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**BIOLOGY**

**9700/22**

Paper 2 AS Level Structured Questions

**May/June 2017**

MARK SCHEME

Maximum Mark: 60

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**Published**

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**Mark scheme abbreviations**

<b>;</b>	separates marking points
<b>/</b>	alternative answers for the same point
<b>R</b>	reject
<b>A</b>	accept (for answers correctly cued by the question, or by extra guidance)
<b>AW</b>	alternative wording (where responses vary more than usual)
<b><u>underline</u></b>	actual word given must be used by candidate (grammatical variants accepted)
<b>max</b>	indicates the maximum number of marks that can be given
<b>ora</b>	or reverse argument
<b>mp</b>	marking point (with relevant number)
<b>ecf</b>	error carried forward
<b>I</b>	ignore
<b>AVP</b>	alternative valid point

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Question	Answer			Marks
1(a)	<i>one mark per blank box</i>			<b>5</b>
	type of cell	function of cell	example of organelle required to carry out function	
	palisade mesophyll	photosynthesis ; <b>A</b> (absorb light to) synthesise, organic compounds / glucose / starch (from inorganic compounds)	chloroplast	
	Leydig	synthesis of steroid hormones	smooth endoplasmic reticulum ; <b>A</b> SER / smooth ER	
	plasma cell ; <b>A</b> B-cell / white blood cell / leucocyte / (B-) lymphocyte / agranulocyte <b>R</b> T lymphocyte / granulocyte / phagocyte / macrophage / neutrophil	production of secretory vesicles containing antibody	Golgi body	
	root hair cell	active uptake of nitrates	mitochondrion ; <b>A</b> cell surface / plasma, membrane <b>A</b> cell membrane	
	pancreas acinar	synthesis of enzymes	rough endoplasmic reticulum ; <b>A</b> RER / rough ER <b>A</b> ribosomes <b>A</b> mitochondrion	

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Question	Answer	Marks
1(b)	<p><b>I</b> functions of individual tissues  <i>if all cell types named as single cell, allow max 1 for named tissue types</i></p> <p><i>(organ because more than one tissue type)</i>            three named tissue types ; ; ;</p> <p>endothelium      <b>A</b> squamous epithelium                                     <b>A</b> endothelial cells                                     <b>A</b> epithelial cells</p> <p>smooth muscle      <b>A</b> smooth muscle cells            connective tissue</p> <p>elastic tissue      <b>A</b> elastic fibres                                     <b>R</b> elastin / elastic muscle</p> <p>fibrous tissue <b>A</b> collagen <b>A</b> collagen fibres            nervous tissue      <b>A</b> nerve cells</p> <p>blood <b>A</b> blood cells  <i>only in context of vasa vasorum</i></p> <p><i>general function</i>            transports / carries / AW, <u>blood</u> ; <b>A</b> delivers <b>R</b> pumps blood <b>I</b> provides</p> <p>detail ; e.g. to tissues / to body cells / to body / away from heart / AW  <b>R</b> to lungs            (blood) is oxygenated / contains oxygen</p>	<b>max 4</b>
	<b>Total:</b>	<b>9</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)	addition of water shown ; <b>A</b> H <sub>2</sub> O fatty acid(s) <u>and</u> glycerol ;	<b>2</b>
2(b)	<p><i>positive result</i> emulsion ; <b>I</b> on top / throughout <b>A</b> milky (layer) / cloudy (suspension) / opaque / white droplets <b>R</b> precipitate</p> <p><i>ref. to mixing with / dissolving in / adding / adding to, alcohol / ethanol ; <b>R</b> if incorrect substance added to alcohol, e.g. fatty acids, then allow ecf</i></p> <p>then, add / add to, water ; <i>max 1 for method if heated or added additional chemicals max 1 if wrong sequence or all contents into one test tube at once no marks if both of above (wrong sequence and heated)</i></p> <p><i>accept other valid methods</i></p>	<b>3</b>

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Question	Answer	Marks
2(c)	<p><b>1</b> increase (pH2) to pH7, decrease from pH7 (to pH10.5) ;  <b>A</b> trend described as increase then decrease  <b>or</b>            optimum / peak / maximum activity / <u>99%</u> / <u>100%</u> (relative) activity, at pH7 ;</p> <p><b>2</b> steep(er) decrease from, pH7 / optimum, (to pH10.5) ; <i>in context of steepness of increase from pH2–7</i></p> <p><b>3</b> detail either side of optimum (pH2–7 <b>or</b> pH7–10.5) ;  <i>pH2–7</i>            less steep (increase) pH5–pH7 / little difference between pH5 and 6 / steepest increase between pH2–4  <b>or</b>  <i>pH 7–10.5</i>            steeper decrease between pH 7 and 7.5 / less steep decrease between pH 7.5 and 10.5</p> <p><b>4</b> activity, pH2–7 / below 7, higher than activity, after pH8 ;  <b>A</b> in, alkaline / basic, pH / conditions  <b>A</b> enzyme works better in acidic <u>and</u> neutral conditions <b>ora</b>  <b>A</b> enzyme works better in acidic than, alkaline / basic, conditions <b>ora</b></p> <p><b>5</b> enzyme active throughout the pH range ;</p> <p><b>6</b> data / manipulated data, (to support above mps) ;  <i>needs comparison values, pH and, percentage activity / %</i></p> <p><b>7</b> <i>ref. to <u>partial</u> denaturation at higher pH ;</i> <b>A</b> starts to denature</p>	<b>max 4</b>
2(d)(i)	<p><i>suggestion of changed conditions for immobilised compared to free e.g.</i></p> <p>(immobilised) support material / AW, affects enzyme action ;            support material is charged ;  <i>idea that free has greater exposure to hydrogen ions <b>or</b> immobilised has protection from hydrogen ions ;</i>  <i>idea that immobilised has changed ability to catalyse ;</i>            immobilised has (slightly) altered active site ; <b>R</b> <i>ref. to</i> denaturation  <b>I</b> changes to tertiary structure            support material causes change to, external / substrate, solution ;</p>	<b>max 1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(d)(ii)	can be re-used ; can be easily recovered ; easier downstream processing ; product, not / less, contaminated ; longer shelf life of enzyme ; more stable ; can use higher temperatures (owing to protective matrix) ; more productive ; less time-consuming ; <i>cost alone is not enough</i>	<b>max 1</b>
	<b>Total:</b>	<b>11</b>

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Question	Answer	Marks
3(a)	<i>(Plasmodium) falciparum / malariae / ovale / vivax ;</i>	<b>1</b>
3(b)	<i>Anopheles ;</i> <b>I</b> female / male <b>I</b> specific epithet e.g. <i>gambiae</i>	<b>1</b>
3(c)	<p><i>look for ora</i></p> <p><b>1</b> higher / better / AW, resolution / resolving power ;</p> <p><b>2</b> <math>\left\{ \begin{array}{l} 0.5 \text{ nm (A } 0.2\text{--}1 \text{ nm) compared to, } 200 \text{ nm } 0.2 \mu\text{m (A range } 100\text{--}300 \text{ nm)} \\ \text{or} \\ \text{electrons have shorter wavelength ;} \\ \text{R electron microscope has a shorter wavelength} \\ \text{or} \\ \textit{idea that cell structures too small to interfere with light waves ora} \end{array} \right\}</math></p> <p><b>3</b> better able to distinguish between two points ;           <b>A</b> as a definition if mp 1 achieved</p> <p><b>4</b> (can see) more detail ; <i>treat 'clearer' as neutral</i></p> <p><b>5</b> able to make thinner sections / able to see inside (oocyst) ;</p> <p><b>6</b> can continue to obtain higher magnifications and see more detail ;</p>	<b>max 2</b>
3(d)	<p>(magnification =) <math>\frac{\text{image / scale bar (length)}}{\text{actual / object (length)}}</math> ; <b>A</b> triangle / letters only</p> <p><i>(x) 500 ;; using 10 mm as measured length A calculated values for measured length of 9 mm or 11 mm</i></p> <p><i>allow one mark if correct answer given with units</i></p> <p><i>allow one mark if incorrect answer and</i></p> <p><i>correct measurement and correct working</i></p> <p><i>correct measurement and formula but incorrect conversion</i></p> <p><i>measurement <math>\pm 2</math> mm and correct working</i></p>	<b>3</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(e)	<p><u>vector</u> ;</p> <p><i>ref. to feeding / taking / AW, <u>blood</u> (from a person) ;</i>  <i>e.g. taking blood meals / Plasmodium enters blood during feeding</i></p> <p><i>infective cells / Plasmodium / pathogen / parasite / AW, enter (person) with, anticoagulant / saliva ;</i>  <b>I</b> <i>malaria / disease, enters</i>  <b>A</b> <i>idea that, infective cells / Plasmodium, in saliva / salivary glands</i></p> <p><i>AVP ; e.g. ref. to providing correct conditions for, part of Plasmodium life cycle / sexual reproduction in Plasmodium</i></p>	<b>max 2</b>
	<b>Total:</b>	<b>9</b>

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Question	Answer	Marks
4(a)(i)	<p><b>1</b> circle round <b>5</b> ; <i>to max 2 but 4 cells produced = max 1 out of 2</i></p> <p><b>I</b> details of telophase leading to cytokinesis</p> <p><b>2</b> { cell plate forms (across equator of cell) <b>or</b> cell wall / cellulose, laid down ; <b>A</b> cell wall forms (between the two)</p> <p><b>3</b> (so) <u>cytoplasm</u> divided (into two) ; <b>R</b> <u>cytoplasm</u> constricts / pinches in / cleavage furrow forms / cleavage forms (<i>i.e. referring to animal cell</i>)</p> <p><b>4</b> AVP ; detail of cell plate formation e.g. <i>ref. to vesicles transported to equator / involvement of cytoskeletal structures</i> <i>idea that organelles shared out</i></p>	<b>max 3</b>
4(a)(ii)	<p>circle round <b>S</b> ; synthesis of <u>two</u> identical DNA, molecules / double helices (from one) ; each new molecule consists of one, original / parental, strand, and one, new / newly synthesised, strand ; AW <b>A</b> daughter <i>for newly synthesised</i></p>	<b>3</b>

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Question	Answer	Marks
4(b)	<p><i>role</i></p> <p><b>1</b> form cells that can, differentiate / become specialised ;  <b>A</b> can develop into other cell types / totipotent  <b>A</b> named examples</p> <p><b>2</b> for, cell replacement / tissue repair / growth ; <b>R</b> for cell growth  <b>I</b> found in growing region</p> <p><b>3</b> divides to give continuous supply of, meristematic / stem, cells ;  <b>A</b> divides to forms more, meristematic / stem, cells</p> <p><i>feature</i></p> <p><b>4</b> (stem cells are) undifferentiated ; <b>A</b> not specialised / unspecialised</p> <p><b>5</b> able to divide ; <i>must be in context of mitosis</i>  <b>A</b> able to undergo mitosis <b>A</b> can replicate <b>I</b> reproduce  <b>R</b> uncontrolled division</p> <p><b>6</b> <i>idea that genes not switched off ; ora</i></p>	<b>max 3</b>
4(c)(i)	<p>growing / storage, area / region / correct named part of plant ;  <i>examples of part of plant that stores / growing</i>  root / shoot tip / bud / flower / maturing leaf / tuber / fruit / seed</p> <p><b>I</b> where sucrose, used / used up <b>I</b> nutrients unqualified  receives, assimilates / sucrose / AW ; <b>A</b> area where sucrose unloaded  <i>in context of, via phloem / from source / from leaf</i></p>	<b>max 1</b>
4(c)(ii)	<p><i>strong</i>  high requirement for assimilates ;  fast growing / highly active ; AW e.g. requires a lot of energy</p>	<b>max 1</b>



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Question	Answer	Marks
5(a)(i)	trachea / windpipe + bronchus / bronchi + bronchiole / bronchioles ; <i>treat as neutral type of bronchiole</i>	1
5(a)(ii)	goblet ;	1
5(b)	<p><i>D = accept points from diagram</i></p> <p><b>1D</b> recognition / AW / binding / attachment, (of macrophage) to, bacterium / <i>S. pneumoniae</i> / (bacterial) antigen ;  <b>A</b> detects / identifies  <i>(D) must label, bacteria / S. pneumoniae, or macrophage and show bacterium attached</i></p> <p><b>2</b> <u>endocytosis</u> / <u>phagocytosis</u> ;</p> <p><b>3D</b> described ; e.g. engulfing / enveloping / pseudopodia surround  phagocytic / endocytotic, vacuole formed <b>A</b> phagosome <b>A</b> vesicle</p> <p><b>4D</b> fusion of lysosome(s) (to vacuole) ; <i>(D) must label lysosome</i></p> <p><b>5D</b> breakdown / destruction / digestion / AW, of bacterium / <i>S. pneumoniae</i> ;  <b>A</b> kills <i>(D) annotated on diagram</i></p> <p><b>6D</b> ref. to, <u>hydrolytic</u> / <u>digestive</u>, <u>enzymes</u> ; <b>A</b> named digestive enzymes  <i>must be in context of lysosome (D) labelled as such</i></p>	<b>max 3</b>
5(c)	<p>elastin broken down / elastic fibres damaged ;  <b>A</b> elastic fibres broken down  <b>A</b> less, elastin / elastic fibres</p> <p><i>detail e.g.</i>  (alveolar) wall becomes overstretched / AW  weakened (alveolar) wall / AW e.g. cannot withstand higher pressure  bursts on inhalation  (bronchioles collapse) on exhalation, trapped / remaining, air bursts alveoli</p> <p>} ;</p>	<b>2</b>

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Question	Answer	Marks
5(d)	<p><i>accept (the) glycoprotein for GM-CSF throughout</i></p> <p><b>1</b> (excess surfactant) stimulates immune system cells ;</p> <p><b>2</b> release / secretion, of, GM-CSF ; <b>I</b> produce</p> <p><b>3</b> GM-CSF is a <u>signal</u> <b>or</b> GM-CSF is a signalling, molecule / protein / glycoprotein ; <b>A</b> messaging molecule</p> <p><b>4</b> binds to / combines with / AW, (cell surface membrane) receptors (on alveolar macrophages) ;</p> <p><b>5</b> <i>ref. to specificity ;</i> <b>A</b> described as GM-CSF receptor complementary shape for GM-CSF</p> <p><b>6</b> leads to / sets off / triggers / AW, response (in the cell) / removal of surfactant ; <i>in context of macrophage</i> <b>A</b> stimulates</p> <p><b>7</b> detail ; e.g. triggers secondary messenger activates enzymes / enzyme cascade signal transduction phosphorylation events</p>	<b>max 4</b>
	<b>Total:</b>	<b>11</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(a)	<i>row 1</i> globular + globular ; <i>row 2</i> 2, alpha / $\alpha$ , globin, and 2, beta / $\beta$ , globin (chains) ; <b>A</b> 2 alpha and 2 beta chains <i>row 3</i> disulfide (bridges / bonds) ; covalent is neutral	<b>3</b>
6(b)	<i>mRNA strand produced</i> UGU ; <i>tRNA anticodon sequence</i> UGU ;	<b>2</b>
	<b>Total:</b>	<b>5</b>