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

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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]

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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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