Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **October/November 2018**

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 International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

PUBLISHED

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.

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.

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

Question	Answer	Marks
1(a)	**A** trachea **;** **A** windpipe **I** *ref.* to cartilage rings **B** bronchiole **;** **I** respiratory / terminal , before bronchiole **C** alveoli **;** **A** alveolus / air sac / alveolar sac	**3**
1(b)	*any one from* lung cancer **;** emphysema **;** chronic bronchitis **;** COPD **;** cystic fibrosis **;** AVP **;** e.g. asthma *must be non-infectious*	**1**
1(c)	*Plasmodium, falciparum* / *vivax* / *ovale* / *malariae* **;**	**1**
1(d)	*any three from* *pathogen* (because) four / several, different, causative species / AW, (with different antigens) **;** (pathogen has) many antigens as it is eukaryotic / many genes coding for antigens **;** *ref.* to mutation changing antigens **;** pathogen has different stages of life cycle (within human) with different antigens **;** **I** *ref.* to antigenic shift antigenic concealment / pathogen spends part of life cycle within host cells / AW **;** **A** short time in blood plasma *vaccine* *ref.* to more than one type of vaccine needed **;** suggestion that antigens used have not given the strongest immune response **;** *vaccination programme* *ref.* to only trial programmes **;** **A** programmes not global *ref.* to not achieving herd immunity / not enough people (successfully) vaccinated **;** detail **;** e.g. lack of willingness to be vaccinated lack of trained people to give vaccines poor nutrition and poor immune response	**3**

Question	Answer	Marks
1(e)	*allow* *mosquitoes* / *vectors, for Anopheles* *pathogen* / *parasite, for Plasmodium* *any four from (max 1 for list of factors without explanation)* *assume in context of comparison with area **Q*** *ref.* to a suitable climate for *Anopheles,* e.g. tropical / subtropical / hot and humid **;** presence of *Anopheles* species which carry *Plasmodium* **;** *ref. Anopheles* breeding sites present / (many) water sources (suitable for breeding) **;** difficulty in controlling / lack of control, of *Anopheles* breeding sites **;** AW, e.g. stagnant water not drained lack of / cannot afford, spraying with, insecticide / pesticide ***/*** repellents **;** insecticide-resistant forms of *Anopheles* exist **;** lack of / insufficient use of, mosquito nets **;** mosquito nets not impregnated with insecticide **;** lack of, artemisinin drugs / drugs to treat disease **;** drug-resistant forms of *Plasmodium* exist **;** idea of *Plasmodium* requiring temperatures of approximately 20 °C (in vector) **;** **A** area **P** has temperature / conditions for survival of *Plasmodium* *ref.* to difficulties in diagnosing disease (so delay / no treatment) **;** e.g. lack of diagnostic tests lack of trained personnel AVP **;;** e.g. some countries in area **Q** have *Anopheles* but control is good, *ref.* to feature of *Anopheles* species present in area **P** feed at all times during the day feed only on humans good host for reproduction of *Plasmodium* poor education so people don't know how to protect themselves from malaria	**4**

Question	Answer	Marks
2(a)	glycosidic **;** **I** any qualification of glycosidic, e.g. β,1–4	**1**
2(b)(i)	hydrolysis **;**	**1**
2(b)(ii)	*any two from* (lactose) lowers the water potential (in the lumen of the intestine) / AW **;** reduces the water potential gradient (between the intestine and the blood) **;** osmosis occurs ; (must be in the correct context)	**2**
2(c)(i)	*any two from* pack more beads into the column **;** slows the passage of milk through the column **;** more time for enzyme to be exposed to substrate **;** (small beads have a) larger surface area to volume ratio **;** rate of reaction will be faster **/** AW **;** **A** faster reactions will take less time to collect results (at each temperature) **;** fast(er), rate of diffusion of, substrate / product **;**	**2**
2(c)(ii)	*any three from* both have same activity between 0 and 20 °C **;** **A** described with values from **Fig. 2.2** between 20 °C and 40 °C, the activity of **F** increases more steeply than **I** **;** **F**, has a lower optimum temperature / peaks at a lower temperature / AW, than **I** **;** **A** optimum temperature, **F** is 40 °C v **I** is 50 °C at 70 °C, no activity for **F** but there is activity for **I** **;** **A** 4% for **I** and 0% for **F** **A** denatured for 0% above the optimum temperature **I** has a steeper decrease of activity **;** **I** is active over a greater range of temperatures (than F) **;**	**3**

Question	Answer	Marks
3(a)(i)	*any three from* (polymer / polysaccharide of) β-glucose **;** glycosidic, bonds / linkages **;** **A** glucosidic (β) 1–4 (glycosidic) bonds **;** **R** if 1–6 also given *ref.* to (β) glucose units, linked at 180° to each other / alternately orientated / AW **;** unbranched (polymer) / straight chain / linear **;** able to form hydrogen bonds with parallel chains / AW **;**	**3**
3(a)(ii)	chloroplast / granum / thylakoid / middle lamella / large vacuole / nucleus at edge of cell **;**	**1**
3(a)(iii)	provide energy (for the cell) **;** **R** produce energy any two examples **;;** e.g. biosynthesis **A** named example active transport / proton pumping movement / described, e.g. movement of, vesicles / chromosomes endocytosis / exocytosis	**3**
3(b)	*any two from* water molecules are dipoles **;** **A** polar (each water molecule has) σ+ hydrogen (atoms) and a σ– oxygen (atom) **;** the positively charged hydrogen (atom) of one water molecule is attracted to the negatively charged oxygen (atom) of another water molecule **;** weak attraction between water molecules **;**	**2**
3(c)	*any two from* water molecules are polar **;** ions are charged **;** *ref.* attraction between water molecules and ions **;** AVP **;** e.g. oxygen σ– faces positive ion	**2**

Question	Answer	Marks
4(a)	correct formula **;** (×) 1200 **;** **A** 1171 (41 000 ÷ 35) 1229 **or** 1228.6 (43 000 ÷ 35) *max 1 if units given*	**2**
4(b)(i)	*any two from* DNA , replication / AW **;** **A** S phase **I** chromosome replication (early interphase) chromosome becomes two chromatids **;** **A** described DNA checked for errors / errors in DNA repaired **;** synthesis of, (growth) protein / enzymes (for growth) **;** cell growth **;** organelle synthesis **;** centrioles replicate **;** AVP **;** e.g. *ref.* to checkpoint(s) nucleotide synthesis	**2**
4(b)(ii)	*any two from* *ref.* target cells are endothelial cells **;** VEGF / cell signalling molecule, binds / AW, to receptor **;** **R** receptor cells *ref.* specificity (of receptors) / VEGF / cell signalling molecule, complementary to receptors **;** suggestion of detail following binding **;** e.g. triggers secondary messenger activates enzymes / enzyme cascade signal transduction phosphorylation events	**2**

Question	Answer	Marks
4(c)	*any four from* VEGF protein / antigen, injected into, mouse / small mammal **;** time for immune response to occur **;** **A** description of event in immune response plasma cells / B-lymphocytes / splenocytes, extracted from mouse **;** plasma cells / AW, fused with, myeloma / cancer, cells **;** (to produce) hybridoma cells **;** clone hydridoma cells **;** separate cells and culture in individual wells **;** screen for cells secreting desired antibody **;** hybridoma cells grown in large scale culture / AW **;** AVP **;** e.g. *ref.* to fusogen	**4**
4(d)	*any one from* monoclonal antibodies identified, as foreign / non-self / act as an antigen **;** (monoclonal antibodies) stimulate an, immune / allergic, response **;** AVP **;** e.g. (antibodies destroyed so) not enough antibody (to be effective)	**1**

Question	Answer	Marks
5(a)	*any two from* cell wall made from, peptidoglycan / murein **;** **A** not cellulose DNA free in the cytoplasm **;** **or** circular / closed loop, of DNA **;** **or** naked DNA / no histones **;** 70s ribosomes **;** AVP **;** e.g. no membrane around flagellum **or** flagellum is <u>not</u> 9+2 (microtubule pattern) **;**	**2**
5(b)	*any two from* transport of sucrose / assimilates / products of photosynthesis (in phloem), is prevented / AW **;** *ref.* starch synthesised in root from transported assimilates / AW **;** starch not converted in leaf to sugars / sucrose, (for transport) **;** idea that pathogen and phloem present in, all organs / many organs / leaves / roots **;** AVP **;** e.g. reason(s) why it cannot be xylem	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(c)</td><td>
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<tr><th>feature</th><th>DNA nucleotide with adenine</th><th>RNA nucleotide with adenine</th><th>ATP</th></tr>
<tr><td>contains nitrogen (yes or no)</td><td>yes</td><td>yes</td><td>yes ;</td></tr>
<tr><td>contains a pyrimidine base (yes or no)</td><td>no</td><td>no</td><td>no ;</td></tr>
<tr><td>number of phosphate groups</td><td>1</td><td>1</td><td>3 ;</td></tr>
<tr><td>name of the sugar component</td><td>deoxyribose ;</td><td>ribose</td><td>ribose ;</td></tr>
</table>
</td><td>5</td></tr>
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Question	Answer	Marks
6(a)(i)	*any three from* haem group containing iron (atom) **;** four haem groups (per molecule of haemoglobin) **;** each iron (atom) / haem / prosthetic group, binds one oxygen molecule **;** **or** four oxygen molecule per haemoglobin molecule **;** cooperative binding / allosteric effect described **;** AVP **;**	**3**
6(a)(ii)	*any two from* *ref.* folding of polypeptide chain(s) / globin(s) fold (to give globular structure) **;** **A** *ref.* to, tertiary structure / quaternary structure (so) hydrophilic R groups (of amino acids) are on the outside of the molecule / hydrophobic R groups (of amino acids) on the inside of the molecule **;** **A** hydrophilic and hydrophobic amino acids hydrogen bonds form with water (molecules) **;**	**2**
6(b)(i)	llama = 90.5% human = 78.5% **;**	**1**
6(b)(ii)	*any two from* lower partial pressure of oxygen at high altitude **;** at the same partial pressure the percentage saturation is (much) higher than for humans **;** *ref.* to haemoglobin has a higher affinity for oxygen **;** *idea that* sufficient oxygen delivered to tissues to satisfy demand **;**	**2**