







**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	<b>a SIM</b>	both show diversity <b>OR</b> similar pattern/peaks and troughs in the first part of the chromosome / up to «approximately» 1.5 megabases <b>OR</b> similar diversity between 2.4 to 2.7 mb <b>OR</b> both highest at 0.7 mb ✓	<i>One answer from mpa and one from mpb required for 2 [max].</i>	2 max
		<b>b DIFF</b>	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> <b>OR</b> <i>O. s. indica</i> much lower at PROG1 <b>OR</b> <i>O. rufipogon</i> does not drop < 2.5 whereas <i>O. s. indica</i> approaches 0 <b>OR</b> <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)

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

(continued...)

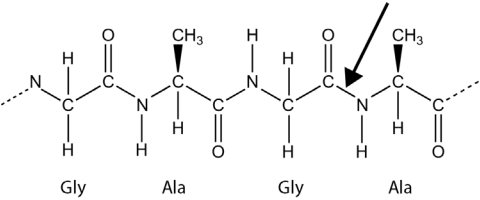
(Question 1 continued)

<b>g</b>	<b>a</b>	large difference in diversity index between <i>O. s. indica</i> and <i>O. s. japonica</i> «suggests independent evolution» ✓		<b>4 max</b>
	<b>b</b>	«some of the» peaks/troughs for <i>O. s. indica</i> and <i>O. s. japonica</i> in different positions «suggests independent evolution» ✓		
	<b>c</b>	<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>	
	<b>d</b>	<i>O. s. japonica</i> has very different proportions of ancestral and derived alleles compared to <i>O. s. indica</i> ✓		
	<b>e</b>	<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>	
	<b>f</b>	<i>O. s. japonica</i> has a large number of derived alleles similar to <i>O. rufipogon III</i> <b>OR</b> «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>	
	<b>g</b>	<i>O. s. indica</i> and <i>O. s. japonica</i> are in different clades ✓ <b>OR</b> <i>O. s. indica</i> and <i>O. rufipogon I</i> are in the same clade ✓		
	<b>h</b>	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 <b>OR</b> start-ser-arg-arg <b>OR</b> met-ser-arg-arg-stop <b>OR</b> 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)

	<b>c</b>		they occurred after the common origin of life <i>OWTTE</i> <b>OR</b> the genetic code is not «in fact» universal ✓	<i>Look for alternatives.</i>	<b>1</b>												
	<b>d</b>	<b>i</b>	any annotation between a C=O and the next NH ✓	e.g. 	<b>1</b>												
		<b>ii</b>	condensation ✓	<i>Do not accept anabolism alone.</i>	<b>1</b>												
	<b>e</b>		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 35%; text-align: center;"><b>c</b></th> <th style="width: 50%; text-align: center;"><b>d</b></th> </tr> <tr> <th></th> <th style="text-align: center;"><b>Function</b></th> <th style="text-align: center;"><b>Conformation</b></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>a</b></td> <td>Rubisco enzyme/catalyst / carbon fixation / <i>OWTTE</i></td> <td>globular ✓</td> </tr> <tr> <td style="text-align: center;"><b>b</b></td> <td>Spider silk absorb stretch/structural / <i>OWTTE</i></td> <td>fibrous/longitudinal /linear/«mainly»β-pleated ✓</td> </tr> </tbody> </table>		<b>c</b>	<b>d</b>		<b>Function</b>	<b>Conformation</b>	<b>a</b>	Rubisco enzyme/catalyst / carbon fixation / <i>OWTTE</i>	globular ✓	<b>b</b>	Spider silk absorb stretch/structural / <i>OWTTE</i>	fibrous/longitudinal /linear/«mainly»β-pleated ✓	Award <b>[1]</b> per correct row or correct column.	<b>2</b>
	<b>c</b>	<b>d</b>															
	<b>Function</b>	<b>Conformation</b>															
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<b>b</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)

<b>c</b>		<b>a</b>	linear DNA molecules <b>OR</b> DNA associated with histone «proteins» ✓				<b>3 max</b>		
		<b>b</b>	carry the same sequence of <u>genes</u> ✓						
		<b>c</b>	«but» not necessarily the same <u>alleles</u> «of those genes» ✓						
		<b>d</b>	both are present when nucleus is in diploid state ✓ <b>OR</b> occur in pairs ✓						
		<b>e</b>	have <u>same</u> size/length/banding patterns ✓						
		<b>f</b>	centromeres are in the same position ✓						
<b>d</b>		<b>a</b>				<i>Award [1] per correct row.</i>	<b>3</b>		
								<b>Yeasts</b>	<b>Humans</b>
			<i>Small yield of ATP</i>					<i>yes</i>	<i>yes</i>
			require oxygen					no	no ✓
			<b>b</b>					produce ethanol and CO <sub>2</sub>	
<b>c</b>			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
		<b>a</b>	bilayer of phospholipids with both "tails" towards the inside «of the bilayer» ✓	<i>This can be taken unlabeled from diagram.</i>	
		<b>b</b>	hydrophilic/polar <b>and</b> hydrophobic/non-polar annotation ✓		
		<b>c</b>	cholesterol between phospholipid tails ✓		
		<b>d</b>	glycoprotein ✓		
		<b>e</b>	integral proteins/channel proteins ✓		
		<b>f</b>	peripheral proteins ✓	<i>Allow this if it does not extend across the membrane</i>	

(continued...)

(Question 5 continued)

<b>b</b>	<b>a</b>	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>	<b>4 max</b>
	<b>b</b>	agreed/developed by scientists / <i>OWTTE</i> ✓		
	<b>c</b>	hierarchy of taxa used ✓		
	<b>d</b>	three domains used/three domain names ✓		
	<b>e</b>	genome/DNA sequence similarities <b>OR</b> amino acid sequence of specific proteins ✓		
	<b>f</b>	species from a common ancestor are grouped together <b>OR</b> included in the same clade/branch in cladogram ✓		
	<b>g</b>	use evidence of evolutionary origin ✓		
	<b>h</b>	shared characteristics within a group <b>OR</b> similar embryonic development ✓		

(continued...)

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

(continued...)

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

*(continued...)*

(Question 6 continued)

<b>b</b>	<b>a</b>	«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>	<b>4 max</b>							
	<b>b</b>	«other set of» gametes/parental genotype $I^B, i$ ✓									
	<b>c</b>	«genotypes of offspring are respectively» $I^A I^B, I^B i, I^A i, ii$ ✓	<i>All four correct required.</i>								
	<b>d</b>	«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;"><math>I^A</math></td> <td style="padding: 5px;"><math>i</math></td> </tr> <tr> <td style="padding: 5px;"><math>I^B</math></td> <td style="padding: 5px;"><math>I^A I^B</math></td> <td style="padding: 5px;"><math>I^B i</math></td> </tr> <tr> <td style="padding: 5px;"><math>i</math></td> <td style="padding: 5px;"><math>I^A i</math></td> <td style="padding: 5px;"><math>ii</math></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...)



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