

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

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	GCE AS/A LEVEL – May/June 2010	9700	21

- 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]

Page 3	Mark Scheme: Teachers' version	Syllabus	Paper
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- 2 (a) award two marks if correct answer (29) or (28) is given
allow +/- 1 mm in reading the line
 $100\,000\ \mu\text{m} / 3\,500 = (28.57)$
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]

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
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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]

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
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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]