response ;
4 B lymphocytes / B cells / plasma cells, synthesise / produce / secrete / release, antibodies ;
5 ref. to T helper cells (enhancing humoral response) ;
6 clonal selection / described ;
7 specific, (T / B) lymphocytes / antibodies ; **A** 'particular' / AW
8 memory cells, remain (in circulation) / give long-term immunity / give immunological memory / AW ;
9 fast(er) second(ary) response ;
10 ref. to boosters / AW ;
11 immunised person cannot spread disease to others ;
12 herd immunity / unimmunised people are safe(r) ;
13 surveillance of population for signs of disease / when there is an outbreak ;
14 ref. to ring immunity / AW ; [5 max]

[Total: 12]

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5 **(a)** interphase / S phase / synthesis phase ; **R** G1/G2 unqualified by interphase [1]

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

(ii) **M** = adenine and **O** = cytosine ; [1]

(c) each strand, of DNA acts as a template (for the synthesis of a complementary strand) ;
A described in terms of base pairing
new DNA (molecule) has one, old / parental / original, strand and one, new / daughter strand ;
R 'half old and half new' unless clearly referring to two strands [2]

(d) *accept ora*
(errors are) mutations / named type of mutation ;
ora if corrected there are no mutations
(may lead to) production of altered proteins, so, impaired / loss, of function ;
A altered amino acid in, protein / primary structure
(may lead to) different antigens, so cells are rejected (by immune system) ;
idea that cells cannot function together / impaired coordination ;
ref. to cancerous cells / cancer(s) / tumours / sickle cell anaemia or other named monogenic condition ;
further detail ;
e.g. uncontrolled, division / mitosis / cell replication / cell growth
e.g. lack of contact inhibition / no apoptosis *or* described / (proto)oncogene(s) [2 max]

[Total: 7]

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

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

[Total: 5]

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1 (a) *plant cell because presence of*

cell wall **;** **A** cellulose cell wall **R** incorrect cell wall materials

plasmodesma **;** **A** plasmodesmata

tonoplast **;** **A** vacuolar membrane

large/central, vacuole **;** ***ignore*** permanent [2 max]

(b)

name of organelle	diagram of organelle(s) as seen under the electron microscope (not to scale)	one function of organelle	cell type(s) in which organelle is located
	all 3 for one mark oval/circular shape and two membranes close together and inner membrane infolded as two or more cristae **;**	aerobic respiration/ATP, production/synthesis **;** **A** oxidative phosphorylation **A** ref. β oxidation fats **A** ref. urea/ornithine cycle **R** *any answer that refers to* synthesis/production, of energy	
centrioles **;** **A** centriole **A** centrosome			animal **;**
	both for one mark two membranes and ribosomes on external surface **;** **R** *if ribosomes are excessively large*		animal and plant/both **;**
		processing/modification/AW/ packaging, of, proteins/ molecules **;** **A** description of modification e.g. glycosylation **A** production of, secretory/ Golgi, vesicles **A** production of lysosomes **R** protein synthesis	
chloroplast **;**			

[8]

[Total: 10]

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2 (a) (i) right, atrium/auricle **and** left ventricle **;** *correctly labelled*
left hand side box *right hand side box* [1]

(ii) *right atrium has* *(ora for left atrium)*

lower, concentration/partial pressure/AW, of, oxygen **;** **R** no oxygen
A (right) deoxygenated blood (versus oxygenated blood)
A higher saturation of haemoglobin with oxygen

higher concentration/AW of, hydrogen carbonate ions/carbon dioxide **;**
A more carbaminohaemoglobin

higher concentration of water molecules/high(er) water potential/less negative water potential **;**

higher concentration/AW, of glucose **;** [2 max]

(b) *reject if more than one letter for each disease*
pulmonary stenosis = **G ;**
coarctation of the aorta = **D ;**
ventricular septal defect = **F ;** [3]

(c) *accept ora where relevant*

suggest
1 blood flows <u>from</u> aorta <u>to</u> pulmonary artery **;**
2 increased volume of / more, blood to lungs **;**
A blood to lungs at higher pressure
3 oxygenated and deoxygenated mix **;**
4 oxygenated blood / blood from aorta, to lungs **;**

explain (why blood flows from aorta to pulmonary artery)
5 left ventricle thicker wall (than right ventricle) **;**
6 (so) contraction generates greater force (than right ventricle)/AW **;**
7 higher pressure in aorta (than pulmonary artery) **;** [3 max]

[Total: 9]

3 (a) 53 % **;;** *2 marks for correct answer*

max 1 mark for correct calculation but, no/incorrect, answer
or not to nearest whole number
72.4 – 33.9 = 38.5
(38.5 / 72.4) x 100 = 53.18 / 53.2 [2]

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(b) **R** greater wealth unless linked to points below
any two valid reasons e.g. accept answers written as ora

1 more educated population **;** *in context of health*
2 better/greater access to, health care/AW **;**
3 higher level of preventive medicine **;** e.g. immunisation programmes
4 better diet **;** **A** ref. to less malnourished
A ref. to access to food supplies
5 greater access to, therapeutic medicines/drugs **;** **A** antibiotics
6 better/less overcrowded, housing/living conditions **;**
7 better, sanitation/sewage treatment **;**
8 greater access to uncontaminated drinking water **;**
R clean water unqualified
9 fewer, fatal diseases/AW **;**
10 ref. to effects of, civil war/war **;**
11 ref. to natural disaster **;** [2 max]

(c) **(i)** rank of % positive (of countries) is different to rank of difference in <u>decrease</u> in life expectancy **;**
data quote to support **;** e.g. Kenya 6th highest % positive but 3rd highest decrease in life expectancy
S. Africa 4th highest % positive but 6th highest decrease in life expectancy
countries with, similar/same, <u>decrease</u> (in life expectancy) have different % positive **;**
data quote to support **;** e.g.
Malawi 17.8 years decrease, 16%, cf South Africa 17.5 years, 19.9%
Kenya 20.1 years, 14%, cf Zambia 20.1 years, 20% **;**

with ref. to <u>decrease</u> in life expectancy and % positive
Kenya, does not fit general trend/AW **;**
South Africa, does not fit general trend/AW **;**
data quote to support **;** e.g.
Kenya larger <u>decrease</u> than, Malawi/South Africa, but lower % positive
Kenya 20.1 years <u>decrease</u> but only 14.0 %, compared to, Malawi 17.8 with 16.0%/ South Africa 17.5 with 19.9 % **;** [2 max]

(ii) *any two relevant factors e.g.*

1 anti HIV drug therapy/AW **;**
2 ref. to treatment of AIDS-related diseases **;**
3 ref. to education to prevent, transmission/spread **;**
4 use/provide free, condoms/femidoms **;** **A** dental dams
5 avoid promiscuity **;** **A** one sexual partner
6 HIV mothers avoid breast feeding **;**
7 heat treat/screen, blood (for transfusion) **;**
8 needle-exchange schemes/AW **;** **A** ref. to sterile syringes
9 use of sterile equipment, qualified e.g. in surgery/tattooing/piercing **;**
10 testing for HIV status/contact tracing **;**
11 ref. to vaccine development **;** [2 max]

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(d) 1 primary/immune, response ;
2 ref. specificity; *in correct context*
3 (HIV/virus) antigens ;
4 antigen presentation/antigen presenting cell/APC/described ;
5 clonal selection/described ; e.g. recognition of/binding to, antigen by, B-lymphocyte
6 sensitisation/activation/described ; e.g. cell growth or cellular changes
7 clonal proliferation/formation of clone/mitosis/cell division/AW ;
8 B-lymphocytes/B-cells/plasma cells, synthesise/produce/secrete/release, antibody ;
9 T(helper)-lymphocyte response described ; e.g. cytokine production
ignore ref. to T killer cells [5 max]

[Total: 13]

4 (a) (i) (describes the) sequence of amino acids (in a polypeptide chain) ; **A** order/arrangement [1]

(ii) H_2O/water, released ;
(correct) bond formation between (lysine) carboxyl group and (valine) amino group ;
dipeptide (of lysine and valine) and formed with correct structural formula ; [3]

(b) (i) *secondary*
1 regular order/pattern, based on H-bonds ;
2 between CO– group of one amino acid and NH– group of another ;
3 alpha-helix and β-pleated sheet ;

tertiary to max 4
1 folding coiling ;
2 interactions between, R groups side chains ;
3 two correctly named bonds ; e.g. hydrogen bonds, disulfide, bonds/bridges, ionic bonds, hydrophobic interactions
4 further description of bonds ; e.g. *disulfide* between cysteine (S–H) groups
hydrogen between polar groups (NH– and CO–)
ionic between ionised amine and carboxylic acid groups
hydrophobic interactions between non-polar side chains
5 ref. active site, specific/precise, shape ;
6 ref. globular/AW, shape ; **A** spherical/ball
7 ref. amino acids with, hydrophilic/polar, R groups facing to outside ; ora [5 max]

(ii) enables (protein to) function/AW ; **A** enables antimicrobial action/AW
A biological catalyst, qualified
provides active site ;
qualified ref. to specificity ; [1 max]

(c) altered, (mRNA) codon(s)/triplet(s) ; **A** named type of mutation
changed/AW, amino acid(s) ;
ref. to effects of stop codon ; e.g. shortened polypeptide chain
different, primary structure/described ;
A ref. to differences in, transcription/translation
ref. to different properties of, R group/side chain (of normal v replaced amino acid) ;
altered tertiary structure/AW ; **A** different R group interactions
A change/loss of, active site
idea of globular to fibrous change/hydrophilic R groups no longer to outside ; [3 max]

[Total: 13]

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5 (a) *one mark for each correct row ; ; ; ;*

	cartilage	ciliated epithelium	elastic fibres	goblet cells	smooth muscle
A	✓		✓		✓
B	✓	✓		✓	✓
C	×	✓	✓		
D		×	✓	×	

[4]

(b) *goblet cells to max 3*
synthesise/produce/secrete/release, mucus **;**
mucus, sticky/AW **;**
(mucus) traps/AW, pathogens/AW , dust/particles/AW, pollen **;**
A named organism types/microorganisms
R cilia traps
increased secretion when, inflamed / infection **;**

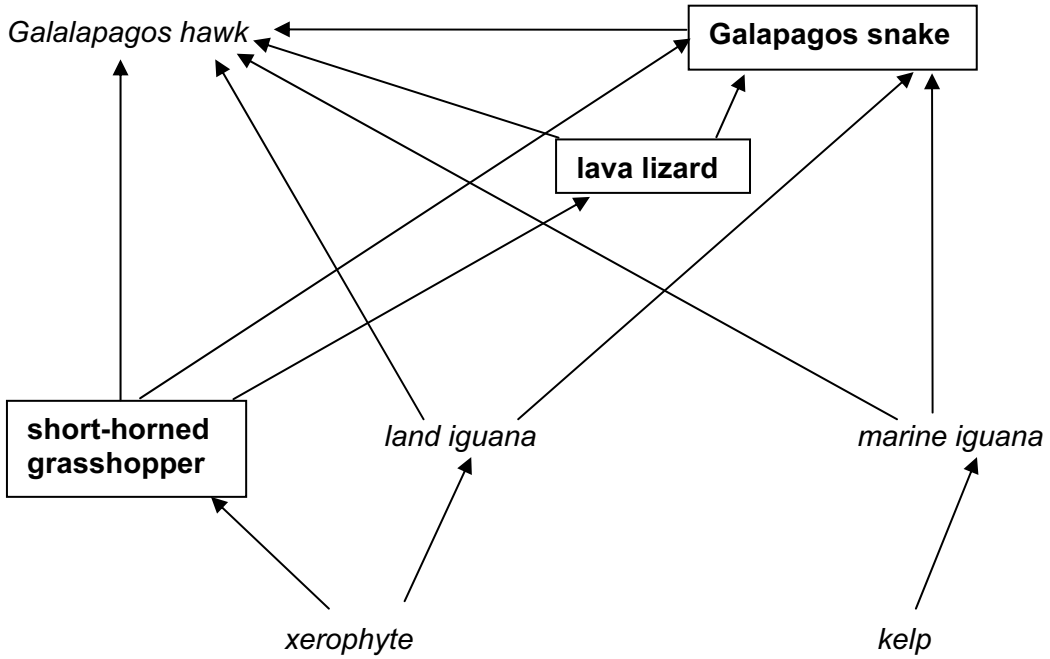
qualified ref. to role of mucus **;** e.g.
increases distance (e.g. of pathogen) to reach (epithelial) cells
acts as barrier/prevents, entry/attachment to, cells
prevent, infections/pathogens reaching alveoli *allow once only in either section*

cilia to max 3
waft/move/AW, mucus **;**
synchronous/metachronal, rhythm **;** AW
movement towards back of throat for, swallowing/coughing out **;**
qualified ref. to role of cilia in health **;** e.g. ref. to, normal air flow/ventilation/keeping airways clear [4 max]

[Total: 8]

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6 (a)



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

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

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

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

[Total: 7]

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1 (a) **A** nucleus **;** **A** (eu)chromatin **R** nucleolus
B mitochondrion **;** **A** mitochondria
C (rough) endoplasmic reticulum **;** **A** (R)ER **R** smooth/S [3]

(b) (i) protein/polypeptide, synthesis/AW **;** **A** protein, transport/modification
A ecf if **C** is identified as Golgi or SERor ribosomes in **1 (a)** [1]

(ii) *ignore refs to magnification*
resolution/resolving power, low(er) **;** ora
200 nm compared to 0.5 nm **; A** resolution quoted in range 100-300 to 0.2-1.0 nm
ref. to visibility of structure **C ;** e.gs.
wavelength of light longer than size of, ribosomes/membrane
ribosomes/membrane, cannot be seen as less than 200nm diameter
ribosomes only 20–30 nm diameter **A** 15–20 nm
membranes 7–10 nm thick
small size linked to explanation of resolution [2 max]

(c) *any one relevant disadvantage e.g.*

only dead specimens can be viewed **;**
mounted in vacuum/pre-treatment, may distort delicate structures **; A** artefacts
expensive, qualified **;** e.g. to buy, maintain, increased cost electricity, costs associated with, time/training
requires, more electrical power **;**
requires stable, high voltage supplies/currents **;**
sensitive to external magnetic fields **;**
difficult to operate/requires technical training **;**
samples more difficult to prepare **; A** examples e.g. thin sections
lengthy preparation time **;**
monochrome/black and white only **;**
not portable/can only be used in specific locations (e.g. with voltage supplies) **;** [1 max]

(d) *allow +/- 1 mm in reading the line*
award two marks if correct answer is given

20 000/6 µm = (3333.3) **A** 19 000/6 = (3 166.7) **A** 21 000/6 = (3 500.0)

3 333 (x)**;;** **A** 3 167 (x) **A** 3 500n(x)

award one mark if answer is given to one or more decimal places or
award one mark if correctly measured and divided by 6 µm but incorrectly converted [2 max]

[Total: 9]

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2 (a) semilunar valve **;** **A** pulmonary valve

prevents backflow (of blood) **;**
from the pulmonary artery/into the right ventricle **;**
or
ensures one-way flow of blood **;**
from the right ventricle/into the pulmonary artery **;** [3]

(b) (**Y**/wall of left ventricle) contains <u>more</u> (cardiac) muscle **;** ora
left ventricle/ventricle beside **Y**, pumps blood to, whole body / further **;** ora
at higher pressure with more force (than right) **;** ora
resistance to blood flow is greater in systemic circulation **;** ora [3 max]

(c) *any two of* SAN, AVN, Purkyne tissue/Bundle of His *in correct context* **;**

SAN/(primary) pacemaker, sends out, waves of excitation/impulses **;**
A electrical (im)pulses
R once only nervous impulse(s)/pulse(s)/signal(s)
R if brain stimulates SAN to send out impulses
spreads across atria **;**
atria contract/atrial systole **;**

fibrous ring/non-conducting tissue/insulating tissue **;**
prevents, it reaching the ventricles/ventricles contracting at the same time (as atria)**;**

atrio-ventricular node/AVN, acts as 'relay station'/sends wave of excitation to ventricles**;**
A in correct context – impulse reaches AVN and is passed on
(therefore) time delay to allow, atria to empty/atria to complete contraction/ventricles to fill//
atria and ventricles do not contract at the same time **;**
time ref. 0.1 – 0.2 seconds **;**

Purkyne tissue bundle of His, conducts, excitation/impulses, to base of, septum/ventricles **;**
A apex of heart
spreads upwards in ventricle (walls) **;**
(so) ventricles contract from base upwards/ventricles force blood up from base **;** [5 max]

[Total: 11]

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3 **(a)** **(i)** primary ; **A** first
quarternary ; **A** fourth [2]

(ii) disulfide (bonds/bridges) ; [1]

(b) peptide bond broken ;
correct involvement of water ;
free –COOH/–COO^- and free –NH_2/–NH_3^+ shown ; [3]

[Total: 6]

4 **(a)** *any one correct description (1 mark) with explanation (1 mark) e.g.*

any named biological control method e.g *B. thuringiensis* ;
kills mosquito larvae ;

use of insecticides ;
kills (adult) mosquitoes ;

elimination of standing water ;
removes, mosquito breeding sites/egg-laying areas ;

use of oil on water ;
prevents maturation of/kills, mosquito larvae ; [2 max]

(b) (malarial) parasite/pathogen/*Plasmodium*, has many antigens ;
eukaryotic/many genes ;
many different stages of life cycle ;
ref. to more than one *Plasmodium* species/strain of each species ;
mutation changes antigens (over time)/antigenic shift/antigenic drift ;
parasite only vulnerable, at certain stages of life cycle/when free in plasma ;
antigenic concealment/described ;
AVP ; e.g. changes antigens which are expressed (through gene switching) [3 max]

(c) percentage of, parasites killed/growth inhibition, increases with drug concentration for both parasites ;
effect is greater on chloroquine-resistant parasites/AW ;
chloroquine-sensitive parasites not affected until 1 μmol dm^{-3} ;
further use of data from Fig. 4.1 to illustrate ;
further detail of difference in trend(s) ; **A** descriptive or figures [3 max]

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(d) **(i)** (percentage) increase in malaria is high(er) in, countries in the, south/south and east **;**
ora **A** named countries **R** more malaria

ref. (percentage) increase correlates with countries where HIV incidence is higher **;**
penalise once if no ref to increase

data quote **;** [2 max]

(ii) HIV, infects/AW, T (helper)–lymphocytes/T-cells **;**
qualified ref. to immune system **;**
(HIV and) malaria may be contracted via blood transfusion **;**
ref. to reduced number of workers so malaria prevention not carried out **;** [2 max]

[Total: 12]

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

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

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

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

(c) **(i)** to check that urea is not hydrolysed/broken down, without enzyme **;** ora
A there is no reaction without enzyme [1]

(ii) hydrolysis reduces, substrate/urea, concentration **;**
urea, hydrolysed/broken down, more quickly in Tube **A** than in Tube **B;**
A ref. to differences in reaction rates

*Tube **A*** enzyme can bind with substrate normally/ES complexes forming (at fast rate) **;**
ora *Tube **B***
shape of active site complementary to (shape of) substrate/AW **;**

*Tube **B*** (competitive) inhibitor, occupying/binding at/AW, active site **;**
ref. substrate unable to enter active site/AW **;**

correct data quote from either column to illustrate **;** [4 max]

[Total: 11]

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6 (a) *1 mark each correct row*

	lined with cilia	reinforced with cartilage	site of gas exchange	contains smooth muscle	
trachea	✓	✓		✓	;
bronchus	✓	✓	×	✓	;
bronchiole	✓	×	×		;
alveoli	×	×	✓	×	;

[4]

(b) good/circulating, blood supply **;**
good ventilation/breathing movements **;** [2]

(c) (i) stretch/expand/lengthen, on inspiration and, recoil/shorten, on expiration ;
A alternatives for inspiration and expiration
R contract and relax
(stretch) to increase, surface area/volume of air, for, diffusion/gas exchange **;**
(recoil) to help, expel air/force air out **;** ***ignore*** contract
prevent alveoli, bursting/breaking/AW **; R** collapsing [1 max]

(ii) emphysema **;** [1]

(d) (cause) mutations **;**
uncontrollable, division/mitosis/cell replication/cell growth **;**
lack of contact inhibition/no apoptosis *or* described/(proto)oncogenes **;**

goblet cells secrete, excess/more/AW, mucus **;**
destroys/weakens/paralyses/AW, cilia **;**
development of scar tissue **;**
inflammation **;**
increased chance of infection/AW **;** [3 max]

[Total: 11]

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