Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **May/June 2017**

MARK SCHEME

Maximum Mark: 60

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 will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

® IGCSE is a registered trademark.

© UCLES 2017

Mark scheme abbreviations

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

© UCLES 2017

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

© UCLES 2017

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

Question	Answer	Marks
2(a)	addition of water shown **;** **A** H_2O fatty acid(s) and glycerol **;**	**2**
2(b)	*positive result* emulsion **;** **I** on top / throughout **A** milky (layer) / cloudy (suspension) / opaque / white droplets **R** precipitate *ref. to* mixing with / dissolving in / adding / adding to, alcohol / ethanol **;** **R** *if incorrect substance added to alcohol, e.g. fatty acids, then allow ecf* then, add / add to, water **;** *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)* *accept other valid methods*	**3**

© UCLES 2017

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

Question	Answer	Marks
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 **;** *cost alone is not enough*	**max 1**
	Total:	**11**

© UCLES 2017

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

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

Question	Answer	Marks
4(a)(i)	**1** circle round **5 ;** *to max 2 but 4 cells produced = max 1 out of 2* **I** details of telophase leading to cytokinesis **2** { cell plate forms (across equator of cell) **or** cell wall / cellulose, laid down **;** **A** cell wall forms (between the two) } **3** (so) <u>cytoplasm</u> divided (into two) **;** **R** <u>cytoplasm</u> constricts / pinches in / cleavage furrow forms / cleavage forms *(i.e. referring to animal cell)* **4** AVP **;** detail of cell plate formation e.g. *ref. to* vesicles transported to equator / involvement of cytoskeletal structures *idea that* organelles shared out	**max 3**
4(a)(ii)	circle round **S ;** 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 **A** daughter *for newly synthesised*	**3**

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

© UCLES 2017

Question	Answer	Marks
4(d)	*accept H^+ / protons, throughout for hydrogen ions* **1** active process / uses ATP / requires energy **;** **2** hydrogen ions, pumped / active transport / move(d), out of companion cells **;** *this also gets mp1 if stated as, pumped / active transport / move by proton pump* **3** into cell wall / apoplast **;** **A** intercellular space **R** pumped into phloem sieve tube **4** hydrogen ion gradient builds up **;** **5** hydrogen ions re-enter companion cell, down gradient / AW **;** **A** facilitated diffusion **6** via, cotransport protein(s) / cotransporter(s) **; A** carrier protein(s) '*hydrogen ions diffuse back into companion cell through cotransport protein' is two marks* **7** <u>cotransport</u> sucrose (molecules) **; A** secondary active transport **A** idea of bringing sucrose into companion cell if cotransport / er stated for previous mp **R** cotransport if into phloem sieve tube from companion cell **8** transport of sucrose against gradient **;** **9** diffusion of sucrose into phloem sieve tube (element) **; R** facilitated diffusion **A** moves from high to low concentration **10** via plasmodesmata **;**	**max 4**
	Total:	**15**

© UCLES 2017

Question	Answer	Marks
5(a)(i)	trachea / windpipe + bronchus / bronchi + bronchiole / bronchioles **;** *treat as neutral type of bronchiole*	**1**
5(a)(ii)	goblet **;**	**1**
5(b)	*D = accept points from diagram* **1D** recognition / AW / binding / attachment, (of macrophage) to, bacterium / *S. pneumoniae* / (bacterial) antigen **;** **A** detects / identifies *(D) must label, bacteria / S. pneumoniae, or macrophage and show bacterium attached* **2** endocytosis / phagocytosis **;** **3D** described **;** e.g. engulfing / enveloping / pseudopodia surround phagocytic / endocytotic, vacuole formed **A** phagosome **A** vesicle **4D** fusion of lysosome(s) (to vacuole) **;** *(D) must label lysosome* **5D** breakdown / destruction / digestion / AW, of bacterium / *S. pneumoniae* **;** **A** kills *(D) annotated on diagram* **6D** *ref. to*, hydrolytic / digestive, enzymes **; A** named digestive enzymes *must be in context of lysosome (D) labelled as such*	**max 3**
5(c)	elastin broken down / elastic fibres damaged **;** **A** elastic fibres broken down **A** less, elastin / elastic fibres *detail e.g.* (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	**2**

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

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

© UCLES 2017