UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2008 question paper

9700 BIOLOGY

9700/02 Paper 2 (Theory 1), 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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2008 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

1 (a) (i) bracket extends across whole bilayer ; [1]

(ii) *fluid*
phospholipids move (within their monolayer) / proteins, move / float ;
A phospholipids are liquid
mosaic
proteins, scattered / dispersed, within, phospholipids / bilayer ;
R membrane unqualified [2]

(iii) both made of, protein / polypeptide(s) / amino acids ;
both have
disulphide bond ;
antigen binding site ;
variable region ;
constant region ; **A** non-variable [2 max]

(b) *helper cells*
secrete / release / produce, cytokines / lymphokines / hormones ;
to stimulate B cells to, divide / develop into plasma cells ;
(which) produce antibodies ;
stimulate macrophages to carry out phagocytosis ;

cytotoxic / killer T cells
seek out / find / bind to, (foreign) antigens, on host cells / pathogens ;
destroy, virally infected host cells / intracellular parasites / viruses ;
attach to surface of cells / 'punch holes' into cells / disrupt cell surface (plasma) membrane;
(release) toxic substances / hydrogen peroxide (into cells) / interferons ;
R enzymes [4 max]

(c) control of entry and exit of substances ;
barrier to, polar molecules / water soluble molecules ;
adhesion ;
idea of retaining, large molecules / cell contents;
allow substances across, passively / by diffusion ;
ref to channel proteins ; **A** pore *allow transport protein once*
move substances through carrier proteins ;
active transport ;
ref to facilitated diffusion ;
endocytosis / exocytosis / phagocytosis / pinocytosis ;
recognise, hormones / neurotransmitters / chemical signals ;
sites of chemical reactions / sites for enzymes ; [3 max]

[Total: 12]

2 (a) (i) *assume answer is about glycogen*

branched ;
1–6 , glycosidic, links / bonds ;
not, coiled / helical ; [2 max]

(ii) compact so large quantity can be stored ;
insoluble so no osmotic effect ;
glucose would lower water potential ; **A** decrease, more negative
(so) water would enter and cell volume would increase ;
(so) plant cells would need thicker cell walls / animal cells might burst ;
glucose reactive molecule ; [3 max]

(b) *use annotations to help award these points*

1 oxygen bridge / glycosidic bond, broken ;
2 at left hand end of chain ;
3 water shown to be involved ; **A** hydrolysis
4 free glucose molecule with –OH drawn on C1 ;
5 chain now ends with –OH on C4 ; [3 max]

[Total: 8]

3 (a) *max 2 if no reference to data*
up to substrate concentration of 24 / 25 g dm^{-3}, substrate concentration is limiting ;
24 / 25 to 30 g dm^{-3}, another factor is limiting ;
enzyme concentration / temperature / pH ;
active sites, not filled up to 24 / 25 g dm^{-3} / all filled above 24 / 25 g dm^{-3} ;
A enzyme working at maximum rate
ref to collisions between substrate molecules and enzyme ; [3 max]

(b) same shape starting at the origin and with plateau starting at 24 / 25 g dm^{-3} ;
lower ; **A** plateau that starts between 7–12 au [2]

(c) *either*
competitive inhibitor / effect described in terms of <u>competition</u> ;
same <u>shape</u> as protein / substrate / elastin ; **A** complementary shape
to active site **R** same / similar, structure to active site
fits into active site ;
blocking entry of substrate / prevents formation of ES complex ;

or
non-competitive inhibitor / described in terms of <u>not competing</u> ;
fits into, a site other than active site / allosteric site ;
<u>shape</u> of enzyme changes / <u>shape</u> of active site changes ;
active site no longer complementary shape to substrate ;

or
combines permanently with, active site / other site on enzyme ;
e.g. by covalent bonding ;
blocks access to active site / causes tertiary structure to change ;
prevents formation of ES complex ; [3 max]

(d) set up different concentrations of substrate ;
same concentration of inhibitor ;
measure rate of reaction ;

if competitive
lower rate at low substrate concentrations, but at high substrate concentration will reach the same plateau ;
increasing substrate concentration reverses inhibition ;

if non-competitive / *irreversible*
lower rate / no activity / does not reach the same rate at high substrate concentrations ;
increase substrate concentration does not reverse inhibition ;

accept sketch graphs to show results [4 max]

(e) expands / stretches, during inhalation ;
recoils during exhalation ;
forces air out of alveoli ;
prevents bursting of alveoli ; [2 max]

(f) emphysema ; **A** chronic obstructive, pulmonary / lung disease
A COPD or COLD [1]

[Total: 15]

4 **(a)** H^+ pumped out ;
creates an H^+ gradient ;
sucrose moves in with H^+
co-transport / through co-transporter ;
energy / ATP, provided by mitochondria ;
sucrose diffuses down concentration gradient ;
through plasmodesmata ; [4 max]

(b) large surface area : volume ratio / to increase surface area ;
gives large surface area of membrane ;
(so) many, pumps *or* co-transporters ; [2 max]

(c) **(i)** higher / greater resolution / resolving power ; **ora**
A 0.5 nm (0.0005 μm) compared with 200 nm (0.02 μm)
because of shorter wavelength ; **A** smaller
more detail can be seen / much clearer (at the same magnification) / can see two points that are close together ;
can see cell structures that are not visible in the LM ;
A e.g. ribosomes / membranes
can see detail of structures just visible in LM with e.g. ;
A mitochondrion / chloroplast [2 max]

(ii) long (length greater than width) ;
sieve plates ;
sieve pores ;
some / less / peripheral, cytoplasm ;
no nucleus / fewer mitochondria / less ER ;
thin wall ; [2 max]

[Total: 10]

5 **(a)** transmitted by, *Anopheles* / mosquito / (insect) vector ;
P. falciparum / parasite, needs, warm / hot, temperatures / >20°C,
to complete its life cycle (in the mosquito) ;
requirement for areas of still water (ref. mosquito life cycle);
eradicated in areas outside tropics (e.g. North America) ; [2 max]

(b) **(i)** **A** 28 ;
B 14 ; [2]

(ii) reduce / halve, chromosome number ;
retain diploid number at fertilisation ;
prevent chromosome number doubling each generation ;
ref to variation ; **A** ref. to meiosis crossing over / independent assortment [2]

(c) genetic complexity of *Plasmodium* ;
A ref to *Plasmodium*, being eukaryotic / having many genes
many antigens / antigenic variation ;
many stages in life cycle (within human) ;
antigens change in different stages ;
idea that variation generated during meiosis ;
mutations / recessive alleles, are expressed in haploid stage(s) ; **ora**
Plasmodium / parasite, lives within cells ; **A** only briefly free in the blood stream
A antigenic concealment
T-lymphocyte / B-lymphocyte, receptors not stimulated ;
antibodies cannot work against stages within cells ; [4 max]

[Total: 10]

6 **B** 3
C 4
D 9
E 6
F 2 [5]

[Total: 5]