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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

9700 BIOLOGY

9700/22 Paper 2 (Structured Questions AS), maximum raw mark 60

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1 (a) (i) calcium ions are, water soluble / charged / not, fat / lipid, soluble / hydrophilic / ionic **;** **A** not oil soluble
phospholipid bilayer / AW, is hydrophobic / AW **;** [2]

(ii) active transport / active uptake **;** [1]

(calcium ions) moved against their concentration gradient **;**
ref. to, carrier protein / transport protein / pump protein **;** **ignore** ion pump
R channel protein
ref. to calcium ions combine with binding site **;**
carrier protein, changes shape / conformational change **;**
ref. to ATP **;** [2 max]

(b) bacteria / antigen / epitope, combine(s) with / attach to/ recognition by, receptor **;**
antibody on bacteria combines with receptor **;**
opsonisation / opsonisation described **;** e.g. facilitates phagocytosis
ref. to constant region **;**

membrane infolds / invaginates / envelops / engulfs / enclose / AW **;**
accept answers without 'membrane' where implied previously / later
membrane fuses **;**
to form, vacuole / vesicle / phagosome (enclosing bacteria) **;** [3 max]

(c) lysosomes fuse with, vacuole / vesicle / phagosome **;**
A form secondary lysosomes
lysosomes contain, enzymes / named digestive enzyme **;**
(catalyse) hydrolysis / digestion **;** **A** breakdown
(digests / breaks down) protein / murein (or peptidoglycan) / carbohydrate / lipid / phospholipid / nucleic acid / DNA / RNA **;**
named bond **;** e.g. peptide, glycosidic, ester, phosphodiester [4 max]

[Total: 12]

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2 **(a)** denature, sucrase / enzyme **;** **A** deactivate
stop the reaction (in each tube at the same time) **;**

idea that Benedict's test requires a high temperature **;**
ref to reducing sugars **;** [2 max]

(b) starts at, the origin / 5 g dm^{-3}, increases to 45–55 g dm^{-3} **;**
constant from 80 to 100 g dm^{-3} **;** [2]

(c)

description	*conc*	*rate**
	5	0.0036
	10	0.0069
	15	0.0105
	20	0.0133
	50	0.0213
	100	0.0222

penalise lack of units once only

1 increase in rate of hydrolysis to approx 50 g dm^{-3} **;**
A decrease in time taken to approx 50 g dm^{-3} / correct rate calculations* to show an increase
2 remains constant / plateaus / levels out / AW, from approx 50 g dm^{-3} to 100 g dm^{-3} **;**

explanation to max 4
3 (sucrase / enzyme) hydrolyses / breaks , glycosidic bonds **;**
4 forming, reducing sugars / glucose / fructose **;**

5 *idea that* concentration is the limiting factor, at low concentration of, sucrose / substrate **;**

6 (at low concentrations) active sites, unoccupied / available **;**
A as concentration increases, more active sites are occupied / more enzyme-substrate complexes formed / AW

7 at higher concentrations all active sites, occupied / saturated / AW **;**
R enzymes for 'active sites'
8 substrate, in excess / AW **;**
9 V_{max} reached / working at maximum rate **;**

idea that
10 at higher concentrations, enzyme / sucrase, is the limiting factor **;** [5 max]

[Total: 9]

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3 **(a)** so they have the same number of chromosomes (as parent cell) **;**

idea that cells would be rejected (if genetically different) **;**
ref. to role of the immune system in removing genetically different cells **;** [2]

(b) *reject 'smoking' or 'radioactive transmissions' unqualified*

(chemical) carcinogen(s) / named **;**
any two named chemical carcinogens to max 2 if term carcinogen not used
e.g. benzpyrene / ethidium bromide / phenol / tar *check any others*

UV **;**
X rays **;**
ionising radiation **;**
gamma rays **;**
radon **;**
virus(es) / correctly named virus **;** **A** HIV / HPV / HTLV / HSV **R** named disease
genetic / hereditary, factors **;** [2 max]

(c) **(i)** cytokinesis **;** [1]

(ii) chromosomes, uncoil / become diffuse / decondense / AW **;**
A chromosomes unwind / become long and thin
A chromosomes become chromatin
A cell enters interphase
spindle breaks down / microtubules disassemble / AW **;** **R** disappears

nuclear envelope, reforms / forms / forming **;** **A** nuclear membrane **R** (re)appears
nucleolus / nucleoli, reform(s) / forms / forming **;** **R** (re)appears

cell membrane, drawn together / furrows / AW **;**
idea of role of, microfilaments / AW, in 'drawstring' effect **;**

division of cytoplasm / cell separation / cleavage / cleavage furrow develops **;**
A cytokinesis *if not credited in* ***(i)***
cell membrane fuses **;** [3 max]

(iii) divide / replicate, uncontrollably **;** **ignore** quickly / fast
A uncontrolled mitosis **R** grow uncontrollably
do not, differentiate / become specialised **;** **A** loss of function
form an (irregular) mass (of cells) / AW **;** **A** (a) growth
promotes growth of blood vessels / AW **;**
AVP **;** e.g. ref to genes / no programmed cell death / loss of contact inhibition [2 max]

[Total: 10]

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4 (a) (i) moist / AW, surface of mesophyll cells **;**
water evaporates / evaporation **;** *in correct context*
from spongy mesophyll cell walls **;**
into (intercellular) air spaces **;**
air within leaf is fully saturated **;**
water vapour diffuses through stomata **;** **A** 'water' if evaporated

down water potential gradient / from a high to a low water potential / from less negative to more negative water potential [3 max]

(ii) mass / water, loss increases from 0400 to 1600 and then decreases **;**
0.3–4.4 g h^{-1} **;** **A** other correct comparative data quote with units

mass / water, uptake increases from 0800 to 1900–1930 and then decreases **;**
0.8–0.9 – 3.4 g h^{-1} **;** **A** other correct comparative data quote with units

rate of, mass / water, loss peaks before rate of water uptake **;**
A description related to light (mass loss) and dark (uptake)
data quote for times of peaks for both rates **;** 1600 and approx 1900

0600 to 1600 rate of mass loss, ref. to steeper gradient **;**

(rate of) mass / water, loss is higher than uptake, between 0700 and approx 1830 **;**
A ora [4 max]

(b) cohesion-tension **;**
cohesion / AW between water molecules **;**
hydrogen bonds **;** *accept here or for adhesion once only*
transpiration pull / water is pulled up the xylem / water in a continuous column **;**

ignore negative / hydrostatic pressure

adhesion to (cell) walls **;**
water molecules 'stick' to cellulose / cellulose is hydrophilic **;**
A lignin (although it is hydrophobic!) [3 max]

[Total: 10]

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5 (a) (i) **H** nucleolus **;**
J Golgi (body / apparatus) **;**
K cell wall **;** **R** murein / peptidoglycan **ignore** cellulose or chitin
L vacuolar membrane / vacuole **;** **A** tonoplast **R** cell sap [4 max]

(ii) no double membrane-bound organelles **;**
no, nucleus / nuclear membrane / nuclear envelope / nucleolus **;**
A DNA lies free in the cytoplasm
no mitochondrion **;**
mesosomes **;**
no (large) vacuole **;**
no, ER / RER / SER **;**
no Golgi (body / apparatus) **;**
smaller / 70S / 18nm, ribosomes **;**
cell wall made of, murein / peptidoglycan / different compounds (from eukaryote) **;**
circular DNA / plasmid(s) / no linear DNA **;**
no histones / not complexed with proteins **;** **A** naked DNA / no chromosomes
AVP **;** e.g. pili / no 9+2 microtubule pattern [2 max]

(b) nucleus, transcription / described as DNA to complementary RNA code / AW **;**

nuclear pore, mRNA to, cytoplasm / ribosome / RER **;**
RER / ribosome, assembly of amino acids / translation / polypeptide *or* protein synthesis **;**
RER, transports protein to Golgi (apparatus / body) / modifies protein **;**

Golgi adds, carbohydrates / sugars, to proteins **;** **A** glycosylation
A post translational modification / other e.g.s
Golgi, packages protein / makes vesicle(s) **;**

(Golgi) vesicle fuses with cell (surface) membrane **;**

mitochondrion, provides / produces / synthesises, ATP *in correct context* **;** [4 max]

[Total: 10]

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6 (a) *community*

all populations / all organisms / all plants + animals (+ microorganisms) **;**
R all the species

in same, place / ecosystem / area / (common) habitat, (at same time) **;** [2 max]

(b) (i) *award two marks for the correct answer (4.5%)*

if no answer or incorrect answer or answer to too many decimal places, award one mark for working (2946/65 800 × 100)

2946 / 65 800 (× 100)

4.5 (%) **;;** [2 max]

(ii) energy available (from secondary consumers) is too small **;** **R** no energy
2 kJ m^{-2} (per week) **;** [2]

(iii) decomposers are, saprophytes / saprotrophs / saprobionts / bacteria / fungi **;**

plant matter provides little, protein / AW **;** ora **A** high carbon / low nitrogen
plant matter / cellulose / lignin, not easy to decompose **;**
ref. to organic matter / energy source, in plants not easy to obtain **;**
supply of nitrogen is, limiting factor / limits growth of decomposers **;**
(animal waste) protein / amino acids / urea, provides nitrogen **;**
(animal wastes) provide materials for growth of, decomposers **;**
further detail e.g. amino acids for proteins / membrane proteins / (hydrolytic) enzymes / other named protein(s) / nucleotides / nucleic acids **;**

more decomposers leads to faster decomposition (hence more energy flow) **;** [3 max]

[Total: 9]

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