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UNIVERSITY of CAMBRIDGE
International Examinations

As part of CIE's continual commitment to maintaining best practice in assessment, CIE has begun to use different variants of some question papers for our most popular assessments with extremely large and widespread candidature, The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions are unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiner's Reports.

Question Paper	Mark Scheme	Principal Examiner's Report
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

Who can I contact for further information on these changes?
Please direct any questions about this to CIE's Customer Services team at: international@cie.org.uk

First variant Mark Scheme

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.

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1 (a) *check column **A** and **B** for correct ref. to feature if not clear in first column e.g. gives description*

feature	phagocyte (**A**)	plasma cell (**B**)
rough endoplasmic reticulum / RER *allow ER if rough / RER stated in next column(s)* **R** SER	small quantity / AW **A** few, less	large quantity / AW ; **A** many, more
ribosomes	few *or* ref. to free	many ; *or* not free / fixed
lysosomes	some / present / ✓	none / absent / x ;
vacuoles / vesicles / phagosomes	some / present / ✓	none / absent / x ;
nucleus	lobed / AW **A** irregular, not round **R** curved, elongated, no definite shape	round / not lobed / not irregular / AW ; **A** spherical, circular
Golgi (body)	absent / x	present / ✓ ;
plasma / cell (surface), membrane	with, endocytotic / pinocytotic / phagocytic / exocytotic, vesicles / vacuoles **A** invaginations, infoldings **R** indentations	without, endocytotic / pinocytotic / phagocytic / exocytotic, vesicles / vacuoles **A** no invaginations, no infoldings **R** no indentations
mitochondria	less / few / 3	more / many / 7 ;

[3 max]

(b) (to nearest whole number) (x) 6000 ;; **A** 5900 – 6100
allow 1 mark for correct working if answer incorrect / not to whole number
e.g. length of scale bar in mm × 1000, divide by actual size
60 mm × 1000 / 10 **A** 59 – 61 mm [2]

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(c) *phagocyte*
move to sites of infection ;
ingest / engulf / pseudopodia enveloping / phagocytosis of / endocytosis of, bacteria / microbes / pathogens / AW ;
R antigens, virus
(form) phagocytic / endocytotic, vacuoles ;
A vesicles, phagosomes
ref to lysosomes ;
enzymes / named (hydrolytic) enzymes ;
digest / hydrolyse, (bacteria / AW) ;
antigen presentation / description ; [3 max]

plasma cell
produce / secrete / release / synthesise , antibodies ; **A** make
into, plasma / tissue fluid / lymph ; **A** blood
antibodies are proteins ;
ref to, RER / ribosomes ;
specificity qualified e.g. of, antibodies / lymphocyte / plasma cell
or description e.g. each type of plasma cell produces one type of antibody ;
Golgi (body) packages antibodies / ref to formation of (Golgi) vesicles ; [3 max]

(d) (bacteria likely to be) resistant to (at least) one antibiotic (so useless) ;
less likely to be resistant to all / chance that bacteria will develop resistance to all antibiotics used is very small ;
ref to mutation / change to DNA ;

(bacteria are) inside cells where protected from antibiotics ;
(mycobacteria) divide / grow, slowly ;
ensures all bacteria killed / reduces below critical level ;
otherwise, bacteria remain / reservoir of infection ;
(so) prevents development of antibiotic resistance ; [4 max]

[Total: 15]

2 **(a)** *treat refs to mechanisms as neutral*
(soil to) root hair ;
idea of across, cortex / cortical cells (root) ;
apoplast / along cell walls ;
symplast / via, cytoplasm / plasmodesmata ;
through, endodermis / endodermal cells, by symplast pathway ;
(because of) suberin / Casparian strip ;
ref to passage cells ;
apoplast into the xylem ; [4 max]

(b) **(i)** stomata are open (to allow diffusion / gas exchange) ;
(for) entry of CO_2 / release of O_2 ; AW
large surface area inside leaf (for gas exchange) ;
cell surfaces / walls, in (palisade / spongy) mesophyll ;
moist / damp / wet ;
correct ref to evaporation ;
water vapour, diffuses out / AW; **A** water *if linked to evaporation* [3 max]

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(ii) *adaptations*

(epidermal) hairs / trichomes ; **R** spikes, spines
stomata in, pits / cavities / chambers ; **R** sunken stomata

reduced air movement / still air ;
holds water vapour / has high(er) humidity / AW ; **A** holds moist air
(therefore) less steep, water potential / vapour pressure / diffusion, gradient ;
A qualified ref to diffusion shells between air inside leaf and air in pits ;

thick / waxy, cuticle (on upper, epidermis / surface) ;
multilayered, epidermis / hypodermis ;
thick walled epidermal cells ;
cuticle reflects sunlight ;
stomata only on lower surface / no stomata on upper surface ; [3 max]

[Total: 10]

3 (a) (i) tertiary (structure) ; **A** 3^o [1]

(ii) secondary (structure) ; **A** 2^o , alpha / α, helix [1]

(b) active site ; **A** catalytic site [1]

(c) (i)

mRNA	CGU ;	UGC / UGU	;	GAA
DNA	GCA	ACG / ACA		CTT ;

[3]

(ii) many / several / more than one, triplet for each amino acid ; **A** codon
an e.g. from Table 3.1 ;
degenerate code / description e.g. 64 possible triplets for 20 amino acids ; **A** codons
AVP ; e.g. may be an intron in this region, different nucleotides at the beginning (signal sequence) [2 max]

(d) (i) *reject references to time e.g. rapid, slowly*
as the concentration of, enzyme / lysozyme, increases the percentage of bacteria surviving decreases / AW ; **R** if only 1 named
steep, decline / decrease, 0 to 10 / first two concentrations, for *E. coli* ;
A large percentage difference in *E.coli* surviving at 0 to 10 / first two concentrations
less steep / more gradual, decline / decrease, from 10 to 150 for *E. coli* ;
decline / decrease, shallower / less steep from 0 – ,40 / 60 / 70 / 80, for *S. aureus* ;
A small percentage difference in *S. aureus* surviving from 0 – , 60 / 70 / 80
decline / decrease, more significant / steeper / more abrupt, from 60 / 70 / 80, up to 150 for *S. aureus* ; **A** large percentage difference *in S.aureus* surviving from 60 / 70 / 80, up to 150
always more *S. aureus* than *E. coli* ; ora
all bacteria survive with no lysozyme ;
lysozyme is more effective, at killing / against, *E. coli* / AW ; **A** ora
all *E. coli* killed, at 150 pmol dm^{-3} (of lysozyme) / at highest concentration ;
comparative data quote ; *both axes, both curves*
comparative data quote ; *penalise once for lack of units in both* [4 max]

(ii) different, polysaccharides / peptidoglycans, in cell walls ;

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S. aureus, does not have / has less, polysaccharides / peptidoglycans, in cell wall ;
ref to shape of active site ;
ref to shape of, polysaccharide / peptidoglycan (to fit into active site) ;
S. aureus has a capsule / ora ; **A** protective lipids
AVP ; e.g. *S. aureus* produces inhibitor [2 max]

[Total: 14]

4 **(a)** blood passes through the heart twice during one (complete) circuit of the body ;
A one cycle / one circulation **R** cardiac cycle
A systemic / body, and, pulmonary / lung, circulation [1]

(b) withstands high(er) blood pressure ;
maintains blood pressure ;
ref to <u>more</u>, elastin / collagen / (smooth) muscle ;
A thicker muscle [2 max]

(c) vasoconstriction / contract / constrict / close / narrow, to, stop / control / reduce, blood flowing through capillaries ;
blood, diverted / shunted, elsewhere ;
any suitable e.g. ; diverted from, skin when cold / gut during exercise

vasodilation / relax / dilate / open / widen, to allow blood to flow through capillaries ;
blood required in tissue to deliver, oxygen / glucose *or* to remove, lactate / carbon dioxide ;
[1 max]

(d) pores / gaps / perforations, in / between, (endothelial) cells ;
A pores in capillary wall **R** spaces, holes
water / ions / glucose, move out ; **A** named small soluble substances
***R** list which contains incorrect substance /* red blood cells
<u>hydrostatic</u> pressure of blood is greater than (hydrostatic) pressure of tissue fluid ;
(causing) pressure filtration / AW e.g. forced out under pressure / ultrafiltration ; **R** leaking
pinocytosis across capillary wall ; [3 max]

(i) *any three of the following*
more / plasma, proteins ;
more glucose ; **R** sugars
more, fat / fatty acids / glycerol ;
lower, water / solute, potential ; **R** water concentration
lower carbon dioxide concentration / lower concentration of HCO_3^- ;
higher oxygen concentration ;
AVP ; e.g. cell secretes substance that is in higher concentration in tissue fluid, another named solute, higher pressure [3 max]

(ii) lymph / lymphatic fluid ; [1]

[Total: 11]

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5 (a) *one mark for each row*

statement	haemoglobin	DNA	phospholipids	antibodies	
contains iron	✓	x	x	x	;
contains phosphate	x	✓	✓	x	;
able to self-replicate	x	✓	x	x	;
hydrogen bonds stabilise the molecule	✓	✓	x	✓	;
contains nitrogen	✓	✓	✓	✓	;

[5]

(b) *AVP answers must be in context to a watery external environment*
ref to molecules held together / strong attraction / AW ;
A cohesion between water molecules
detail of hydrogen bonding, e.g. slight –ve charge on O, slight +ve charge on H ;
A water molecules are polar
high boiling point / boils at 100°C ;
high latent heat of vaporisation ;
so water is liquid over wide range of temperatures ;
(liquid so) provides, support / buoyancy ;
high (specific) heat capacity ;
stable temperature / temperature of water does not change quickly ;
large amount of energy needed to be transferred from water for it to freeze / high latent heat of fusion ;
maximum density at 4°C / less dense at 0°C ;
provides surface tension ;
ref solvent ;
AVP ;
AVP ;
e.g. ref to surface dwellers, less need for support tissue,
stable habitat qualified, ref upwelling currents
ice floats / insulates [5 max]

[Total: 10]

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Second variant Mark Scheme

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

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MARK SCHEME for the October/November 2008 question paper

9700 BIOLOGY

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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 <u>plasma</u> 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 <u>and</u> 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]

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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]

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(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]

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(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^{o}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]

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