CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0610 BIOLOGY

0610/32 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.

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

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Mark schemes will use these abbreviations

- ; separates marking points
- / alternatives
- **R** reject
- **A** accept (for answers correctly cued by the question)
- **I** ignore as irrelevant
- **ecf** error carried forward
- **AW** alternative wording (where responses vary more than usual)
- **AVP** alternative valid point
- **ORA** or reverse argument
- underline actual word given must be used by candidate (grammatical variants excepted)
- ( ) the word / phrase in brackets is not required but sets the context
- max indicates the maximum number of marks

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Question	Expected answers	Mark	Additional Guidance
1 (a)	unsegmented ; **A** no segments soft bodies ; (muscular) foot ; **ignore** feet mantle ; visceral mass ; AVP ;	[max 2]	**ignore** no (exo)skeleton no backbone no bones radula bilaterally symmetrical shell / exoskeleton
(b)	(8) legs / tentacles / arms / limbs / AW ; (large) eye ; has a head ; no shell / (completely) soft body / no exoskeleton / no external skeleton ; suckers (on tentacles) ;	[max 2]	**R** any internal features (see the question) **R** feelers / hands **ignore** no (muscular) foot / feet **A** suction pads
(c)	*look for an adaptation for attachment and an adaptation for survival when exposed to air* *allow ecf from part* **(a)** *attachment* threads / (muscular) foot / sticky fluid ; *survival in the air* *either* shell / exoskeleton, prevents / reduces, water loss / *or* shell / exoskeleton, protects against (named) predator(s) ;	[max 2]	**A** any suitable description of the threads e.g. fibres, projections, extensions, tentacles, etc. **R** suckers **A** slime / mucus for sticky fluid **ignore** protection unqualified **ignore** anything to do with gas exchange **ignore** camouflage if named must **not** be an aquatic predator

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Question	Expected answers	Mark	Additional Guidance
(d) 1 2 3 4 5 6 7	has no, competitor(s) / predators (therefore increase in numbers) ; has no, pathogens / parasites / disease-causing organism(s) ; competes with existing species for, food/nutrients/space/oxygen ; could be a, predator / consumer , of other species ; **A** feeds on (many) other species could introduce, disease / parasite, for native species cause migration of native species ; AVP ; e.g. reduces <u>biodiversity</u> causes <u>extinct</u>ion decrease in numbers, higher in food web / at higher trophic levels increase in predators of zebra mussels	[max 3]	
(e) 1 2 3 4 5 6	do not move about / stay in one place, so exposed to pollutant (continuously) ; pollutant, kills them / reduces their numbers / prevents them breeding ; so presence / absence, is a good indicator ; pollutant accumulates (in animal's body) ; pollutant, detectable when concentrations are low / no longer present ; AVP ; they are filter feeders do not need to know what the pollutant is (as would be the case for a chemical test) no need for lab facilities / no need for equipment / can be done in the field	[max 2]	**R** more accurate **ignore** easy to, see / collect ; quicker to do skills / training needed / cheaper

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Question	Expected answers	Mark	Additional Guidance
(f)	*non-biodegradable plastics*		
1	swallowed / ingested / eaten / cannot be digested **;**		
2	caught around / trapped / entangled **;**		
3	choke / blocks gut / smother / suffocate / injure / cut / trap / stuck in / AW **;**		**ignore** kills / dies unqualified
4	plastic blocks light for <u>photosynthesis</u> **;**		**A** organism is poisoned (by toxins)
5	may, contain / release, (oil-soluble) toxins / poisons **;**		**R** 'plastics are toxic'
6	large pieces of plastic may block flow of water (in a river) **;**		**A** suffocate in **MP3** as a consequence of **MP4**
7	that reduce concentration of dissolved oxygen **;**		**MP6** and **MP7** are linked
8	effect of loss of organism at a trophic level **;**		
9	AVP **;** e.g. any other consequence for organisms	[max 3]	

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<table>
<tr><th>Question</th><th>Expected answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>2 (a) (i)</td><td>
<table>
<tr><td>stimulus</td><td>(blue) light / (change in) light intensity / dim to bright light ;</td></tr>
<tr><td>receptor cells</td><td>cones / rods ;</td></tr>
<tr><td>effector</td><td>(circular) muscle, of / in, iris ;</td></tr>
<tr><td>response</td><td>pupil, gets smaller / constricts / AW ;</td></tr>
</table>
</td><td>[4]</td><td>ignore retina (as it is a tissue)

R ciliary muscle
R radial muscle

R muscle / pupil, contracts
ignore muscle contraction</td></tr>
<tr><td>(ii)

1
2

3

4
5</td><td>if marked in the context of accommodation or a mixture of the two reflexes, then mark to max 3

(nervous / electrical) <u>impulses</u> ;
sent by / initiated by, (named) receptors / sensory cells / retina ;
R if optic nerve, sends / initiates / AW, the impulse
via / along / through, <u>sensory neurone(s)</u> / <u>optic nerve</u>

to, brain / CNS / grey matter ; ignore spinal cord
(from the brain) via / along / through, <u>motor neurone</u> (to effector) ;</td><td>[max 4]</td><td>MP1 – M5 ignore ‘signals’ / ‘messages’ / AW

ignore relay / connector / inter-, neurone ;

ignore ‘impulses to brain’ after the response has happened</td></tr>
</table>

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Question	Expected answers	Mark	Additional Guidance
(b) 1	increase in, heart / pulse, rate ;		**R** 'lots of heart beats' unqualified / increases heart beat
2	increase in, breathing rate / depth of breathing ;		
3	more oxygen, taken in / absorbed ; *linked to MP2*		**MP3** accept oxygen taken in faster
4	for (increase rate of) aerobic respiration ;		**MP4 ignore** metabolic rate increases
5	more energy released ; **R** energy produced		
6	vasodilation in / arteries widen in / more blood to, muscle / brain ;		**MP6** accept faster blood supply to muscle
7	more oxygen to muscles ; *linked to MP1 or MP6*		**MP7** accept faster supply of oxygen to muscle
8	vasoconstriction in / less blood to, gut / skin ;		**MP8** accept slower blood supply to gut / skin
9	stimulates, breakdown / conversion, of glycogen to glucose in liver ;		**MP9 ignore** glycogen to glucose in muscle
10	increases glucose (concentration) in the blood ;		**MP10** does not have to be linked to **MP9**
11	dilates pupils ;		
12	lets more light into eye ;		
13	heightened sensitivity / increased mental awareness / AW ;		**MP13 R** 'excited'
14	AVP ; e.g. increased width of (named) airways, increase in blood pressure	[max 5]	
(c)	*assume answers are about involuntary unless told otherwise*		
1	automatic / no conscious decision / does not involve thought / involves decision making ;		**ignore** voluntary / involuntary responses can / cannot be controlled unqualified
2	higher centres / AW, of brain not involved ;		
3	faster / immediate ;		
4	response always the same ;		
5	involves, one / small number of, muscle(s) ;		
6	may involve glands ;		
7	they are protective / AW ;	[max 2]	

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Question	Expected answers	Mark	Additional Guidance
3 (a) (i) 1	kills, / destroys, (all) bacteria / microorganisms ; **A** viruses		**ignore** 'remove' / 'gets rid of' / 'eliminates'
	to prevent		**ignore** 'harmful'
2	contamination / remove contaminants (of the milk / yoghurt) ;		**ignore** impurities / make milk pure
3	competition with the two bacteria added ;		
4	disease / might be pathogens / any suitable e.g. (TB / food poisoning) ;		kills harmful bacteria = 1 mark kills bacteria that cause disease = 2 marks kills bacteria that might contaminate the milk = 2 marks
5	production of toxins ;		
6	alteration of the, flavour / taste ;		
7	AVP ;		
(ii) 1	best / optimum / ideal, temperature ;		
2	for bacterial, growth / division / reproduction ;		**R** 'speeds up the reaction' unqualified
	A bacteria grow quickly		
3	ref to enzymes ; **R** if enzymes are denatured at 45 ^{o}C		
4	ref to, kinetic energy / collisions ;		
5	produce most lactic acid in the shortest time ;		
	A 'lactic acid production takes too long at lower temperatures'		
6	ref to cost ;		
7	bacteria killed / enzymes denatured, at higher temperatures /		**A** enzymes are not denatured / bacteria are not killed, at this temperature
		[max 2]	

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Question	Expected answers	Mark	Additional Guidance
(iii) 1	lag phase / numbers increase slowly / low rate of growth ;		**accept** (cell) division / (binary) fission / reproduction for growth for **MP1** and **MP3**
	ignore 'numbers stay the same'		
2	(while) bacteria, make proteins / increase in size ;		
3	log phase / exponential phase / numbers increase quickly ;		
	A rapid rate of growth / bacteria divide faster than die		
4	plenty of, food / nutrients / oxygen ; **ignore** raw materials		**MP4 A** 'availability of food / AW'
5	stationary phase / numbers stay constant ;		
	A 'birth' rate = death rate		
6	death phase / increase in death rate / decrease in numbers / bacteria be		
7	(because of) lack of, food/nutrients/oxygen *or* decrease in pH / accumu		
8	ref to <u>limit</u>ing factors ;		
9	AVP ; e.g. *Lactobacillus bulgaricus* increases first	[max 5]	
(iv) 1	need different bacteria to, carry out different processes / produce		**A** both needed to make lactic acid **A** 'work differently'
2	*idea that* each bacterium needs something produced by the other ;		
3	*Streptococcus (thermophilus)* does not make lactic acid ;		
4	*Lactobacillus (bulgaricus)* needs formic acid produced by		If **MP4** awarded then also award **MP2**
5	each stage requires a different (specific) enzyme ;		
	A enzymes work on different substrates		**A** *S. thermophilus*
6	*idea that* each bacterium cannot make all the enzymes needed ;		**A** *L. bulgaricus*
7	AVP ;		
		[max 2]	

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Question	Expected answers	Mark	Additional Guidance	
(b)	preservative / acidity regulator / pH regulator ; antioxidant ; colouring / food dye ; flavouring ; emulsifier ; sweetener ; thickener ; stabiliser ;	[max 3]	**ignore** names and/or (E) numbers of additives e.g. MSG, tartrazine, sunset yellow, etc.	**Reject** fruit chocolate nutrients any named nutrient, e.g. food starch / corn starch (named) vitamin(s) (named) mineral(s) salt calcium supplement

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Question	Expected answers	Mark	Additional Guidance
4 (a)	<table><tr><td>pea plant</td><td>**D**</td><td>**E**</td></tr><tr><td>substance transported</td><td>sucrose</td><td>phosphate ions</td></tr><tr><td>transport tissue</td><td>phloem ;</td><td>xylem ;</td></tr><tr><td>sink</td><td>growing tip / flower / fruit / seed / stem / root ;</td><td>growing tip / flower / fruit / seed / stem / leaves / chloroplasts ;</td></tr></table>	[4]	**ignore** any vessels / tubes / etc **A** growing point / meristems / areas where growth occurs
(b)	amino acids ; **R** proteins	[1]	**A** (named) plant hormones
(c) 1 2 3 4 5	photosynthesis ; light (energy) is, absorbed / trapped, by chlorophyll ; carbon dioxide reacts with water in the presence of light (energy) ; to make glucose (and oxygen) ; glucose used to make sucrose ; **ignore** fructose	[max 3]	**A** word equation / balanced equation if **MP3** not written out do not award **MP3** if 'broken down' **A** formula for glucose in an equation **MP5** do not award if glucose is broken down unless already penalised in **MP3**
(d) 1 2 3 4 5	respired / oxidised to provide energy / used to provide energy / energy for a suitable process ; **R** 'produce energy' **A** respiration unqualified converted to starch for (energy) storage ; converted to cellulose to make cell walls ; used to make nectar to attract, pollinators / AW ; stored in fruits to attract animals (for seed dispersal) ;	[max 2]	e.g. energy for, growth / active transport **R** to make fruit / seed unqualified

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Question	Expected answers	Mark	Additional Guidance
(e) 1	root hairs / root hair cells ;		**ignore** diffusion / movement down a concentration gradient / osmosis
2	active transport ;		
3	against, concentration / diffusion, gradient **A** from low to high concentration ;		**ignore** gradient in 'from low concentration gradient to high concentration gradient'
4	using, energy / ATP ; **R** energy produced / production of energy		
5	from respiration ;		
6	ref to, proteins / carrier molecules (in membranes) ;	[max 3]	

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Question	Expected answers	Mark	Additional Guidance
5 (a)	halves the number of chromosomes / diploid to haploid **;** **ignore** halves the genetic material produces variation / AW **;**	 [2]	**accept** produces haploid, nuclei / cells / gametes **ignore** prevents doubling of chromosome number
(b) (i)	question is discounted	[2]	
(ii) 1	(only) one fertilisation / one zygote / one fertilised egg **;**		**R** 'from a single cell' but allow ecf for other MPs
2	zygote / fertilised egg / (cells in) embryo, divides / splits in two **;**		**R** egg divides
3	by <u>mitosis</u> **;**		
4	into two (groups of) genetically identical cells **;**	[2]	**A** same , genetic material / genetic make-up / genome **R** similar
(c)	increase in, complexity / AW **;** ref to specialisation / differentiation **;** ref to different types of cells **;** ref to, tissues / organs **;**	[max 2]	**ignore** (rapid) growth / change in shape **A** 'legs / arms / AW, start to grow'
(d)	1. X^hY **;** 2. X^HX^h **;** 3. X^HX^H **;**	[3]	***do not accept*** male genotypes for **MP2** and **MP3**

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Question	Expected answers	Mark	Additional Guidance
(e) 1 2	mutation / change in DNA **;** in the gene, for blood clotting protein **/** on X chromosome **;**		**MP2** can only be awarded if **MP1** is awarded
3	in the mother / mother is a carrier / mother is heterozygous **;** **R** parent(s) is / are heterozygous		**MP3 A** in context of allele passing down the female line for several / many generations (without being expressed in a male)
4	haemophilia is <u>sex linked</u> / shows <u>sex linkage</u> **;**		**ignore** carried on the X chromosome as this is in the question
5	*idea that* the mother's egg with the mutant allele fuses with a Y bearing sperm **;**		
6	e.g. cause of mutation **;** ionising radiation / chemical(s)	[max 2]	

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Question	Expected answers	Mark	Additional Guidance
6 (a)	there are different forms of one, feature / characteristic **;** example of a feature shown by Soay sheep **;** coat / fur, colours patterns of coat / AW with and without horns lengths of horns ear, length / width / size / shape face, length / width / size / shape body mass body shape / body size / AW	[2]	look for a general explanation of 'variation in their phenotype' and an example the example chosen does not have to be visible in Fig. 6.1
(b) (i)	*in years with high populations of sheep*		
1	more deaths in total **; A** low survival rate		*looking at sum total of the bars in each graph*
	for all sizes of lambs		
2	more lambs died than survived **;**		*looking at bars for each body mass*
3	any comparative data quote using same body mass in high and low population years – units (kg) are not necessary **A** tolerance given in table for bars between gridlines		e.g. lambs 13-14 (kg), 106 died in high population year against 12 that died in low population year
		[max 2]	see page 18 for table of data

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Question	Expected answers	Mark	Additional Guidance
(ii)	*in high population – ora for low population* *one mark for competition and two marks for marking points 2-11*		**ignore** explanations about why the population is high in some years and low in others – not relevant
1	competition for, shelter / food / grass / resources **;**	[1]	
2	as a result of competition there is shortage of food for each lamb **;**		
	as a result of competition for food		**R** competition for mates
3	lambs do not store enough fat **;**		
4	ref insulation **;**		
5	cannot survive the winter **;**		
6	ewes / females, produce less milk **;**		
7	ref to number of lambs per female **;**		
8	ref to, more likely to die of disease / AW **;** **A** disease more likely to spread		
9	more small lambs die **;**		
10	(pregnant) ewes / females, are short of food	[max 2]	

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Question	Expected answers	Mark	Additional Guidance
(c)	*note that this is **not** a question about artificial selection*		*points need to be in correct sequence and in the context of selection*
1	variation / AW, among the sheep in the population **;**		
2	some are better, adapted / suited / AW, than others **; A** 'best adapted'		**R** better animals survive unqualified by adaptation or some example
3	any example of an adaptive feature for survival in the extreme conditions **;**		'some sheep have thicker coats' = **MP1** and **MP3** **MP3** must be a feature related to survival in extreme conditions, not 'strength', 'fitness' 'healthiness' etc
4	any example of an appropriate selective agent **;** **ignore** 'extreme conditions / weather'		to survive the cold = **MP4**
5	survive and, breed / have offspring **; A ora**		
6	pass on their <u>alleles</u> **;**		
8	*idea that* over time better adapted, features / traits, become more common **;**	[max 4]	

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body mass / kg	low population years		high population years	
	died	survived	died	survived
3 – 4	0	0	6 (5 – 7)	0
5 – 6	0	2 (1 – 3)	15 (14 – 16)	0
7 – 8	0	7 (6 – 8)	20	3 (2 – 4)
9 – 10	5 (4 – 6)	16 (15 – 17)	56	6 (5 – 7)
11 – 12	12 (11 – 12)	48	94 (93 – 95)	25 (24 – 26)
13 – 14	12 (11 – 12)	57 (56 – 58)	106 (105 – 107)	30 (29 – 31)
15 - 16	12 (11 – 12)	52	48	34 (33 – 35)
17 – 18	6 (5 – 7)	22 (21 – 23)	16	18 (17 – 19)
19 – 20	2 (1 – 3)	12	6 (5 – 7)	2 (1 – 3)
21 - 22	0	0	2 (1 – 3)	0

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