Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

BIOLOGY **0610/43**

Paper 4 Theory (Extended) **May/June 2019**

MARK SCHEME

Maximum Mark: 80

Published

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.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks	Guidance
1(a)	nucleus ; mitochondria ; (rough) endoplasmic reticulum ; AVP ;	**2**	
1(b)(i)	*nitrogen* for making, amino acids / proteins ; *glucose* for respiration / source of energy ;	**2**	
1(b)(ii)	for even / uniform, distribution / concentration, of contents / AW ; ensure more access of bacteria with, medium / AW ; prevent settling / clumping of, contents / AW ; so oxygen / glucose / nutrients, dissolves ; so that growth is not limited ; so bacteria can absorb substances (more easily) ; bacteria need oxygen for respiration ;	**3**	

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Question	Answer	Marks	Guidance
1(c)	*description:* at least two correctly named phases **;** any two phases described correctly **;** i.e. **A**: level, **B**: increasing, **C**: level, **D:** decreasing (numbers of live bacteria) correct relevant data quote for any phase **;;** ***A** is the lag, phase / stage:* bacteria, growing / dividing, slowly **;** bacteria adjusting to conditions ***/*** absorbing resources **;** ***B** is the exponential / log, phase / stage:* resources are, not limiting / AW **;** bacteria, growing / dividing, rapidly **;** growth / birth, rate greater than death rate **;** ***C** is the stationary, phase / stage:* growth / birth, rate equal to death rate **;** ***D** is the death, phase / stage:* death rate greater than growth, birth / rate **;** ***C** or **D**:* many bacteria are dying **;** concentration of resources decreasing / resources become limiting **;** space becomes limiting / AW **;** (named) toxins building up **;**	**6**	

Question	Answer	Marks	Guidance
2(a)	carbon dioxide + water ⟶ ; glucose + oxygen ;	**2**	
2(b)(i)	temperature is a factor that affects the rate of photosynthesis ; *reference to* kinetic energy ; *idea of* effect of temperature, on enzymes / diffusion rate (of carbon dioxide) ; *idea that* temperature is a variable that should be standardised ; AVP ;	**2**	
2(b)(ii)	74 ;;;	**3**	
2(b)(iii)	rate (of photosynthesis) increases and, reaches a plateau / AW ; rate (of photosynthesis) increases until 1750 (a.u) / 25 µmol per m^2 per s ; any comparative use of figures for rate ;	**3**	
2(b)(iv)	light intensity is the <u>limiting</u> factor, at all light intensities used / AW ; because rate of photosynthesis does not level off (even at high light intensities) ; carbon dioxide / temperature / chlorophyll / another factor, was not a <u>limiting</u> factor ; *correct reference* to (light) <u>energy</u> ; light is absorbed by chlorophyll ; AVP ;	**4**	

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Question	Answer	Marks	Guidance
3(a)(i)	restriction (enzyme) ;	**1**	
3(a)(ii)	sticky ends ;	**1**	
3(a)(iii)	plasmid is cut with the same (restriction) enzyme (as DNA) ; to form, sticky ends / region **A**, that are complementary to sticky ends of, gene / *cry* ; *reference to* base sequences (being complementary / AW) ; (DNA) ligase used to join plasmid and, *cry* / gene ; AVP ; e.g. formation of recombinant DNA / plasmid	**3**	
3(b)	gene / *cry*, codes for the sequence of amino acids in, (toxic) protein ; DNA / gene / *cry*, is copied / transcribed, to form mRNA ; *cry* / gene / DNA, remains in nucleus ; mRNA moves from nucleus to, cytoplasm / ribosome ; mRNA passes through ribosomes / AW ; ribosomes assemble amino acids (into protein molecules) ; ribosomes make proteins ; AVP ; e.g. order of amino acids determined by base sequence of, mRNA / DNA / gene	**4**	
3(c)	to kill / harm / deter, caterpillars / insects / pests ; higher yield / reduce losses due to, (certain) caterpillars / insects / pests ; higher quality of cotton ; use less insecticide ; (so) less pollution ; (so) less money spent on, insecticides / spraying ; (so) less risk to workers' health (from using insecticides) ; (so) less chance of insecticide resistance ; AVP ;	**3**	

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Question	Answer	Marks	Guidance
4(a)	one loop to lungs / pulmonary circulation, and one loop to rest of the body / systemic circulation ; blood flows through heart twice, for one (complete) circuit / to get back to the same point ;	**1**	
4(b)	lymphocyte / AW ; engulf/ digest / kill / destroy, bacteria / pathogens ; platelet ; red blood cell ;	**4**	
4(c)	wall of artery thicker than wall of vein ; lumen labelled in both drawings ;	**2**	
4(d)(i)	arrow(s) start in right-hand side of heart in correct direction ; arrow(s) point upwards inside pulmonary artery ;	**2**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4(d)(ii)</td><td>
<table>
<tr><th>statement</th><th>name of structure</th><th>letter from Fig. 4.1</th></tr>
<tr><td>chamber that creates the highest blood pressure</td><td>left ventricle</td><td>F ;</td></tr>
<tr><td>blood vessel containing blood with the highest concentration of oxygen</td><td>pulmonary vein / aorta</td><td>C / A ;</td></tr>
<tr><td>structure that prevents blood going from ventricle to atrium</td><td>atrioventricular valve</td><td>E ;</td></tr>
<tr><td>structure that prevents backflow of blood from artery to ventricle</td><td>semilunar valve</td><td>K ;</td></tr>
<tr><td>chamber that receives blood from vena cava</td><td>right atrium</td><td>J ;</td></tr>
</table>
</td><td>5</td><td>one mark per row</td></tr>
</table>

Question	Answer	Marks	Guidance
4(e)	tissue fluid drains (into lymphatic vessels) ; transports tissue fluid ; back into the blood / circulatory system ; contains, lymphocytes / antibodies (in lymph nodes) ; defence against infection / provide (active) immunity / AW ; (lacteals) absorbs /transports, fats / fatty acids ; from small intestine / duodenum / ileum ; AVP ;	**3**	

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Question	Answer	Marks	Guidance
5(a)	caused by a mutation ; change in, DNA / base sequence ; of gene for haemoglobin ; (causes) a different sequence of amino acids ; (so) abnormal haemoglobin produced ; AVP ;	**3**	
5(b)	both parents carry the, recessive allele / allele for (sickle cell) anaemia ; both parents are heterozygous ; half the gametes of both parents have the recessive allele ; people / children, who are homozygous recessive have (sickle cell) anaemia ; there is a, 0.5 × 0.5 / 0.25, chance of, being homozygous recessive / having (sickle cell) anaemia ;	**4**	
5(c)(i)	(group of) organisms that can reproduce ; to produce fertile offspring ;	**2**	
5(c)(ii)	people with sickle cell anaemia / heterozygotes / carriers / are resistant to, malaria / AW ; people with (homozygous) sickle cell anaemia are, less likely to survive / die of sickle cell disease ; people who are heterozygous / have one copy of the sickle cell allele, are more likely to survive / have selective advantage ; *idea that* they are more likely to breed ; pass on allele for sickle cell ; so increase in frequency of sickle cell allele (in population) ; selective advantage for sickle cell only exists where, (mosquitoes carrying) malaria are present ; AVP ; ref. to evolution / adaptation to (local) conditions	**5**	

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Question	Answer	Marks	Guidance
6(a)(i)	stores / contains, DNA / chromosomes / genes ; controls the cell ; AVP ;	**1**	
6(a)(ii)	**P** – endoplasmic reticulum / (rough) ER / ribosome ; **R** – mitochondrion / mitochondria ;	**2**	
6(b)	catalysts ; starch ; maltose / glucose ; pepsin ; liver ; neutralises ; emulsification ;	**7**	

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