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 May/June 2009 question paper

for the guidance of teachers

9700 BIOLOGY

9700/21 Paper 21 (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) (*nuclear envelope*) drawn with two membranes and a space and at least one nuclear pore ;
(*mitochondrion)* two membranes with at least one crista attached or unattached ;
mitochondrion drawn smaller than nucleus ; ora

if wrongly labelled or both labels omitted, penalise once [3]

(ii) (to nearest <u>whole</u> number) (x) 2857 ;; **A** 2829 – 2886

allow one mark for correct working if answer incorrect / not to whole number / no answer
length of scale bar in mm × 1000, divided by actual size
e.g. 100 mm × 1000 / 35 *(scale bar 99–101 mm)* [2]

(b) cell / plasma / cell surface, membrane(s) ; **R** membranes
cytoplasm / cytosol ;
ribosomes / 70S ribosomes / 18nm ribosomes ; **R** 80S / 20nm / larger, ribosomes
DNA / genes ; **A** chromosome [3 max]

(c) (infected person) coughs / sneezes / spits / releases sputum / breathes <u>out</u> / exhales ;
A releases mucus **R** talks
<u>aerosol</u> / <u>droplets</u> / <u>moist</u> air, inhaled / breathed in (by uninfected person) ; [2]

(d) (i) <u>0.25</u> ; [1]

(ii) *suggested reasons for high fatality ratios*

poor / dense / overcrowded, housing / accommodation ;
low protein diets linked to lowered immunity ;
not, diagnosed / treated, early enough ;
DOTS / described, not used ;
lack of vaccination / vaccinations ineffective ;
antibacterial drugs / antibiotics / AW, not available / too expensive ;
medical services not available, qualified e.g. in rural areas / AW ;
idea of TB, linked to HIV/AIDS / opportunistic disease ;
MDR – TB / XDR – TB / not completing the course of antibiotic treatment increases resistance ;
no effective antibiotics to use ;
no facilities for isolating people ;
lack of, testing / treatment of, cattle / milk ; **A** unpasteurised milk
difficulty in obtaining reliable data / AW ;
ignore references to, overcrowded / poor, countries [4 max]

[Total: 15]

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2 **(a)** habitat ;
all the organisms / plants and animals / populations / AW, in the ecosystem / forest / place / area / habitat ;
niche ;
population ; [4]

(b) **(i)** primary consumer / herbivore ; [1]

(ii) (sloth) cannot digest, cellulose / cell wall (in leaves), itself ;
R cannot digest leaves **R** allows sloth to digest cellulose
able to, absorb / use, products / sugars, from, cellulose / cell wall, digestion ;
provide, vitamins / minerals ;
ref to, protein / nitrogen, recycling ;
idea of protection from gut, pathogens / parasites ; [1 max]

(iii) predators are, secondary consumers / tertiary consumers / top carnivores ;
(population, size / number of) predators limited by numbers of prey / sloths / AW ;
energy loss, between trophic levels / along food chain / inefficient energy transfer ;
detail e.g. only 10% transfer / respiration / heat / movement / excretion / inedible parts / egestion / to decomposers;
(prey numbers small so) competition for, food / prey ;
predators hunted by humans ;
habitats / areas, of predators destroyed ; [3 max]

[Total: 9]

3 **(a)** thin / flat ;
large / high, surface area to volume ratio / small / low, volume to surface area ratio ; **R** large surface area (on its own)
(SA:V ratio) 5.95:1 ; **A** anything between 5:1 and 7:1 **or** suitable calculation e.g. 2 × (12.5 × 3.0) / 12.6

body surface is gas exchange surface ;
no cell is far from surface / short (diffusion) distance ;
ref. diffusion of, oxygen / carbon dioxide / gases ; **A** gas exchange by diffusion
A description of diffusion as movement from high to low concentration
low, activity / metabolic rate / metabolism ; [4 max]

(b) **(i)** cell membranes impermeable to sodium ions ;
(as) sodium ion channels are not present (in cell membranes) ;
active transport / active uptake ; **A** sodium pumps to take up sodium ions
move sodium ions against their concentration gradient ;
uses, energy / ATP ;
R refs to cell walls / impermeable skin [2 max]

(ii) ref. to, (nerve) impulses / action potentials / depolarisation / resting potential ; *treat ref. to electric as neutral*
helps to maintain, water / solute / osmotic, potential of, body fluids / named body fluid ;
helps to maintain, osmotic / electrolyte, balance ;
ref. to, urine formation / osmoregulation ;
absorption of glucose / co-transport ; [1 max]

[Total: 7]

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4 (a) (i) **A** transcription ;
B tRNA / transfer RNA ;
C ribosome ; **A** subunit of ribosome / ribosomal subunit
treat 70S / 80S or small / large as neutral
D anticodon ; [4]

(ii) *similarities*

made of amino acids / amino acid monomers / polymer of amino acids **A** protein / polypeptides
have quaternary structure / have more than one polypeptide chain ;
four, sub-units / polypeptides ;
haem / porphyrin / prosthetic group(s) ; [2 max]

difference

(four) sub-units / polypeptides, are identical ;
or
haemoglobin has, two different, sub-units / polypeptides ;
or
haemoglobin has alpha and beta polypeptides ;

(catalase) has active site(s) ; **A** Hb has (oxygen) binding site [1 max]

(iii) each, sub-unit / polypeptide, has an active site ;
catalase has four, active sites / haem groups ; [1 max]

(b) iodine in potassium iodide solution / iodine in KI solution / I in KI solution ; **A** iodine solution **R** iodine

Benedict's, solution / reagent ; **A** Benedict's
A Fehling's solution / NaOH and $CuSO_4$ [2]

treat refs to colour changes as neutral

[Total: 10]

5 (a) water moves <u>down</u> water potential gradient ; **A** high(er) to low(er)
water potential / less negative to more negative water potential
apoplast pathway / through cell walls ;
symplast pathway / through, plasmodesmata / cytoplasm ;
evaporation ;
from <u>spongy</u> <u>mesophyll</u> <u>cell</u> <u>walls</u> ;
into (substomatal / intercellular) air space ;
diffusion of water vapour ; **A** diffusion of water if evaporation used in correct context elsewhere
through stomata ; [4 max]

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(b) *explanation must correctly relate to structure before marks can be awarded*
any three from the following six pairs

either
cellulose, cell wall / lining ;
allows adhesion of water ;
or
thick (cellulose) cell wall ;
prevents collapse / idea of providing support (under tension) ;

either
lignin ;
waterproofing / prevents water loss ;
or
lignin ; **A** rings / spirals / thickening / AW (of walls)
prevents collapse / idea of providing support (under tension) ;

no cytoplasm / lack of contents / hollow / empty lumen ; **R** dead
less resistance to / unimpeded / uninterrupted / unhindered / ease of / AW, flow / AW ;
A greater volume per unit time / faster rate **R** continuous, smooth

lack of end walls / continuous tube ;
less resistance to / unimpeded / uninterrupted / unhindered / ease of / AW, flow / AW ;
R continuous, smooth

pits / pores ; **R** holes
lateral movement / movement around air bubbles / supplies (water) to (surrounding), cells / tissues ;

wide / large diameter / large lumen ;
so large volume of water can be transported ; [6 max]

[Total: 10]

6 **(a)** chromosomes / chromatids, on equatorial plate / at equator / AW ;
A in, centre / middle, of cell
nuclear, membrane / envelope, dispersing / breaking up / (partially) visible / AW ;
A disappearing
chromosomes, in one group / not in two groups / not arrow shaped / not going to poles / not separated / AW ;
R chromosomes at poles [2 max]

(b) smoke / tar, is carcinogenic / contains carcinogens ; **A** named carcinogen e.g. benzpyrene / phenol
genes control, cell division / mitosis ;
mutation / change to DNA (in these genes) ; **A** DNA damaged **A** ref. to mutagenic
gene expression affected / AW ; e.g. ref to oncogenes / proto – to onco – / tumour suppressor genes switched off
cells, grow / divide, uncontrollably / continuously ; **A** uncontrolled mitosis
cancer cells do not respond to signals ;
(and) form a (malignant) tumour ;
(tar) settles on bronchial, epithelial cells / epithelium ; [4 max]

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(c) idea of, a long time gap / years, qualified ; e.g. before symptoms of, cancer / tumour, appear between decreased number smoking and lower mortality rates
correct ref. to data to support above ; *trends must be anchored in both graphs*
if data is used, must be anchored in both graphs and numerically correct
increasing mortality rate
increase in lung cancer deaths linked to rise in smoking in 1930s+ ;
valid ref. to other direct risk factors (for lung cancer) in 1930s+ ; e.g. air pollution, mass chest X-ray screening

decreasing mortality rate because
earlier diagnosis (so fewer die) ;
improved, health care / treatment (extends life) ;

ref. to epidemiological evidence linking smoking and lung cancer / almost all cases of lung cancer, are caused by smoking / occur in smokers ; [3 max]

[Total: 9]

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Second variant Mark Scheme

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

9700 BIOLOGY

9700/22 Paper 22 (AS Structured Questions), maximum raw mark 60

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Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE A/AS LEVEL – May/June 2009	9700	22

1 (a) (i) *Golgi body*

at least three unlinked cisternae drawn in cytoplasm ;
secretory vesicles forming at the side of the Golgi ;

exocytosis

vesicle shown fused to cell surface membrane ; **R** if add arrows pointing towards cell contents [3]

(ii) (to nearest <u>whole</u> micrometre) 5(μm) ;;

allow one mark for correct working if answer is incorrect / not to whole number / no answer

length of bar / 8000
e.g. $\frac{4\text{ cm}}{8000}$ $\frac{40\text{ mm}}{8000}$ $\frac{40000\mu\text{m}}{8000}$ **A** +/- 1mm on length of bar [2]

(b) capsule / slime layer ;
cell wall ; **R** cellulose / chitin, cell wall
flagellum (of flagellin) ;
DNA free in cytoplasm / loop of DNA / circular DNA / nucleoid / plasmid ;
DNA, naked / without histones ;
only, smaller / 70S / 18nm, ribosomes ; **A** only one type of ribosome
mesosome ; [3 max]

(c) <u>0.47</u> ; [1]

(d) *provide, boiled water / bottled water / sterile water ; **A** valid description of method to, remove / kill, bacteria*
*provide, oral / intravenous, rehydration therapy / ORT ; **A** ORS*
(contains) <u>glucose</u> <u>and,</u> salts / electrolytes ;
absorption of salts helps to absorb <u>glucose</u> ;
(absorption of salts) increases water uptake, by osmosis / AW ;
deaths usually caused by (rapid) dehydration ;
idea of rapid provision (of, ORT / medical supplies / personnel) ;
provide antibiotics (for severe cases) ;
*safe sewage disposal, qualified ; **R** sewage treatment plants* [4 max]

(e) transmission cycle is broken ;
sewage treatment plants / mains drainage ;
human faeces do not come into contact with drinking water supply ;
water treatment plants ; **A** drinking water is, chlorinated / treated, to kill bacteria ;
drinking water is piped to homes ; [2 max]

[Total: 15]

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2 **(a)** habitat ;
all the organisms / plants and animals / populations / AW, in the ecosystem / forest / place / area / habitat ;
niche ;
population ; [4]

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(ii) (sloth) cannot digest, cellulose / cell wall (in leaves), itself ;
R cannot digest leaves **R** allows sloth to digest cellulose
able to, absorb / use, products / sugars, from, cellulose / cell wall, digestion ;
provide, vitamins / minerals ;
ref to, protein / nitrogen, recycling ;
idea of protection from gut, pathogens / parasites ; [1 max]

(iii) predators are, secondary consumers / tertiary consumers / top carnivores ;
(population, size / number of) predators limited by numbers of prey / sloths / AW ;
energy loss, between trophic levels / along food chain / inefficient energy transfer ;
detail e.g. only 10% transfer / respiration / heat / movement / excretion / inedible parts / egestion / to decomposers ;
(prey numbers small so) competition for, food / prey ;
predators hunted by humans ;
habitats / areas, of predators destroyed ; [3 max]

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haemoglobin has alpha and beta polypeptides ;

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[Total: 10]

5 (a) **P** to one endodermal cell ;

Q to the cell <u>wall</u> of one of the four xylem vessels ;

R to cells immediately above the xylem ; **A** to one cell [3]

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(b) Casparian strip / suberin, is impermeable (to water) ;
blocks, apoplast pathway / pathway between cells / cell wall pathway ;
ref. to passage cells ;
water / (inorganic) solutes / minerals / ions, must pass through, endodermal cells / symplast pathway / symplast pathway described ;
cell can select solutes / AW ;
ref. to, active transport / carrier proteins ;
ref. to presence of solutes (at base of xylem) causing increase in root pressure / AW [3 max]

(c) *explanation must correctly relate to structure before marks can be awarded*

any two from the following six pairs

sieve pores ;
allow easy flow (from sieve tube element to sieve tube element) ; **R** flow of water

sieve plate ;
(may) prevent sieve tubes from bursting / AW ;

cell (surface) membrane / plasma membrane ;
prevents loss, of sucrose / assimilates / phloem sap ;

little cell contents / AW ; **R** no cell contents
little resistance / AW, to flow ; **R** flow of water

plasmodesmata ;
allows flow, to / from, companion cells ;

thin walls ;
for, rapid / easy, entry of water (at source, to build up pressure) ; [4]

[Total: 10]

6 **(a)** chromosomes / chromatids, on equatorial plate / at equator / AW ;
A in, centre / middle, of cell
nuclear, membrane / envelope, dispersing / breaking up / (partially) visible / AW ;
A disappearing
chromosomes, in one group / not in two groups / not arrow shaped / not going to poles / not separated / AW ;
R chromosomes at poles [2 max]

(b) smoke / tar, is carcinogenic / contains carcinogens ; **A** named carcinogen e.g. benzpyrene / phenol
genes control, cell division / mitosis ;
mutation / change to DNA (in these genes) ; **A** DNA damaged **A** ref. to mutagenic
gene expression affected / AW ; e.g. ref to oncogenes / proto to onco / tumour suppressor genes switched off
cells, grow / divide, uncontrollably / continuously ; **A** uncontrolled mitosis
cancer cells do not respond to signals ;
(and) form a (malignant) tumour ;
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ref. to epidemiological evidence linking smoking and lung cancer / almost all cases of lung cancer, are caused by smoking / occur in smokers ; [3 max]

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