

Markscheme

November 2019

Biology

Standard level

Paper 2

17 pages

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Section B

Extended response questions - quality of construction

- Extended response questions for SLP2 carry a mark total of **[16]**. Of these marks, **[15]** are awarded for content and **[1]** for the quality of the answer.
- **[1]** for quality is awarded when:
 - the candidate's answers are clear enough to be understood without re-reading.
 - the candidate has answered the question succinctly with little or no repetition or irrelevant material.
- Candidates that score very highly on the content marks need not necessarily automatically gain **[1]** for quality (and vice versa).

Section A

Question		Marking point	Answers	Notes	Total
1.	a		cannot interbreed to produce <u>fertile</u> offspring ✓	<i>Accept converse or a good explanation.</i>	1
	b		« <i>O. sativa</i> » <i>japonica</i> ✓		1
	c	a SIM	both show diversity OR similar pattern/peaks and troughs in the first part of the chromosome / up to «approximately» 1.5 megabases OR similar diversity between 2.4 to 2.7 mb OR both highest at 0.7 mb ✓	<i>One answer from mpa and one from mpb required for 2 [max].</i>	2 max
		b DIFF	there are «two» major drops in diversity for <i>O. sativa indica</i> whereas none for <i>O. rufipogon</i> /much wider fluctuations in <i>O. s. indica</i> OR <i>O. s. indica</i> much lower at PROG1 OR <i>O. rufipogon</i> does not drop < 2.5 whereas <i>O. s. indica</i> approaches 0 OR <i>O. rufipogon</i> generally higher than <i>O. s. indica</i> after 1.4-1.5 ✓	<i>Accept a statement of where the drops occur.</i>	

(continued...)

(Question 1 continued)

	d		$\frac{3}{4}$ / 0.75 / 75% ✓	Do not accept 0.75 % or 75 or ratios	1
	e	a	<i>O. s. indica</i> has more of the ancestral allele «for all three genes» ✓	Accept converse.	2 max
		b	lower/higher values for ancestral/derived are not for the same genes ✓	Allow specific gene examples.	
		c.	for <i>O. s. indica</i> the highest proportion is for <u>DPL2</u> <u>ancestral</u> , but for <i>O. s. japonica</i> is <u>GS3</u> <u>derived</u> allele ✓	Allow converse for smallest derived.	
	f		any reference to comparison ✓		1

(continued...)

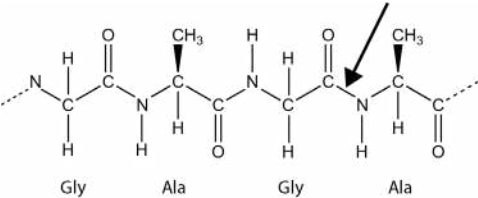
(Question 1 continued)

g	a	large difference in diversity index between <i>O. s. indica</i> and <i>O. s. japonica</i> «suggests independent evolution» ✓		4 max
	b	«some of the» peaks/troughs for <i>O. s. indica</i> and <i>O. s. japonica</i> in different positions «suggests independent evolution» ✓		
	c	<i>O. s. indica</i> has a similar diversity index to <i>O. rufipogon</i> «which suggests closer relationship/recent divergence» ✓	<i>Allow converse for japonica</i>	
	d	<i>O. s. japonica</i> has very different proportions of ancestral and derived alleles compared to <i>O. s. indica</i> ✓		
	e	<i>O. s. indica</i> has similar large number of ancestral alleles to <i>O. rufipogon I/II</i> ✓	<i>Allow converse for derived</i>	
	f	<i>O. s. japonica</i> has a large number of derived alleles similar to <i>O. rufipogon III</i> OR «but» the number of derived alleles is greater in <i>O. s. japonica</i> than in <i>O. rufipogon III</i> ✓	<i>Allow converse for ancestral</i>	
	g	<i>O. s. indica</i> and <i>O. s. japonica</i> are in different clades ✓ OR <i>O. s. indica</i> and <i>O. rufipogon I</i> are in the same clade ✓		
	h	evidence from one chromosome/3 genes/2 studies is not sufficient to form a conclusion ✓		

2.	a			«three bases on mRNA» coding for one amino acid «in a polypeptide» ✓		1
	b	i		met-ser-arg-arg OR start-ser-arg-arg OR met-ser-arg-arg-stop OR start-ser-arg-arg-stop ✓	<i>Do not accept peptides containing an amino acid/leu for the last codon.</i>	1
		ii		TAC TCG GCT TCC ATC GAC ✓		1

(continued...)

(Question 2 continued)

	c		they occurred after the common origin of life <i>OWTTE</i> OR the genetic code is not «in fact» universal ✓	<i>Look for alternatives.</i>	1												
	d	i	any annotation between a C=O and the next NH ✓	<i>e.g.</i> 	1												
		ii	condensation ✓	<i>Do not accept anabolism alone.</i>	1												
	e		<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>c</th> <th>d</th> </tr> <tr> <th></th> <th>Function</th> <th>Conformation</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>Rubisco enzyme/catalyst / carbon fixation / <i>OWTTE</i></td> <td>globular ✓</td> </tr> <tr> <td>b</td> <td>Spider silk absorb stretch/structural / <i>OWTTE</i></td> <td>fibrous/longitudinal /linear/«mainly»β-pleated ✓</td> </tr> </tbody> </table>		c	d		Function	Conformation	a	Rubisco enzyme/catalyst / carbon fixation / <i>OWTTE</i>	globular ✓	b	Spider silk absorb stretch/structural / <i>OWTTE</i>	fibrous/longitudinal /linear/«mainly»β-pleated ✓	<i>Award [1] per correct row or correct column.</i>	2
	c	d															
	Function	Conformation															
a	Rubisco enzyme/catalyst / carbon fixation / <i>OWTTE</i>	globular ✓															
b	Spider silk absorb stretch/structural / <i>OWTTE</i>	fibrous/longitudinal /linear/«mainly»β-pleated ✓															

3.	a	a.	cells can only arise from preexisting cells ✓		2 max
		b	living organisms are composed of cells/smallest unit of life ✓		
		c	organisms consisting of only one cell carry out all functions of life in that cell/cells perform life functions «at some point in their existence» ✓		
		d	although most organisms conform to cell theory, there are exceptions ✓		
	b	a	nutrition ✓	Do not allow “feeding”, plants do not “feed”. Mark the first two answers only.	2 max
		b	metabolism/respiration ✓		
		c	growth ✓		
		d	response/irritability ✓		
		e	excretion ✓		
		f	homeostasis ✓		
		g	reproduction ✓		

(continued...)

(Question 3 continued)

c	a	linear DNA molecules OR DNA associated with histone «proteins» ✓		3 max		
	b	carry the same sequence of <u>genes</u> ✓				
	c	«but» not necessarily the same <u>alleles</u> «of those genes» ✓				
	d	both are present when nucleus is in diploid state ✓ OR occur in pairs ✓				
	e	have <u>same</u> size/length/banding patterns ✓				
	f	centromeres are in the same position ✓				
d			<i>Award [1] per correct row.</i>	3		
					Yeasts	Humans
		<i>Small yield of ATP</i>			<i>yes</i>	<i>yes</i>
	a	require oxygen			no	no ✓
	b	produce ethanol and CO ₂			yes	no ✓
c	produce lactate	no	yes ✓			

4.	a		competition/lack of resources/death/exceeding carrying capacity ✓	<i>Allow a description of it. Do not allow "overpopulation" or "natural selection".</i>	1
	b		a «better adapted» tend to survive more ✓		3 max
			b «better adapted» reproduce/produce more offspring ✓		
			c pass on characteristics to their offspring «when they reproduce» ✓		
			d their frequency increases «within the population» due to natural selection ✓		
			e leading to evolution ✓		

Section B

Clarity of communication: [1]

The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.

Question		Marking point	Answers	Notes	Total
5.	a			<i>Elements should be clearly drawn, correctly positioned and annotated.</i>	4 max
		a	bilayer of phospholipids with both "tails" towards the inside «of the bilayer» ✓	<i>This can be taken unlabeled from diagram.</i>	
		b	hydrophilic/polar and hydrophobic/non-polar annotation ✓		
		c	cholesterol between phospholipid tails ✓		
		d	glycoprotein ✓		
		e	integral proteins/channel proteins ✓		
		f	peripheral proteins ✓	<i>Allow this if it does not extend across the membrane</i>	

(continued...)

(Question 5 continued)

b	a	use of the binomial system ✓	<p><i>Names of the seven taxa not required.</i></p> <p><i>OWTTE</i></p> <p><i>Allow example e.g. fossil record comparison</i></p>	4 max
	b	agreed/developed by scientists / <i>OWTTE</i> ✓		
	c	hierarchy of taxa used ✓		
	d	three domains used/three domain names ✓		
	e	genome/DNA sequence similarities OR amino acid sequence of specific proteins ✓		
	f	species from a common ancestor are grouped together OR included in the same clade/branch in cladogram ✓		
	g	use evidence of evolutionary origin ✓		
	h	shared characteristics within a group OR similar embryonic development ✓		

(continued...)

c	a.	autotrophs/producers/plants obtain inorganic nutrients from the «abiotic» environment ✓	<i>Allow OWTTE for mpf for passed up trophic levels.</i>	7 max
	b.	energy provided «mainly» by sunlight ✓		
	c.	light energy converted «to chemical energy» through photosynthesis ✓		
	d	photosynthesis/producers/autotrophs convert inorganic carbon/carbon dioxide and water into carbon/organic compounds ✓		
	e	«these» carbon compounds/foods contain/are a source of «useable» energy «for life» ✓		
	f	carbon compounds/energy are transferred along food chains when eaten by consumers/heterotrophs ✓		
	g	respiration returns carbon «dioxide» to the environment ✓		
	h	respiration releases stored/chemical energy as ATP/heat ✓		
	i	energy/ATP is used to carry out life functions/synthesis/growth/movement ✓		
	j	energy is lost/not recycled ✓		
	k	nutrients are recycled / example of recycled nutrient e.g. carbon ✓		
	l	decomposers recycle minerals/inorganic nutrients ✓		

(continued...)

6.	a	a	platelets respond to/detect skin/blood vessel damage ✓	<i>Accept answers presented as a flow chart.</i>	4 max
		b	platelets release clotting factors ✓		
		c	clotting factors trigger a chain/cascade of reactions ✓		
		d	«leading to» formation of thrombin ✓		
		e	thrombin causes fibrinogen conversion into fibrin ✓		
		f	blood clot seals the wound due to fibrin network of fibres ✓		

(continued...)

(Question 6 continued)

b	a	«first set of» gametes/parental genotype I^A, i ✓	<p><i>Answers can be given in a Punnett grid or in prose.</i></p> <p><i>Accept the four possible blood groups of the offspring anywhere in the answer.</i></p>	4 max							
	b	«other set of» gametes/parental genotype I^B, i ✓									
	c	«genotypes of offspring are respectively» $I^A I^B, I^B i, I^A i, ii$ ✓	<i>All four correct required.</i>								
	d	«phenotypes of offspring are respectively» AB, B, A, O ✓	<i>All four correct required linked to genotypes</i>								
			<p><i>Award marks only for the first grid if more than one drawn;</i></p> <p><i>e.g. of Punnett grid</i></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;">gametes</td> <td style="padding: 5px;">I^A</td> <td style="padding: 5px;">i</td> </tr> <tr> <td style="padding: 5px;">I^B</td> <td style="padding: 5px;">$I^A I^B$</td> <td style="padding: 5px;">$I^B i$</td> </tr> <tr> <td style="padding: 5px;">i</td> <td style="padding: 5px;">$I^A i$</td> <td style="padding: 5px;">ii</td> </tr> </table>		gametes	I^A	i	I^B	$I^A I^B$	$I^B i$	i
gametes	I^A	i									
I^B	$I^A I^B$	$I^B i$									
i	$I^A i$	ii									

(continued...)

c	a	air carried through trachea AND bronchi/bronchioles AND alveoli ✓	All three required in correct order. Accept correctly annotated diagram.	7 max	
	b	alveoli increase the surface area/thin walled for gas exchange ✓			
	c	gas exchange carried out through type I pneumocytes ✓			
	d	type II pneumocytes secrete surfactant to reduce surface tension ✓			
	e	moist surface/surfactant allows gases to diffuse in solution ✓			
	f	ventilation/moving blood maintains concentration gradients of oxygen and carbon dioxide ✓			
	g	between air in alveoli and blood in «adjacent» capillaries OR oxygen diffuses from alveoli to capillaries and carbon dioxide from capillaries to alveoli ✓			OWTTE
	h	<u>external</u> intercostal muscles/ <u>diaphragm</u> contract during inspiration ✓			
	i	lowering air pressure «in lungs»/increasing thorax volume ✓			
	j	relaxation of external intercostal muscles/diaphragm enable «passive» expiration ✓			
	k	<u>internal</u> intercostal «and abdominal muscles» contract «to force» expiration ✓			
l	expiration due to increasing air pressure «in lungs»/decreasing thorax volume ✓				