CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9700 BIOLOGY

9700/21 Paper 2 (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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Mark scheme abbreviations:

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance)
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore

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1 (a) *award two marks if correct answer within range 29 000 to 31 000 is given*
allow ±3 mm in reading the line, e.g.

$\frac{90\,000}{3.0}$ $\frac{90\times10^{3}}{3.0\times10^{-6}}$ $\frac{9.0\times10^{-2}}{3.0\times10^{-9}}$

(×) $30\,000 / 3 \times 10^{4}$ **;;**

one mark if not rounded to nearest whole number
one mark if a unit (mm, μm) is given
one mark if line is measured and given in mm or cm within accepted range and divided by 3.0 μm but incorrect conversion factor used for the line measurement or 3.0 μm [2]

(b)

feature	identity	name
provides motility	**F**	flagellum
stores genetic information	**G**	DNA **;** **I** *any description, e.g. loop of / circular* **A** chromosome(s) / nucleoid **R** plasmid / chromatid
partially permeable	**C**	cell surface / plasma, membrane **;** **A** phospholipid bilayer
composed of murein (peptidoglycan)	**E**	cell wall **;** **R** cellulose cell wall
site of translation	**A**	(70S / 18 nm) ribosome(s) **;** **R** 80S / 22 nm / larger, ribosome

[4]

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(c) **A** (double) membrane-bound organelles *only if* <u>no</u> *examples given* (true)

nucleus / nuclear envelope **;** **A** nuclear membrane **I** well-defined
chloroplast **;** **A** grana / thylakoid(s) **A** plastid
(permanent) vacuole / tonoplast **;** **R** vesicles *unqualified* **A** lysosome
mitochondrion / mitochondria **;** **A** cristae
Golgi (body / apparatus / complex) / dictyosome **;** **A** Golgi vesicle(s)

rough endoplasmic reticulum / rough (ER) / RER **;**
smooth endoplasmic reticulum / smooth ER / SER **;** **A** endoplasmic reticulum, *if RER* <u>*and*</u> *SER not given*
nucleolus **;**
linear / **AW**, chromosomes **;** **A** DNA + histones
<u>cellulose</u> cell wall **;**
starch grain / amyloplast **;**
plasmodesma(ta) **;**
larger / 80S / 22 nm, ribosomes **;** [max 3]

(d) *one mark for infected person with contaminated faeces, e.g.*
<u>faeces</u> / <u>sewage</u>, contaminates (drinking) water / cooking utensils / vegetable plots / crops / food **;**
A diarrhoea *for faeces*
R (human) waste unqualified
A *ref. to* houseflies landing on contaminated faeces

one mark for uninfected person
eating contaminated food / using contaminated utensils / drinking contaminated water **;**
A bacteria enters water in context of drinking
R infected food or water
I handling contaminated food

A faecal-oral route *for two marks* [2]

(e) pathogen is at most vulnerable when in transfer between hosts / **AW ;**
A idea of breaking the transmission cycle

2 max for the following control methods:
sewage treatment / (effective) sanitation / correct ref. to positioning of latrines **;**
do not use human faeces for fertiliser **;**
piped / treated / boiled / chlorinated / purified, (drinking) water **;**
A sanitised / clean, water
I cooking refs.
A water treatment with UV / ozone
bottled water **;**
water treatment plants upstream of sewage disposal **;**
(to reduce pool of infected people) <u>antibiotics</u> *or* oral / intravenous, rehydration (therapy) **;**
A ORT [max 3]

[Total: 14]

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2 **(a)** population **;**
community **;**
(photo)autotroph / (primary) producer **;**
(ecological) niche **;** [4]

(b) provides ammonium (ions) / ammonia / nitrogen(ous) compounds / fixed nitrogen / organic nitrogen **;** **A** organic compounds
R nitrate / nitrite
R nitrate / nitrite, and ammonia

A *formulae* NH_3 / NH_4^+
if only a formula is used then it must be completely correct

accept the following in context of plants / animals

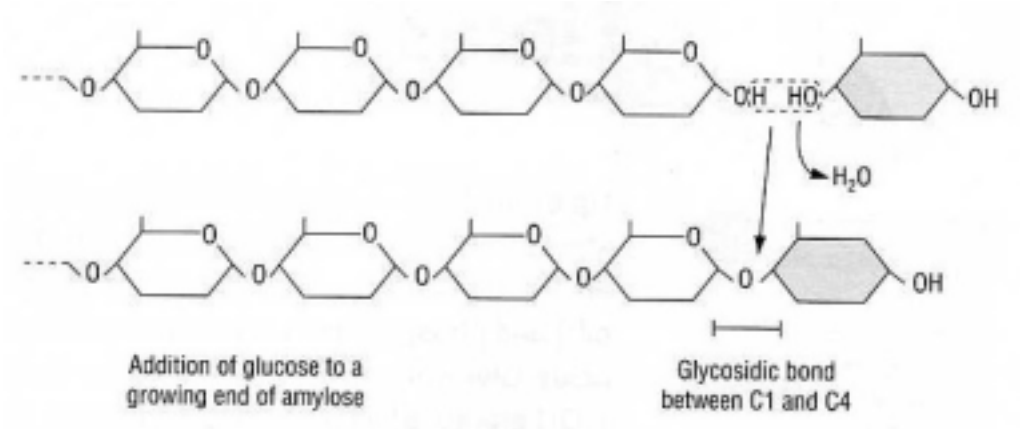
for synthesis of amino acids / nucleotides **;**
synthesis of protein / nucleic acids / DNA / RNA **;**

proteins required for, growth / enzymes / tissue repair / **AW** **;**
nucleic acids for storage of genetic information / **AW** **;**

idea of offsets loss of, (fixed) nitrogen / nitrate ions **;**
reduces effect of (fixed) nitrogen as a limiting factor (for growth) **;** [max 3]

[Total: 7]

3 **(a)** **(i)** –H and –OH indicated **;** **A** *–OH on end of amylose and –H on alpha glucose*
water eliminated / condensation **;** **A** dehydration
oxygen bridge / glycosidic bond, drawn between C1 and C4 **;**



If the whole glucose molecule and / or the end of the amylose molecule has not been drawn, then only award mp3 if C1 and C4 are indicated in some way, e.g. by numbering them or putting in the hydrogens. [3]

(ii) (1,4 / 1,6) glycosidic **;** **A** glucosidic **A** phonetic spelling of glycosidic [1]

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(b)

feature	amylose	glycogen	cellulose
type of glucose	α-glucose	α-glucose	β-glucose ;
branched or unbranched molecule	unbranched	branched	unbranched / not branched ;
role in organisms	energy storage	energy storage	structural / (component of) cell walls / tensile strength / dietary fibre / roughage ; **I** support

[3]

(c) (i) *maltase and maltose must be correctly referenced*
ignore references to reversible/irreversible

(ascorbase) binds to / fits into / enters active site ;
complementary (shape) to active site ;
so substrate / maltose, cannot enter / cannot bind ;
A no / few, ES complex
A prevents formation of ES complexes
A ascorbase forms enzyme inhibitor complex

competes with substrate / competitive inhibition ;
slows the (rate of), digestion / hydrolysis / breakdown, of maltose ;
R 'stops the reaction'
R if in context of starch

alternative answer if candidates assume ascorbase is an enzyme:
ascorbase, breaks down / digests / hydrolyses, maltase ;
A ascorbase destroys the active site of maltase
so no enzymes to digests maltose ;
slows / stops, reaction / digestion / hydrolysis / breakdown, of maltose ; [max 3]

(ii) inhibits / slows down / prevents, breakdown / (catalysing) hydrolysis / digestion, of maltose (to glucose) ; **I** starch

less glucose is absorbed / passes across membranes / enters blood ; [2]

[Total: 12]

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4 (a) (i) *non-self*
foreign / **AW** ; **A** ref. to epitope(s) **I** pathogen / organism

antigen
macromolecule / (glyco)protein / carbohydrate / polysaccharide / oligosaccharide ;
stimulates / **AW**, an immune response / production of antibodies ;
A results in formation of antigen-antibody complexes
A other described events in an immune response [max 2]

(ii) antibody / immunoglobulin / IgG, on cell surface / on cell membrane ;
(act as) receptors ;
ref. to antigen-binding / **AW** ;
(shape) specific / complementary, to antigen ; [max 2]

(b) (i) DNA / gene transcribed / mRNA using DNA as template / **AW** ;
A transcription unqualified
idea of mRNA associating with ribosome(s) ;
ref. to tRNA with specific amino acid (carried to ribosome) ;
pairing / **AW** of codons on mRNA with anticodons on tRNA ;
formation of peptide bonds (between adjacent amino acids) ;
antibody / protein / polypeptide(s), enters RER / moves to Golgi body ;
ref. to forming, secondary / tertiary structure ;
antibody / protein / polypeptide(s), modified / processed / glycosylated / formation of quaternary structure / formation of disulphide bond(s) in Golgi (body / apparatus / complex) ; **I** *ref. to* packaging [max 4]

(ii) vesicles move to cell / surface / plasma, membrane (via cytoskeleton) ;
R secreting vesicles unqualified
vesicles fuse with cell (surface) membrane / exocytosis ; **R** active transport
movement of vesicle / exocytosis requires energy *or* ATP / is active ; [max 2]

(c) memory cells ; **A** form immunological memory **I** 'gives immunity'
remain / stay in circulation / blood / lymphatic system ;
R 'last a long time / long lived' unqualified
for secondary response ;
fast(er) response when exposed again to same pathogen / same antigen ;
A fast(er) clonal selection / fast(er) clonal expansion
A divide quickly / rapidly
A long(er) lasting response
to form plasma cells (and more memory cells) ;
more antibodies produced / higher concentration of antibodies ;
R if in context of memory cells
to prevent person feeling ill / to prevent symptoms ; [max 3]

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(d) **W** – cytokinesis / cytoplasmic division / cell divides into two **;**
I cell division
R mitosis / telophase

Z – (semi-conservative) replication (of DNA) **;**
I S phase / interphase of cell cycle
R copying of DNA
R protein synthesis
R if replication is given in any other phase of the cell cycle [2]

(e) 1 breathing in / inhale smoke / 'second hand' smoke / sidestream smoke **;**
A passive smoking
I exposed to smoke
2 (tobacco smoke contains) carcinogen(s) **;**
3 causes mutation / described **;**
e.g. change to / alters / damages, DNA **R** if in wrong type of cell
4 leads to uncontrolled cell division / mitosis / growth **;**
5 forming a tumour / mass of cells **;**
6 correct ref. to (proto-)oncogenes / tumour suppressor genes **;**
e.g. formation of oncogenes / mutation of tumour suppressor genes / 'switching off' tumour suppressing genes

mutation of correct named gene = 2 marks
e.g. mutation of tumour suppressor gene

P53 (gene) mutates = 2 marks [max 3]

[Total: 18]

5 **(a)** more / thicker, (cardiac) muscle (tissue) in left ventricle **;** **A** ora
A thicker muscular wall

either
atrium pumps blood at lower pressure / against less resistance / to ventricle / short(er) distance / with less force **;**

or
ventricle pumps blood to the body / into systemic circulation / long(er) distance / against greater resistance / at higher pressure / with more force **;**
R ventricle wall withstands high pressure [max 2]

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(b) valve opens to allow blood flow from atrium into ventricle / when pressure in atrium is greater than pressure in ventricle / during atrial systole **;**

valve closes when ventricle contracts / when pressure in ventricle is greater than pressure in atrium / during ventricle systole **;**

during contraction of ventricles
papillary muscles contract to 'pull on' tendons **;** **R** if tendons are said to open the valve
tendons prevent valve, inverting / going inside out / everting / **AW ;** [max 3]

(c) 1 sino-atrial node / SAN sends out, waves of excitation / waves of depolarisation / (electrical) impulses / action potential(s) **;**
R nervous impulses / signal / message *penalise once only*

2 wave of excitation / **AW** / SAN stimulates, (both) atria to contract / atrial systole **;**

3 fibrous ring / non-conducting tissue / insulating tissue (between atria and ventricles), prevents impulse reaching the ventricles / prevents atria and ventricles contracting at the same time **;**

4 atrio-ventricular node / AVN delays impulse (by 0.1 s) / prevents ventricles contracting at the same time as atria **;**

5 allows, atria to empty / ventricles to fill **;**

6 AVN sends out, waves of excitation / impulses to Purkyne tissue / Bundle of His (in septum) **;**

7 causes ventricles to contract together / at the same time / simultaneously / **AW ;** [max 4]

[Total: 9]

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