



BIOLOGY

9790/01

Paper 1 Structured

May/June 2016

MARK SCHEME

Maximum Mark: 100

Published

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Notes:

The following abbreviations may be used in mark schemes:

;	separates marking points
/	alternative and acceptable answers for the same marking point
allow/accept/ A	answers that can be accepted
ignore/ I	statements that are irrelevant – applies to neutral answers
AW/owtte	credit alternative wording/or words to that effect
ecf	error carried forward
(words)	bracketed words that are not essential to gain credit
<u>words</u>	underlined words must be present to gain credit
max	indicates the maximum number of marks that can be given
ORA	or reverse argument
AVP	any valid point – marking points not listed on the mark scheme but which are worthy of credit

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Section A

<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	B	11	A
2	D	12	D
3	B + E	13	A
4	A + D	14	D
5	C	15	B
6	C	16	A
7	B	17	A
8	C	18	D
9	D	19	D
10	A	20	A

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Section B

21 (a) continuous interaction/ spend all their time, with host (plant) ;

A no time spent on independent living/ AW

no requirement for, photosynthesis/ carbon fixation/ light absorption ;

(all) organic compounds/ energy requirements, supplied by host ;

A named organic compound, e.g. amino acids/ sucrose/ glucose

I nutrients

(for *O. flava*) light does not penetrate to roots/ photosynthesis cannot occur in roots ;

[max 1]

(b) (i) *permanently open stomata*:

1 continuous, transpiration/ loss of water vapour ;

A high/ higher, transpiration rate

2 water molecules, are polar/ can form hydrogen bonds ;

3 (so) cohesion between water molecules/ water has cohesive properties ;

4 (so) adhesion of water (molecules) to, lining/ wall (of haustorium) ;

I capillarity

5 ref. to transpiration stream ;

6 cohesion-tension/ transpiration 'pull', to extract water (from host xylem)/ AW ;

7 ref. to water as a solvent for mineral ions/ mineral ions are dissolved in water ;

8 AVP ; e.g. steeper water potential gradient to parasite (than to host) diverts, water/ minerals, from host

no night closure favours passage of water to parasite/ AW

[max 4]

(ii) potassium ions, enter/ accumulate in, guard cells ;

I mechanism of transport

presence of potassium ions, lowers water potential/ water potential more negative ;

(so) water enters by osmosis (down water potential gradient) ;

guard cells turgid/ turgor pressure in guard cells increases (so, stomatal pore/ stomata, opens) ; **A** turgor in guard cells increases

[max 3]

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(c) height above mean high water mark distribution:

- 1 *A. subterminale* from, 0.02–0.05 to 0.4 m ;
- 2 *S. virginica* from, 0.0/0.01, to, 0.09/0.1 m ;
A mean high water mark for 0.0 m
- 3 *A. subterminale* has a greater range / *S. virginica* has a smaller range ;
- 4 no *C. salina* (parasitising) at height above, 0.17–0.20 m
or
C. salina only (parasitising) at heights below, 0.18–0.20 m ;

distance:

- 5 *A. subterminale* present from 0 to, 180–200 m ;
- 6 *S. virginica*, from 170–180 m to 380–400 m ;
A any one distance within the range
- 7 *C. salina*, from 150 to 400 m / greater presence in *S. virginica* range
(compared to *A. subterminale* range) / ORA ;

ecotone / overlap / meeting zone:

- 8 *C. salina* parasitises both glassworts / all three species are present ;
- 9 ref. to small range, for height / distance, where, both glassworts / all three species, occur ;

[max 3]

(d) **A** manipulated data for mp 1, mp 2, mp 3 and mp 4 if high and low values not given

I manipulated data if incorrect, high / low, values given

in quadrats without *C. salina* over three years:

- 1 percentage cover of *A. subterminale* decreased from, 61/62, to, 46/47/48 ;
- 2 percentage cover of *S. virginica* increased from, 66/67/68, to, 86/87/88 ;
if mp 1 and mp 2 not gained allow one mark for
percentage cover of *A. subterminale* decreased and *S. virginica*
increased
- 3 in each of the three years, percentage cover for *A. subterminale* lower than
S. virginica / ORA ;

in quadrats with *C. salina* over three years:

- 4 percentage cover of, *A. subterminale* increased from, 54/55/56, to,
76/77/78 ;
- 5 percentage cover of *S. virginica* decreased from, 63/64/65, to, 32/33/34 ;
if mp 4 and mp 5 not gained allow one mark for
percentage cover of *A. subterminale* increased and *S. virginica*
decreased
- 6 in 1995 and 1996, percentage cover for *A. subterminale* higher than *S.*
virginica ;

general:

- 7 *A. subterminale* / *S. virginica*, quadrats with *C. salina*, greater change in
percentage cover in successive years compared to quadrats without
C. salina / AW ;
- 8 AVP ; e.g. for quadrats, with *C. salina* / without *C. salina*, differences in
percentage cover are greatest 1994–1995
changes in percentage cover of *S. virginica* for quadrats,
with / without, *C. salina* greater than *A. subterminale*

[max 3]

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(e) without C. salina:

- 1 greater abundance of *S. virginica* compared to *A. subterminale* ;
- 2 *S. virginica*, better / dominant, competitor ;

with C. salina:

- 3 reduces abundance of / has a detrimental effect on / AW, *S. virginica* ;
A has more of a detrimental effect on *S. virginica* than *A. subterminale*
- 4 *A. subterminale*, better competitor / selective advantage / AW / ORA ;
- 5 further detail mp 3 / mp 4 ;
e.g. nutrients extracted from host (xylem and phloem)
(possibly) proportionately greater number *S. virginica* parasitised
- 6 ref. to alters role / niche, of *S. virginica* ;
- 7 increases availability of niche of *A. subterminale* ;
A idea of increased abundance, qualified with example to show niche change,
e.g. more, space / light
- 8 suggestion that *C. salina* maintains biodiversity ;
A without *C. salina*, biodiversity could decrease
A without *C. salina*, *S. virginica* could (eventually) outcompete
A. subterminale
- 9 AVP ; e.g. location of ecotone could change
energy flow altered by presence of, parasite / *C. salina* ;

[max 4]

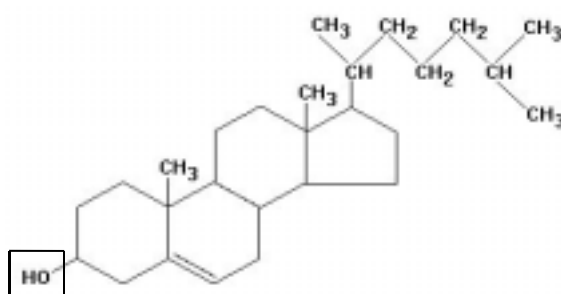
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- (f) effect on host plant species affects rest of community ;
 (greatly) alters, food chains/food webs/energy flow ;
 presence in/loss from, community/ecosystem, causes, major/AW, changes ;
 impact on the community greater than would be expected (compared to relative
 abundance/total mass) ; **A** disproportionately large influence
 parasitism maintains diversity (of ecosystem) ;
 further detail ; e.g. reduces competition so allows other plant species to
 survive

[max 2]

[Total: 20]

- 22 (a) (i) box around OH group ;



[1]

- (ii) 1 (most of molecule) between fatty acid tails/within the hydrophobic
 core/AW ;
A inner part of membrane
 2 hydroxyl/hydrophilic portion, aligns with/AW, phosphate heads ;
A faces aqueous environment/AW
 3 ref. to attraction to fatty acid chain (of phospholipid) ;
- role to max 3:*
- 4 when temperatures low increases fluidity ;
 5 (in low temperatures) prevents close packing of, fatty acid
 tails/phospholipids ;
A prevents membranes from freezing
- 6 when temperatures high decreases fluidity ;
 7 (in high temperatures) prevents excessive movement of phospholipids ;
A idea that prevents phospholipids from moving too far apart
- if mp 4 and mp 6 not gained allow 1 mark for
 regulates fluidity/ensures membrane remains fluid/maintains stability*
- 8 helps prevent passage of, polar molecules/ions/AW ;
A idea of contributing to partially permeable nature of membrane

[max 4]

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(b) large surface area (exposed for absorption) ;

because

long ;

folded ;

villi ; **A** ecf from folded into villi

microvilli/brush border ;

presence of smooth muscle ; *in context of villi or intestinal wall*

movement (villi/chyme), aids contact with surface/maintains concentration gradient ;

highly vascularised/good capillary network ; **A** good blood supply maintains concentration gradient (for absorption) ;

lacteals/lymphatics, (associated with villi) ;

for uptake of, lipids/chylomicrons/AW ;

any cellular feature correctly linked to its role in absorption ;

e.g. many mitochondria for active, transport/uptake, named soluble product

[max 4]

(c) 1 (passive) diffusion across (cell surface) membrane/hydrophobic core/phospholipid bilayer ;

A facilitated diffusion through, transport/channel/carrier, proteins

2 active transport via, transport/membrane/carrier, proteins ;

A pump proteins

A endocytosis (to form endocytotic vesicle)

3 moves to/enters, smooth endoplasmic reticulum/smooth ER/SER (for conversion) ;

4 transfer via vesicles to Golgi (body/apparatus/complex) ;

5 *idea of* movement through/within, Golgi for, formation of chylomicron/further processing/modification/packaging (into vesicles) ;

6 transport of vesicle, via cytoskeleton/using microtubules ;

in context of, mp 2 with endocytosis or mp 4 or mp 7

7 secretory/exocytotic/Golgi, vesicle fuses with cell surface membrane ;

A vesicle alone if mp 4 or 5 gained

8 exocytosis ;

9 ref. to ATP required (for vesicle movement/exocytosis) ;

10 *suggestion of* entry into lymphatic vessel as, endocytosis/through endothelial gaps ;

[max 4]

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- (d) continuous variation shown ;
 ref. to two different causes of environmental variation ; ;
A examples e.g. different diets
 different transit times
 different volumes of bile produced
 different states of (gut) health
 polygenic **or** a number of / many / more than two, genes involved ;
 (genes can have) multiple alleles ;
 additive effect of (poly)genes ;
 further detail ; ; e.g. variation in, genes coding for transport
 proteins / transporter genes
 varying abundance of transport proteins
 varying degrees of gene expression
 variation in genes involved in microvilli formation

AVP ; e.g. mutations leading to variations within a gene associated with
 absorption

[max 4]

- (e) 1 decreases LDL (cholesterol) concentration ;
 2 increases HDL (cholesterol) concentration ;
lowers LDL : HDL = two marks
- 3 reduces, atheroma / atheromatous plaque, formation ;
A plaque for atheromatous plaque
A reduces risk of, atherosclerosis / arteriosclerosis
- 4 reduces risk of, coronary heart disease / CHD / myocardial infarction / heart
 attack / AW ;
- 5 further detail ; e.g. increases (receptors for increased) uptake of LDL by liver
 (cells)
 less / no, deposition of cholesterol in tunica intima / AW
 fewer, foam cells / macrophages with engulfed cholesterol
 reduces risk of thrombus formation

[max 3]

[Total: 20]

23 (a) interphase / S phase / synthesis phase ; I early / late [1]

- (b) to form, sister / identical, chromatid ;
A idea of forming another chromatid to make the chromosome as seen at
 prophase
A for mitosis / nuclear division (to form two new cells)
A ensures each new daughter cell has identical, chromosomes / genetic
 material (as original cell) [1]

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(c) hybrid DNA separates / AW ; A both strands used as templates only, ^{14}N / light, DNA available / newly synthesised strand contains only ^{14}N / light DNA ;

(so) ^{15}N / heavy, strand, and, ^{14}N / light, strand (to obtain 'hybrid' DNA) ;
so band at same, height / density, as first generation ;

^{14}N / light, strand and, ^{14}N / light, strand (to form all light DNA) ;

so band at same, height / density, as normal ;
bands half width as equal quantities of each / AW ;

[max 3]

(d) (i) time-saving / faster / take too long if only one site / AW ;
further detail ; e.g. proof reading, is efficient / takes a short time
shortens the time when DNA inactive for
transcription
important in timing of cell cycle

[max 1]

(ii) 2 hydrogen bonds between A-T versus 3 hydrogen bonds between C-G (to
break) ;
(overall) fewer hydrogen bonds to break (to separate complementary strands
for replication) ;

[max 1]

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(b) accept murein for peptidoglycan throughout

- 1 Gram-positive, more layers / thicker layer, peptidoglycan / ORA ;
A Gram-positive thick layer peptidoglycan vs Gram-negative more complex
- 2 detail of penicillin mode of action ;
e.g. prevents formation of peptide cross-links
inhibits transpeptidase action
- 3 Gram-negative have fewer peptide cross-links (so less susceptible to penicillin) ;
- 4 Gram-negative less, easily killed by / easily lysed by / susceptible to / AW, penicillin / ORA ;
- 5 Gram-negative has (partial) barrier, to antibiotics / penicillin / ORA ;
- 6 Gram-negative, outer layer / outer membrane / ORA ;
- 7 further detail ; e.g. lipopolysaccharides / lipoproteins / phospholipids
- 8 AVP ; e.g. Gram-negative, periplasm may provide extra barrier
Gram-negative may have efflux pumps in outer membrane

[max 4]

(c) (penicillin acts at a bacterial cell wall and)

viruses, do not have, a cell wall ;
viruses do not have peptidoglycan / murein ;

penicillin acts only on growing cells / viruses do not grow ;
penicillin does not act on (viral), protein coat / capsid / capsomeres / viral envelopes ;
suggestion that viruses, are usually inside host cells / not within reach (of penicillin) ;

[max 2]

- (d)**
- 1 no fusion of vesicle with (pre-synaptic) membrane ;
 - 2 GABA, not released into / does not diffuse across, synaptic cleft ;
A synapse
A no exocytosis to release GABA
 - 3 no binding to receptors on post-synaptic membrane ;
 - 4 GABA is inhibitory neurotransmitter / no inhibitory effect from GABA ;
 - 5 *idea that* excitatory stimulus continues / excitatory neurone can continue to act / excitatory synapse unaffected / AW ;
 - 6 continuous impulses to muscles so, continued muscular contraction / no muscle relaxation ;
A continuous excitation to muscles
 - 7 AVP ; detail of action of GABA that is prevented
e.g. causes changes in, opening / closing, of ion channels
increase permeability of post-synaptic membrane to, entry of chloride ions / exit of potassium ions
produces, inhibitory post-synaptic potentials / hyperpolarisation
decreases ability of post-synaptic neurone to generate action potential

[max 4]

[Total: 12]

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25 (a) *benefit to max 1:*
 cell specialisation ;
 division of labour / AW ;
 greater control of the internal environment ;

disadvantage to max 1:
 slower rate of reproduction ;
 (increased complexity so) need for, (greater) coordination / exchange surfaces /
 communication / named system ;
 e.g. nervous system (in animals) / transport system
idea that interdependence of cells makes organism more vulnerable to
 trauma / AW ;

[max 2]

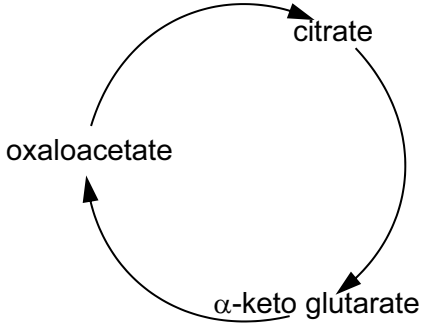
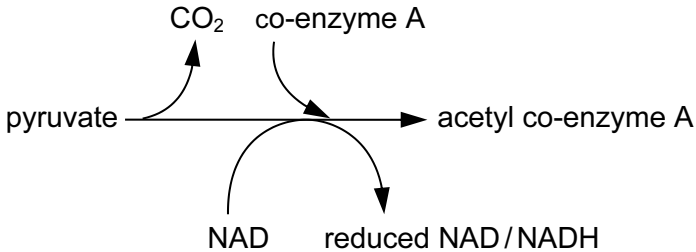
(b) (most have) small surface area to volume ratio ;
 diffusion, too slow / insufficient, to supply needs ;
 longer distances / AW ;
 example ; e.g. efficient removal of waste / much waste produced
 efficient delivery of glucose / high requirement for glucose
idea that all cells can be supplied with, glucose / oxygen /
 nutrients
idea that diffusion to cells can occur if mass flow delivers
 nutrients closer to cells

[max 2]

(c) *in vitro* fertilisation occurs outside the body / ORA ;
in vitro fertilisation, requires external manipulation / laboratory procedure / ORA ;
idea that in vitro fertilisation eggs removed (artificially) from female / ORA ;

[max 1]

(d)

arrangement of biochemicals in metabolic pathway	name of pathway
<p>citrate → α-keto glutarate → oxaloacetate</p> <p>or</p>  <p style="text-align: right;">;</p>	<p>Krebs / AW, cycle ;</p>
 <p><i>allow flexibility on position of output of CO₂ and input of co-enzyme A</i></p> <p style="text-align: right;">;</p>	<p>link reaction ;</p>

[4]

[Total: 9]

- 26 (a) glucose, diffuses / AW, across membrane ;
A larger molecules do not pass across membrane
 glucose oxidase, specific to glucose / only binds with glucose / (shape of) active site (of glucose oxidase) complementary to glucose ;

[2]

(b)

oxygen / O ₂	gluconic acid	;
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[1]

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- (c) *type 2:* ORA for *type 1*
idea that insulin is secreted, which then fails to have an effect ;
 e.g. target cells do not respond
 cells less, responsive / sensitive, to insulin
 defective insulin membrane receptors
 overactivity of other hormones / named (thyroxine / cortisone / ACTH)
 control by, diet / exercise ;
idea that do not require, external source of insulin / insulin injections / insulin pumps ;
A may only need insulin later (in life)

[3]

[Total: 6]