CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 series

0610 BIOLOGY

0610/31 Paper 3 (Extended Theory), maximum raw mark 80

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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Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- R reject
- I ignore (mark as if this material was not present)
- A accept (a less than ideal answer which should be marked correct)
- AW alternative wording
- underline words underlined must be present
- max indicates the maximum number of marks that can be awarded
- mark independently the second mark may be given even if the first mark is wrong
- A, S, P, L Axes, Size, Plots and Line for graphs
- O, S, D, L Outline, Size, Detail and Label for drawings
- (n)ecf (no) error carried forward
- ( ) the word / phrase in brackets is not required, but sets the context
- ora or reverse argument.
- AVP any valid point

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Question	Answer	Marks	Additional Guidance
1 (a)	nucleus: **1** controls (activities in) the cell / AW; **2** contains, chromosomes / genes / alleles / genetic information / DNA; **3** controls how cells, develop / divide / reproduce / grow; **4** cell membrane: **5** forms a barrier / separates a cell from surroundings; **6** allows / controls, movement of (named) substance(s), across / in / out; keeps contents of cell inside / keeps cytoplasm intact / AW;	**max 4**	**I** 'brain' of cell / 'tells cell what to do' **MP1 A** ref to making proteins **A** makes ribosomes e.g. O_2 / CO_2 / nutrients **I** ref to shape / 'covers cell' / protects cell
(b)	a group of cells, same type / do the same function;	**1**	cells are in the same place = group
(c)	**1** mucus traps, particles / any example; **2** mucus protects lining; **3** (cilia) beat / create wave motion / wafting; **4** move, mucus / fluid away; **5** reduce risk of / stop, (named) pathogens entering lungs;	**max 3**	e.g. dust / bacteria / spores / virus **I** 'collects' particles
		[Total: 8]	
2 (a)	the allele that is expressed (if it is present) / AW; always seen in the phenotype; masks (effect of) recessive allele;	**max 1**	**I** 'powerful' defines the phenotype defines characteristic(s)
(b) (i)	*Parent genotype*: Ff , Ff; *Parent phenotype*: (with) flecks × (with) flecks; *Gametes*: F , f, F , f; Working shown to derive genotype; *Offspring genotype*: FF , Ff , ff; linked to correct phenotype	**5**	**ECF** on incorrect key usage **ECF** from each line **A** Punnett square / criss-cross lines

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>(ii)</td><td>ff × ff;

parents may be implied as first part of the question asks for parental genotype

both parents must have a recessive <u>allele</u> /

(if ff × ff) no dominant or F <u>allele</u>, in either parent /

(if ff × ff) both parents must be homozygous, recessive / without flecks

no parent must be homozygous dominant /

presence of (even) one dominant allele in parents could result in flecks;</td><td>2</td><td>A Ff × Ff and Ff × ff
ECF on incorrect key usage from (i)

A gene for allele</td></tr>
<tr><td></td><td></td><td>[Total: 8]</td><td></td></tr>
<tr><td>3 (a)</td><td>
<table>
<tr><td>substance</td><td>direction of movement</td><td>reason</td></tr>
<tr><td>amino acids</td><td>to fetus / from mother</td><td>make proteins / translation / growth / make cells / AW;</td></tr>
<tr><td>carbon dioxide</td><td>from fetus</td><td>waste gas from respiration</td></tr>
<tr><td>glucose</td><td>to fetus / from mother</td><td>(release) energy / respiration / stored as glycogen;</td></tr>
<tr><td>oxygen</td><td>to fetus / from mother</td><td>(gas for) respiration;</td></tr>
<tr><td>urea</td><td>from fetus / to mother</td><td>excretion / metabolic waste;</td></tr>
</table>
</td><td>4</td><td>one mark per row

A nitrogenous waste</td></tr>
</table>

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Question	Answer	Marks	Additional Guidance
(b)	iron: for red blood cells / haemoglobin / to transport oxygen / prevent anemia; vitamin D: absorption of calcium; growth / formation / strengthening, of bones / teeth; preventing rickets;	**max 2**	max 1 from vitamin D
(c) (i)	lymphocytes / white blood cells / leucocytes;	**1**	**I** white cells unqualified

(ii)	provides (passive) <u>immunity</u>;
	protects against, infection / illness / disease / pathogen(s) / AW;
	reference to disease(s) mother has had;
	immune system of babies not yet developed;
	any one function of antibodies;
		max 3	functions of antibodies:
			• stop pathogens spreading (in the body)
			• stop pathogens entering cells
			• stop pathogens dividing / reproducing / increasing in number
			• cause pathogens to, clump / agglutinate
			• immobilise bacteria
			• kill bacteria
			• make it easier for phagocytes to ingest pathogens
			• neutralise toxin(s) / make toxins harmless

(iii)	bonding / AW, with mother; it's free / 'cheap'; sterile / no risk of infection; body temperature; no preparation / easily available; provides, best / complete / most suitable / balanced / AW, nutrients / food; composition / quantity, of breast milk changes to match development; easier to digest / reduced risk of colic; reduce risk of allergies; contraceptive effect; AVP;	**max 4**	AVPs: no additives protects against, <u>breast</u> cancer / <u>ovarian</u> cancer children less likely to develop diabetes helps the mother's body to return to 'normal', e.g. weight loss / restores uterus
		[Total: 14]	

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Question	Answer	Marks	Additional Guidance
4 (a) (i)	xylem;	1	
(ii)	thick / lignified, cell walls; for support; lignin; cell walls are waterproof / no water leaks out; long / hollow / no cytoplasm / no organelles / no end walls; water passes through easily / low resistance (to flow); pits; for lateral movement; AVP;;	max 2	one feature linked to a reason max 1 for feature
(b)	**1** transpiration / transpiration pull; **2** creates a, tension / negative pressure; **3** water potential gradient; **4** osmosis into leaf cells; **5** continuous column of water; **6** cohesion of water molecules / described; **7** adhesion of water to, cell wall / xylem; **8** water evaporates, into airspaces (in mesophyll); **9** water (vapour), diffuses / passes, out through stomata; **10** root pressure;	max 4	**I** water into roots **I** water concentration **A** evaporates

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Question	Answer	Marks	Additional Guidance
(c) (i)	**1** two peaks; **2** at 10 h, and 14 / 15 h; **3** no water conduction before 4 h; **4** slow / gradual, increase from 4 h to 6 h / 7 h; **5** maximum water conduction rate of 2.4 dm^3 per hour; **6** steep increase in rate of water conduction at 7 h / 7.5 h; **7** decrease in rate of water conduction after 14.5 – 15 h; **8** any other data quote;	**max 3**	Correct units (dm^3 per hour) for water conduction must be stated at least once. If no units at all, only penalise once. **A** at 15 h
(ii)	add the volume (of water conducted) for each hour / calculate area under curve / AW;	**1**	**A** half hour
(iii)	possible reasons: different rates of transpiration; different numbers of leaves / different surface areas; different rates of evaporation; factors affecting transpiration: (sun)light / shade; temperature / heat; humidity; wind speed; different species; different diameters of xylem / AW; any feature of leaf structure; e.g. thickness of cuticle / stomatal density / hairs length of roots; different ages; AVP;	**max 3**	

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Question	Answer	Marks	Additional Guidance
(d)	abiotic: increase in carbon dioxide, concentration / production; decrease in oxygen, concentration / production; increased soil erosion; reduced soil fertility; less soil water / faster flow of water from the land; increased, flooding / landslips; disrupts water cycle; greater exposure / AW; biotic: habitat / ecosystem, loss; disruption to, food chain / food webs; less biodiversity; extinction described; seeds germinate / seedlings grow / regeneration; AVP;	max 4	**I** global warming / greenhouse effect **A** less decomposition **I** desertification **A** silting of rivers **A** 'loss of / no, food' **A** 'species die out' / local extinction examples of AVP: organisms exposed to greater, grazing / predation
		[Total: 18]	
5 (a)	cell wall, peptidoglycan / murein; no nucleus / no nuclear membrane / have nucleoid; loop of DNA; no mitochondria; no chloroplasts; no vacuoles; smaller ribosomes; have pili; have capsule; small / 1–2 µm; **A** correct reference to size	max 2	**A** plasmids;

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Question	Answer	Marks	Additional Guidance
(b) (i)	lag (phase); log / exponential (phase); stationary / plateau (phase); death (phase);	**4**	
(ii)	no longer reproducing / death rate greater than or equal to 'birth' rate; ref to limiting factor(s); no / less, (named) nutrients; no / less, space; no / less, oxygen; build-up of (named) waste; waste is toxic; idea that pH could change to be unsuitable;	**max 2**	**A** reached carrying capacity **A** lactose / sugar / glucose / salts / minerals e.g. carbon dioxide / lactic acid
(c)	increase in, size / length / mass / volume / AW; increase in dry mass; increase in cell number; ref to permanent;	**max 2**	**note:** increase in dry mass = 2 marks **A** ref to cell division / mitosis / reproduction of cells / tissues **R** reproduction unqualified **I** development
(d)	asexual (reproduction) / binary fission;	**max 1**	**R** mitosis

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Question	Answer	Marks	Additional Guidance
(e)	advantages: longer shelf-life / stop foods going off; stop / reduce, growth of (unwanted) bacteria / fungi / microbes; prevent food poisoning; improve / give, taste / flavor; give colour / improve appearance; give texture; emulsify / stabilise, food components; disadvantages: hyperactivity (in children); allergies; vomiting / nausea / headache; asthma; possible link with cancer; AVP;	max 4	advantages to max 3 **A** reproduction / multiplication / AW disadvantages to max 3
		[Total: 15]	
6 (a)	<u>lock and key</u> mechanism; substrate fits into enzyme; (shape of) substrate is complementary to, enzyme / active site; ref to active site; substrate breaks / product(s) forms / product(s) leaves enzyme; enzyme, free for next reaction / not used up / remains unchanged; AVP;	max 3	e.g. lowers activation energy
(b)	(cellulose) <u>cell wall</u>;	1	

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Question	Answer	Marks	Additional Guidance
(c) (i)	protease activity, similar / AW, on both sites; all enzyme activity is, greater / better / faster, in site **A**; cellulase activity on site **A** greater than protease activity on site **A**; cellulase activity, higher on site **A**, than site **B** / ORA; cellulase and protease activity on site **B** similar; use of data with units to support any of these marking points;	**max 3**	do not award data quote unqualified
(ii)	pH / water content, no effect on protease activity; cellulase more active, at higher pH / less acidic environment; cellulase more active, at lower soil moisture; ref to optimum pH of, protease / cellulase / enzymes; low pH may denature cellulase; idea of different leaf composition; size of leaves / surface area / species of leaf; different stage of decomposition;	**max 3**	
(d)	**1** ref to, decomposers / bacteria / fungi; **2** proteins are broken down to amino acids; **3** by proteases; **4** amino acids converted to, ammonia / ammonium (ions); **5** deamination; **6** ammonia / ammonium ions, converted to nitrite ions; **7** nitrites converted to nitrate ions; **8** nitrification / oxidation / nitrifying bacteria; **9** nitrate ions absorbed by plants;	**max 3**	protease is linked to **MP2** ammonia to nitrate = 1 **A** nitrites **A** nitrates ammonia to nitrite and then to nitrate = 2 **A** nitrates
(e) (i)	nitrogen fixation;	**1**	

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Question	Answer	Marks	Additional Guidance
(ii)	root nodules (on legumes); free living bacteria; nitrogen-fixing bacteria; nitrogen, converted to, ammonium / ammonia / amino acids;	max 2	**I** lightning **I** nitrate(s) **I** nitrification / nitrifying bacteria
		[Total: 17]	

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