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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UNIVERSITY of CAMBRIDGE
International Examinations

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]

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]

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]

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]

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]