



GCE

Biology

Advanced GCE

Unit **F215**: Control, Genomes and Environment

Mark Scheme for January 2013

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Mark Scheme

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Annotations

Annotation	Meaning
	Correct answer
	Incorrect response
	Benefit of Doubt
	Not Benefit of Doubt
	Error Carried Forward
	Given mark
	Underline (for ambiguous/contradictory wording)
	Omission mark
	Ignore
	Correct response (for a QWC question)
	QWC* mark awarded
	First Answer

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Subject-specific Marking Instructions

CREDIT AW FOR ALL

i.e. credit any alternatively worded statement that conveys the same sense as the mark point.
If a particular word is essential and no other will do it is underlined.

IGNORE wrong or vague statements unless **they directly contradict** a mark point.

ACCEPT incorrect spellings if they are recognisable **and** sound the same when pronounced.

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Question			Answer	Marks	Guidance
1	(a)		sex linkage / sex linked ;	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT non-autosomal linkage</p>
1	(b)	(i)	<p>$Z^B Z^b$ barred male ;</p> <p>$Z^B W$ barred female ;</p> <p>$Z^b W$ non-barred female ;</p>	3	<p>If no gender given, AWARD one mark only if all three adult colours correct</p> <p>If no colours given, AWARD one mark only if all three genders correct</p> <p>CREDIT AW for 'barred' e.g. 'black (feathers) striped with white (bars)' or 'striped / stripey'.</p> <p>CREDIT AW for 'non-barred' e.g. (all) black / not striped.</p>

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Question			Answer	Marks	Guidance																
1	(b)	(ii)	<table border="1"> <tr> <td>parent phenotypes:</td> <td>barred female</td> <td>non-barred male</td> <td></td> </tr> <tr> <td>parent genotypes:</td> <td>$Z^B W$</td> <td>$Z^b Z^b$</td> <td>;</td> </tr> <tr> <td>gametes:</td> <td>Z^B and W</td> <td>Z^b (and Z^b)</td> <td>;</td> </tr> <tr> <td>F1 genotypes:</td> <td>$Z^B Z^b$</td> <td>$Z^b W$</td> <td>;</td> </tr> </table> <p><i>F1 day-old chick phenotypes</i> <i>male</i> black (body) with a white spot (on head) ;</p> <p><i>female</i> (all) black / black body and head / black with no white spot (on head) ;</p>	parent phenotypes:	barred female	non-barred male		parent genotypes:	$Z^B W$	$Z^b Z^b$;	gametes:	Z^B and W	Z^b (and Z^b)	;	F1 genotypes:	$Z^B Z^b$	$Z^b W$;	5	If symbols other than those given (B and b) are used (e.g. A and a), penalise once and then apply ECF. If X and Y are used instead of W and Z, penalise once and then apply ECF. If alleles put onto the W, penalise once and then apply ECF. ACCEPT W written before Z, or other order change eg $Z^B Z^b$ as $Z^b Z^B$. Gametes must apply to candidate's stated parent genotypes – apply ECF. IGNORE genotype repeated (i.e. no space between the gametes). CREDIT F1 genotypes in any order IGNORE repetitions such as each genotype stated twice. Apply ECF if genotypes match gametes given. F1 genotypes and phenotypes should match, including repetitions if given. Apply ECF DO NOT CREDIT adult phenotypes
parent phenotypes:	barred female	non-barred male																			
parent genotypes:	$Z^B W$	$Z^b Z^b$;																		
gametes:	Z^B and W	Z^b (and Z^b)	;																		
F1 genotypes:	$Z^B Z^b$	$Z^b W$;																		
1	(c)	(i)	<u>homozygous recessive</u> ;	1	ACCEPT reverse word order IGNORE double																
1	(c)	(ii)	(all are) white ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks																
Total				11																	

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Question		Answer	Marks	Guidance
2	(a)	<p>1 <u>geographical</u>, isolation / separation / barrier ;</p> <p>2 <i>idea of</i> reproductive isolation ;</p> <p>3 different , <u>selection</u> pressures / adaptations (on different islands) ;</p> <p>4 small , populations / gene pools ;</p> <p>5 <i>idea of mp 4</i> resulting in founder effect ;</p> <p>6 <i>idea of mp 4</i> resulting in greater <u>genetic drift</u> ;</p>	2	<p>1 IGNORE allopatric speciation</p> <p>2 e.g. no / less , interbreeding between different , populations (early) / species (late)</p> <p>3 IGNORE different to mainland ACCEPT in different environments or conditions they evolve or adapt differently</p> <p>4 DO NOT CREDIT small species</p> <p>5 ACCEPT <i>idea of mp 4</i> resulting in greater impact of , mutation / input of alleles (migration) / loss of alleles (accidents etc.)</p>
2	(b)	(i)	681 ; ;	<p>2 Correct answer = 2 marks even if no working shown</p> <p><i>Expected working</i> $125\ 000 - 16\ 000 = 109\ 000$ $(109\ 000 \div 16\ 000) \times 100 = 681\ (\%)$</p> <p>If answer not rounded or rounded incorrectly ACCEPT e.g. 682 or 681.3 or 681.25 for 1 mark</p> <p>If the final answer is incorrect and no mark was awarded for a figure close to correct value, ACCEPT the figure 109 000 in the working or 125 000 – 16 000 for 1 mark.</p>

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Question			Answer	Marks	Guidance
2	(b)	(ii)	<p>1 <u>habitat / ecosystem</u> , disturbance / destruction ;</p> <p>2 (land used for) (named) building / roads ;</p> <p>3 (land used for) agriculture / farming ;</p> <p>4 deforestation ;</p> <p>5 effect of (tourist) , boats / divers, described ;</p> <p>6 more / increased , <u>pollution</u> ;</p> <p>7 sewage / eutrophication , in sea / water ;</p> <p>8 oil / fuel , spill in sea ;</p> <p>9 (humans) hunting / collecting / (over-) fishing ;</p> <p>10 competition from introduced species ;</p> <p>11 predation / overgrazing , by introduced species ;</p> <p>12 (new / named) , diseases / pathogens, introduced ;</p>	6	<p>2 e.g. houses, schools, factories ACCEPT urbanisation and development for tourism</p> <p>4 ACCEPT description e.g. cutting down trees / logging</p> <p>9 CREDIT poaching / green sea turtles caught in fish nets</p> <p>10 CREDIT nest / egg , trampling by introduced species</p> <p>12 CREDIT West Nile virus / avian malaria / bird flu</p>
			<p>QWC – linking TWO ecological pressures above to TWO examples of affected species ;</p>	1	<p>Two Galapagos animals or plants named in context. e.g. • (marine / land) iguana, (lava) lizard, (ground) finch (mp11 predation by cats)</p> <ul style="list-style-type: none"> • rock purslane (mp11 overgrazing by goats) • (giant) tortoise (mp9 hunting, mp10 competition from goats) • whale / seal / named fish / sea cucumber (mp9 hunting) • <u>Scalesia</u> tree (mp4 deforestation, mp10 competition from red quinine tree) • (blue-footed) boobies (mp11 predation by rats)

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Question		Answer	Marks	Guidance
2	(c)	<p><i>economic</i> fewer jobs / smaller profits / business closure / reduced tourism / less income / less revenue ;</p> <p><i>ethical</i> question of , humane killing / animal suffering or people suffer through losing their , homes / friends / jobs ;</p>	2	<p>IGNORE economic loss</p> <p>IGNORE right to life arguments</p>
Total			13	

Question		Answer	Marks	Guidance
3		<p>1 E ; 2 C ;</p> <p>3 B ; 4 given</p> <p>5 F ; 6 A ;</p> <p>7 G ; 8 D ;</p>	7	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p>
Total			7	

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Question		Answer	Marks	Guidance
4	(a)	1 mutation ;	5	1 CREDIT in context of gene or chromosome mutation ACCEPT a suitable description e.g. change in DNA base sequence / non-disjunction
		2 <u>meiosis</u> ;		2 DO NOT CREDIT incorrect spelling of meiosis
		3 cross(ing)-over ;		3 ACCEPT formation of chiasmata
		4 between non-sister chromatids ;		4 DO NOT CREDIT sister here (CON) but IGNORE sister for mp 3 and mp 5
		5 (in) <u>prophase I</u> ;		5 needs to be in context of 3 or 4
		6 independent / random , assortment / segregation ;		6 ACCEPT description e.g. random alignment of bivalents
		7 (in) <u>metaphase</u> ;		7 needs to be in context of 6 metaphase I (chromosomes) or I I (chromatids) IGNORE anaphase
		8 <i>idea of</i> random , fertilisation / fusion of gametes ;		8 CREDIT description relating to plant (as Q states rhubarb) e.g. any pollen grain could land on any stigma / any pollen grain could reach any ovule
		9 AVP ;		9 ref. epigenetics

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Question			Answer	Marks	Guidance
4	(b)	(i)	reproductive ; <u>cloning</u> ;	2	ACCEPT 'whole organism'
4	(b)	(ii)	(callus / plant) tissue culture / micropropagation ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT tissue culturing / micropropagating IGNORE cloning
4	(b)	(iii)	<i>they have different (qualitatively or quantitatively)</i> 1 genes / DNA / alleles / genotypes ; 2 repressor proteins ; 3 enzymes ; 4 protein folding / tertiary structure / thermostability ; 5 (plant) growth regulators / hormones ;	2	Mark the first 2 suggestions. Must have 'different' idea at least ONCE e.g. higher / only one of them has x 3 CREDIT different enzymes or different amounts 4 CREDIT enzyme activity at different temperatures 5 ACCEPT PGRs / named hormones eg gibberellins
4	(c)	(i)	1 (test) different varieties ; 2 several plants or leaves (of each) / repeat readings ; 3 same age ; 4 same soil , type / mineral content / pH ; 5 same light , exposure / conditions ; 6 same , watering regime / temperature / <u>CO₂ concentration</u> ;	5	1 ACCEPT 'Timperley Early' and 'Victoria' IGNORE species 2 ACCEPT three or more CREDIT 'control / controlled' for 'same' in mps 3,4,5,6 & 7 4 IGNORE soil nutrient level or content 5 CREDIT light intensity / wavelength / duration IGNORE amount of light <i>If none of mps 4-6 awarded</i>

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Question		Answer	Marks	Guidance
		<p>7 same, preparation or testing procedure detail ; (e.g. leaf mass / volume of solvent / soaking time / temperature)</p> <p>8 test / measure, (oxalic) acid concentration / acidity / pH / H⁺ ion concentration ;</p> <p>9 detail of measuring method ;</p>		<p>ACCEPT 'grown under same conditions' for 1 mark and dot for QWC if stated as controlled</p> <p>7 IGNORE amount (of solvent / water / ethanol / alcohol) or size (of leaf). Procedure can be liquidising/pestle and mortar, stated same for each.</p> <p>8 IGNORE amount / content / how much (of acid or H⁺ ions) except for QWC</p> <p>9 e.g. pH probe universal indicator (not litmus) titration IGNORE colorimetry</p>
		QWC ;	1	<p>Award if variables correctly identified as <u>independent</u> (1 only) and <u>controlled</u> (any of 3/4/5/6/7) and <u>dependent</u> (8 only).</p>

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Question			Answer	Marks	Guidance
4	(c)	(ii)	<p>1 bacteria / fungi ;</p> <p>2 <i>idea of external digestion</i> ;</p> <p>3 by , enzymes / named enzymes ;</p> <p>4 absorption of breakdown products ;</p> <p>5 release of carbon dioxide and water ;</p> <p>6 (breakdown of protein) makes , ammonium , ions / compounds or NH₄⁺ ;</p>	3	<p>1 DO NOT CREDIT wrong bacteria eg nitrogen fixing, nitrifying, denitrifying, <i>Rhizobium</i>, <i>Nitrosomonas</i>, <i>Nitrobacter</i></p> <p>2 CREDIT saprotrophic / saprophytic / saprobiotic</p> <p>3 ACCEPT 'breaking down' for digestion e.g. cellulase / lignase</p> <p>6 CREDIT ammonification IGNORE ammonia / nitrates</p>
4	(d)		<p>auxin / IAA ;</p> <p>not destroyed by light / more present in dark ;</p> <p>moves down from shoot tip / uniformly distributed ;</p> <p>(causes) <u>cell</u> elongation ;</p>	2	IGNORE gibberellins and references to phototropism and more light on one side
			Total	21	

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Question		Answer	Marks	Guidance																								
5	(a)	<table border="1"> <thead> <tr> <th>control element</th> <th>made of protein</th> <th>binds to a protein</th> <th>codes for protein</th> </tr> </thead> <tbody> <tr> <td>insulin</td> <td>✓</td> <td>✓</td> <td>x</td> </tr> <tr> <td>c AMP</td> <td>x</td> <td>✓</td> <td>x</td> </tr> <tr> <td><i>lac</i> I (inhibitor) gene</td> <td>x</td> <td>✓</td> <td>✓</td> </tr> <tr> <td><i>lac</i> O (operator) gene</td> <td>x</td> <td>✓</td> <td>x</td> </tr> <tr> <td>homeotic gene product</td> <td>✓</td> <td>x</td> <td>x</td> </tr> </tbody> </table>	control element	made of protein	binds to a protein	codes for protein	insulin	✓	✓	x	c AMP	x	✓	x	<i>lac</i> I (inhibitor) gene	x	✓	✓	<i>lac</i> O (operator) gene	x	✓	x	homeotic gene product	✓	x	x	5	<p>Award one mark for each correct row. DO NOT CREDIT blank spaces, multiple answers or hybrid ticks (a tick that has been crossed through, so it cannot be judged if it is a tick or a cross.)</p>
control element	made of protein	binds to a protein	codes for protein																									
insulin	✓	✓	x																									
c AMP	x	✓	x																									
<i>lac</i> I (inhibitor) gene	x	✓	✓																									
<i>lac</i> O (operator) gene	x	✓	x																									
homeotic gene product	✓	x	x																									

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Question		Answer	Marks	Guidance
5	(b)	<p><i>RNA polymerase</i></p> <p>1 makes (m / messenger / t / transfer / r / ribosomal) RNA ;</p> <p>2 <u>transcription</u> ;</p> <p>3 one strand (DNA) used / short section used / one strand formed ;</p> <p><i>DNA polymerase</i></p> <p>4 <u>DNA replication</u> ;</p> <p>5 semi-conservative / both strands used / whole length used / 2 strands formed ;</p> <p>6 before , nuclear / cell , division ;</p>	4	<p>2 CREDIT transcribes / transcribed</p> <p>3 Must be a clear statement</p> <p>4 CREDIT replicates / replicated</p> <p>5 Must be a clear statement</p> <p>6 CREDIT before , mitosis / meiosis / cytokinesis CREDIT in S phase (of interphase) IGNORE interphase unqualified</p>
5	(c)	<p>1 apoptosis ;</p> <p>2 cytoskeleton ;</p> <p>3 enzymes ;</p> <p>4 phagocytosis ;</p> <p>5 mitosis / mitotic cell division ;</p> <p>6 tumour ;</p>	6	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>1 ACCEPT 'apoptosis' as phonetic</p> <p>2 ACCEPT cell skeleton</p> <p>3 CREDIT proteases / lysosomes</p> <p>6 ACCEPT cancer / carcinoma</p>
		Total	15	

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Question		Answer	Marks	Guidance
6	(a)	<p>P lag ; Q log(arithmetic) / exponential ; R stationary ;</p>	3	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>IGNORE plateau</p>
6	(b)	<p>(molecule made in or needed for cell's normal) survival / function / growth / development / reproduction ;</p> <p>named example ;</p>	2	<p>IGNORE metabolism (as stated in Q) / phase</p> <p>e.g. glucose / sucrose / (named) amino acid / CO₂ / ethanol / (named) nucleotide / named named respiratory intermediate / (named) protein / (named) enzyme</p> <p>DO NOT CREDIT antibiotics</p>
6	(c) (i)	<p>Q ;</p>	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT log / exponential</p>
6	(c) (ii)	<p>R ;</p>	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT stationary</p>
6	(c) (iii)	<p>R / S ;</p>	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT stationary / decline / death (phase)</p>

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Question		Answer	Marks	Guidance		
6	(d)	(i)	4	<p>Mark the first suggestion on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>C CREDIT <i>idea of paddles distributing the available oxygen more evenly</i></p> <p>C ACCEPT continuous, adding / supply, of oxygen</p> <p>IGNORE aeration as named F but ACCEPT for C</p> <p>C CREDIT <i>idea of paddles distributing the available nutrients more evenly</i></p> <p>C ACCEPT continuous, adding / supply, of nutrients</p> <p>IGNORE food as named F but ACCEPT for C</p> <p>C ACCEPT 'suitable' for 'optimum' temperature</p> <p>ACCEPT prevent overheating / enzymes denaturing</p> <p>C ACCEPT 'suitable' for 'optimum' pH</p> <p>ACCEPT prevent enzymes denaturing</p> <p>C CREDIT reduce pressure (for waste gases)</p> <p>F CREDIT named microbes e.g. bacteria / fungi / pathogens</p> <p>C CREDIT idea of use of filters or aseptic techniques</p>		
					<i>factor (F)</i>	<i>change needed (C)</i>
					oxygen ;	increase it / more / high or stir / sparging ;
					(named) nutrient ;	increase it / more / high or stir ;
					temperature ;	maintain at / control at / change to , optimum or cool or ref. to using water jacket ;
					pH ;	maintain at / control at / change to, optimum or add, buffer / acid / alkali ;
					(waste) product / gas / CO ₂ ;	harvest / remove / waste gas vent ;
other / unwanted / harmful / competing , microbes ;	prevent entry / asepsis ;					

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Question			Answer	Marks	Guidance
6	(d)	(ii)	<p>1 (child's) cells / DNA / genes / alleles , not changed ;</p> <p>2 vector not used (in child) ;</p> <p>3 child / cells , not producing , HGH / hormone ;</p> <p>4 HGH / drug / injection , has to be given repeatedly / is a short term solution / not a cure ;</p>	3	<p>ACCEPT reverse reasoning throughout e.g. 1 in gene therapy , the person's cells are altered / a functional allele is introduced.</p> <p>1 DO NOT ACCEPT gene replacement ACCEPT genotype</p> <p>2 CREDIT named vector</p> <p>3 CREDIT (the) protein / polypeptide</p>
			Total	15	

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Question		Answer	Marks	Guidance						
7	(a)	C ; D ; B ; A ;	4	Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks						
7	(b)	<table border="1" style="display: inline-table; vertical-align: top;"> <tr><td>goal</td></tr> <tr><td>D</td></tr> <tr><td>A</td></tr> <tr><td>B</td></tr> <tr><td>C</td></tr> <tr><td>E</td></tr> </table> ; ; ; ; ;	goal	D	A	B	C	E	5	Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
goal										
D										
A										
B										
C										
E										
Total			9							

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Question		Answer	Marks	Guidance
8	(a)	<p><i>producer</i> (leaves / plants) fix carbon / photosynthesise / make food / autotroph(ic) / convert light energy to chemical energy / convert inorganic, C / CO₂, to organic molecules ;</p> <p><i>consumer</i> (bird) eat / derives energy from / feeds on , other organisms</p> <p>or heterotroph(ic) ;</p> <p><i>trophic level</i> stage / position / place / level , in a food , chain / web ;</p>	3	<p>IGNORE 'first level in a food chain' DO NOT CREDIT 'produces energy'</p> <p>IGNORE 'consumes' IGNORE named levels / organisms e.g. eats producers ACCEPT animals, and / or, plants</p> <p>IGNORE step, feeding level</p>
8	(b)	(i)	2	<p>CREDIT any two correct answers</p> <p>IGNORE ref to quadrats being the same size (as given in Q)</p> <p>IGNORE amount</p> <p>e.g. method of applying solution length of time spent counting time of day / light intensity soil moisture / rainfall / humidity method to ensure no double counting</p>

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Question			Answer	Marks	Guidance
8	(b)	(ii)	<p>means different / mean less in soil with plants removed ;</p> <p>(but) error bars overlap ;</p> <p>(could have) mean trend reversed / equal numbers in some pairs of results ;</p> <p>difference, not / less , valid ;</p>	2	<p>DO NOT CREDIT if difference in mean stated to be valid IGNORE average</p> <p>ACCEPT cross (over)</p> <p>e.g. in any pair of results you could find that the number of earthworms in the cleared soil could be higher than in the uncleared soil</p> <p>ACCEPT introductory statement ' No it is not'.</p>
8	(b)	(iii)	<p>number / abundance , of earthworms varies , from year to year / from 2004 to 2006 / over the two years / over time ;</p> <p>number / abundance , of earthworms varies , before and after plant clearance / as vegetation changes / during succession ;</p>	2	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT change described e.g. more worms in 2006 than 2004</p> <p>If neither mark point awarded ACCEPT numbers of earthworms constantly , changing / fluctuating for 1 mark</p>
Total				9	

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