Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/22**

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.

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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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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

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Question	Answer	Marks
1(a)	bronchiole **;** **I** respiratory / terminal, before bronchiole	**1**
1(b)	(actual diameter) = image / observed, length, ÷ magnification **;** **A** (A =) I ÷ M **or** magnification triangle 300 µm **;** (12 000 / 40) **A** 275 µm (11 000 / 40) **A** 288 µm (11 500 / 40) **A** 313 µm (12 500 / 40) **A** 325 µm (13 000 / 40)	**2**

Question	Answer	Marks
1(c)	*any four from* *in healthy lungs* **1** correct direction of movement of <u>both</u> respiratory gases **;** e.g. oxygen from alveolus towards blood and carbon dioxide from blood to alveolus **;** oxygen enters the blood system and carbon dioxide leaves **A** red blood cell / haemoglobin, *as ref. to blood* **2** diffusion (of, oxygen / carbon dioxide) **or** movement, down a concentration gradient / from high(er) to low(er) concentration **;** **A** implied e.g. oxygen enters blood from a high<u>er</u> concentration **I** diffusion of gases **3** detail of pathway **; R** *ref. to* cell walls e.g. across, alveolar wall / squamous (epithelial) cells across endothelium / capillary wall **;** **A** squamous cells *in context of capillary* crosses two layers of cells (*alveolar wall and capillary wall)* *comparison healthy with diseased – look for ora* **4** higher rate of exchange / increased rate of diffusion **/** steeper concentration gradient **;** **A** more oxygen to blood per unit time / more carbon dioxide to alveolus per unit time **I** more efficient gas exchange **I** better gas exchange / faster diffusion **5, 6** AVP **; ;** e.g. larger surface area (for, gas exchange / diffusion) shorter diffusion distance *ref. to* (greater) ability to, stretch / recoil (for ventilation to maintain gradient) **or** *ref. to* elasticity *(more v fewer elastic fibres is not sufficient)*	**4**

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Question	Answer	Marks
2(a)	xerophyte / xerophytic **;** **R** succulent / cactus / named	**1**
2(b)(i)	phloem **;** **A** sieve tube(s) **R** phloem sieve / phloem tube **A** sieve tube elements **R** phloem companion cell	**1**
2(b)(ii)	*any two from* **1** for, transport / translocation, } *accept assimilates / products of metabolism, if in context of cardiac glycosides* **or** movement / AW, from source to sink **;** **I** *ref. to* transport of, amino acids / sucrose **2** *ref. to* source, is place of synthesis / AW **or** sink is / movement to, area where not manufactured / storage area / area where they are required **;** **3** as defence mechanism (e.g. against sap feeders) **;**	**2**
2(c)(i)	using / AW, water / H_2O **;** to break bond (between phosphate groups) **;** **R** if bond incorrectly named	**2**
2(c)(ii)	active transport **;**	**1**

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Question	Answer	Marks
2(c)(iii)	*any four from* **1** (reversibly) binds / attaches / AW, to, allosteric site / site other than active site **;** **2** (which) changes, shape / tertiary structure / 3-D structure, of <u>active site</u> **;** **A** active site distorted **I** protein structure **3** substrate / ATP, cannot, enter / bind / fit / AW, to active site **;** **A** active site no longer complementary to substrate **A** enzyme substrate / ES, <u>complexes</u> cannot form **A** ES<u>C</u>s cannot form **I** ATP / substrate, cannot bind to enzyme *without a link to <u>active site</u>* **4** no / less, hydrolysis of ATP **A** breakdown **or** no / less, energy released **;** **I** no energy, synthesised / created / produced **5** Na^+ not moved, out <u>and</u> K^+ not moved in **;** **I** active transport, stops / decreases	**4**

Question	Answer	Marks
2(d)(i)	*allow* *systole for contraction and diastole for relaxation* *bicuspid valve or mitral valve for (left) atrioventricular* *aortic valve for semi-lunar valves* *any four from (max 3 if whole response based on right side of heart)* *before atrial contraction / during relaxation of the left atrium and left ventricle* **1** atrioventricular valve, opens / is open **A** *following atrial contraction* **or** blood trickling into ventricle / some blood enters ventricle **;** **2** atrial contraction, blood flow to ventricles / ventricles fill (with blood) **or** atrial contraction then ventricular contraction **;** *ventricular contraction* **3** biscuspid valve closes <u>and</u> semi-lunar valve opens **;** **R** *if occurs before ventricular contraction* **4** blood flows into aorta **;** **R** if states 'from atrium' or 'then to lungs' **R** *if occurs before ventricular contraction* **5** *ref. to* atrium in relaxation during ventricular contraction **;** *pressure changes* **6** contraction of, atrium / ventricle, increases pressure (of that chamber) **or** *ref. to* (blood) pressure differences to cause opening or closing of valves **;** e.g. pressure in atrium greater than in ventricle so atrioventricular valve opens pressure in ventricle greater than aorta so semilunar valves open pressure in ventricle greater than atrium so bicuspid valve closes	**4**

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Question	Answer	Marks
2(d)(ii)	**I** *ref. to* fibrillation / cardiac cycle rhythm *any three from* **1** more powerful contraction of (cardiac) muscle / increased ability for (cardiac) muscle (**A** cardiac cells) to contract **;** **A** stronger contraction / contract strongly / increased contractility **I** contracts more / increased contraction **2** blood (pumped) at higher pressure **; I** blood at high pressure **3** more force to overcome resistance (in blood vessels) **;** **4** more blood reaches lungs to obtain oxygen (per unit time) / more oxygen reaches (rest of) body / tissues (per unit time) (in blood) **;** *allow idea of efficient delivery of oxygen* **A** more oxygenated blood can be delivered to heart, muscle / tissue AW **5** less fatigue / increased energy / increased mobility / AW **;**	**3**

Question	Answer	Marks
3(a)	*any two from* **1** (division that) produces, new / daughter, cells **A** produces more cells **or** (so) replaces, damaged / lost / dead, cells **;** **2** new / daughter, cells, genetically identical **;** **A** *ref. to* clone if correct context **A** genetic information not lost **I** same number of chromosomes **3** (all) new cells can retain function **;** AW	**2**
3(b)	*any two from* **1** cell cycle continuous / continually divide / AW **;** **2** (produce cells that) can, differentiate / specialise / described **;** **A** multipotent / pluripotent **I** totipotent *divide to produce a cell that can divide and a cell that differentiates = 2 marks* **3** can produce, cells / tissue, that can still function (as before) **;**	**2**

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Question	Answer	Marks
3(c)	*any three from* **1** chemicals (released) are cell signalling, molecules / compounds **;** **2** liver cells, are target cells **;** **A** liver tissue for liver cells **3** binding of, chemicals / cell signalling molecules, to receptors (of liver cells) **;** **R** receptor cells **4** *ref. to* specificity (of receptors) / chemicals complementary to receptors **;** *if **R** above, then allow ecf for idea of complementary* **5** (specific) response is, cell enters the cell cycle / mitosis / cell division **;** **A** DNA replication **6** AVP **;** e.g. *idea of* communication between cells suggestion of detail following binding, e.g. second messenger activated / enzyme cascade /signal transduction / phosphorylation events / enzyme activation **I** cascade of reactions	**3**

Question	Answer	Marks
4(a)	*any three from* protein coat / capsid **;** **I** protein layer nucleic acid **;** DNA or RNA **;** **R** in nucleus **I** in cytoplasm **I** *ref. to*, double / single, strand acellular / not made of cells **;** **I** absence of named cell structures AVP **;** e.g. *ref. to* capsomeres size 15 nm to 1000 nm *accept any in range* (some) are enveloped / have phospholipid bilayer **I** with glycoproteins	**3**
4(b)(i)	one value in the range 64% – 68% **;** *((940 000 – 980 000) ÷ (1 440 000 – 1 480 000)) × 100*	**1**
4(b)(ii)	*allow women for pregnant women and therapy / treatment, for ART* *any three from* **1** (slight) decrease in (total) number of women living with HIV and (overall) increase in number of women living with HIV receiving ART **;** **2** slight decrease / plateau / AW, between 2009 to 2010, in number of women living with HIV receiving, ART / therapy **;** **3** proportion / percentage cover(age), of women receiving ART increases (in time period) **;** **A** calculated values (approx. 13% to 66%) **A** number of women receiving ART increases more steeply than decrease in number of women living with HIV **4** data to support mp1 or 2 **;** *mp1 two years and, two values / manipulated data, for either curve* *mp2 two values, 2009 compared to 2010* ***or*** *manipulated data* *allow ± 20 000 for extracted values*	**3**

Question	Answer	Marks
4(b)(iii)	*in context of pregnant and breastfeeding women who are living with HIV* *any three from* **1** *ref. to* mother to child transmission **;** *in context of HIV transmission* **A** (because) HIV can be passed from mother to baby **A** decreases HIV transmission during, pregnancy / labour / birth / breastfeeding **A** reduces, number / proportion, of babies born with HIV (so fewer die) **I** stops transmission *(as this is in context of global transmission this implies in all cases)* **I** makes babies immune to HIV / AW or gives passive immunity *allow idea that ART may be passed across, placenta / breastmilk, to baby and so provide(short-term) protection against any HIV transmitted from mother* **2** reduces number of, HIV positive women becoming ill (with HIV/AIDS) /women with HIV/AIDS dying from the disease **;** **A** opportunistic infections / named examples e.g. TB **3** example of reduces spread of HIV **;** *in any correct context other than HIV mother to child* e.g. child may grow up without HIV and will not pass on mother less likely to pass on to partner **4, 5** examples of, social / economic, effect **;;** e.g. (healthy women) can contribute to work force can be main carer if partner has died (*idea that* children not orphaned) overall financial savings e.g. if infants are not born with HIV then no lifelong ART required ART may be less costly than treating HIV/AIDS makes breastfeeding safer when no other options exist to feed babies HIV negative children will become next workforce generation all women throughout world receive same treatment	**3**
4(c)(i)	(HIV) antigen / p24 **; A** capsid protein / capsomere(s) / protein coat **R** HIV	**1**
4(c)(ii)	(time needed) so, <u>immune response</u> / clonal expansion / production of B-lymphocytes / production of plasma cells, can occur **;** **A** B-cells / splenocytes **R** plasma cells need to multiply **I** *ref. to* antibody production	**1**

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Question	Answer	Marks
4(c)(iii)	*any one from* immortal / long-lived **;** able to replicate / capable of cell division **;** uncontrolled cell division, can grow / survive, in cell culture **;** cannot grow on, HAT / hypoxanthine-aminopterin-thymidine / step **4**, (culture) medium **;** **A** do not have gene coding for ability to grow on HAT	**1**
4(c)(iv)	hybridoma **;**	**1**
4(c)(v)	*any one from* (check cells for) production / AW, (by hybridoma cells) of, anti-HIVp24 antibody / antibody against p24 **;** **A** the antibody / monoclonal antibody **A** check cells, contain / have / AW, desired antibody / AW *idea that* only want cells that produce desired antibody / do not want cells that produce different antibodies / need to remove cells that don't produce the antibody **;** waste of, money / resources, to culture other cells **/** if no antibody produced **;**	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>polymer – context of a chain / strand
(similar) repeating, smaller molecules / subunits
or
repeating / many, monomers / (RNA) nucleotides ; R branching
A idea of nucleotides joined together to form a chain
A made of nucleotides to form <u>poly</u>nucleotide
‘made of nucleotides’ ‘made of monomers’ not enough

macromolecule (in context of RNA)
large (biological) molecules / 1000 or more atoms / high molecular mass ;
A giant / huge, structure I long</td><td>2</td></tr>
<tr><td>5(b)</td><td>add Benedict’s (solution / reagent) and, boil / heat to 95 °C ;
A temperature 80 °C and above
precipitate / (change from clear blue to) green / yellow / orange / red / brown ;
R if a wrong colour included e.g. black / purple</td><td>2</td></tr>
<tr><td>5(c)</td><td><table><tr><th>feature</th><th>DNA nucleotide</th><th>RNA nucleotide</th></tr><tr><td>sugar component</td><td>deoxyribose</td><td>ribose ;</td></tr><tr><td>purine bases</td><td>adenine / A
guanine / G</td><td>adenine / A
guanine / G } ;</td></tr><tr><td>pyrimidine bases</td><td>cytosine / C
thymine / T</td><td>cytosine / C
uracil / U } ;</td></tr></table>R thiamine for thymine</td><td>3</td></tr>
</table>

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Question	Answer	Marks
6(a)	*rough endoplasmic reticulum* protein / polypeptide / named protein, synthesis / transport / modification **;** **A** post-translational modification / examples *named protein e.g. haemoglobin, carbonic anhydrase, membrane proteins* *Golgi body* modification / processing, of, proteins / lipids **A** post-translational modification / examples / makes proteins functional **or** packaging (molecules) into vesicles **or** formation of, Golgi / secretory, vesicles **or** forms (primary) lysosomes **;** *centrioles* formation of, spindle fibres / spindle **or** microtubule organisation **;**	**3**
6(b)	**A** iron / Fe **;** **I** oxidation status of Fe **A** iron atom / iron ion **R** iron molecule **B** carbaminohaemoglobin **;** **C** haemoglobinic acid **;**	**3**