Cambridge International AS & A Level

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BIOLOGY **9700/22**

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

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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)	one mark for each label to correct structure on Fig. 1.1 **;** **;** **;** *tonoplast line to anywhere on the vacuolar membrane* **R** if two or more different structures stated for a single label	**3**
1(b)	ref. to conversion of measured (**X**-**Y**) line to μm / AW **;** e.g. line is measured in, mm and then multiplied by 1000 / cm and then multiplied by 10 000 evidence that, 60 (±1 mm) is multiplied by 1000 / 6 cm is multiplied by 10 000 measured diameter is 60 000 μm (and) divide by, magnification / 2000 **;**	**2**
1(c)	*two from:* rough endoplasmic reticulum **;** **A** rough ER / RER smooth endoplasmic reticulum **;** **A** smooth ER / SER endoplasmic reticulum **;** *acceptable only if the other structure is <u>not</u> SER / RER* 80S / larger, ribosomes **;** **A** 25–30 nm range plasmodesma(ta) **;** microtubules **;** **A** microfilaments **A** cytoskeleton lysosome(s) **;** Golgi (body / apparatus / complex) **;** secretory / Golgi, vesicles **;** AVP **;** **;** e.g. chromatin EM detail of chloroplast EM detail of mitochondrion **A** mitochondrion nuclear pore nuclear envelope **R** nuclear membrane	**2**

Question	Answer	Marks
1(d)(i)	*two from:* cell wall, pathway / route / AW **;** **A** involves only cell walls **R** if only in roots movement / AW, through intercellular spaces / spaces between cells **;** further detail **;** e.g. water does not, enter cells / cross membranes / cross cytoplasm / move through plasmodesmata osmosis does not occur membranes not involved **R** osmosis once only	**2**
1(d)(ii)	*four from:* hydrogen bonding (between water molecules) **;** water molecules are polar **;** *movement to spongy mesophyll cells* adhesion / attraction, to, cellulose / cellulose fibres / cell walls **;** *this is in context of leaf cells but also allow for xylem* **R** cell walls of lignin **A** hydrophilic parts of lignin cohesion between water molecules / (water molecules are) cohesive **;** *idea that* movement of water (molecules) towards, spongy / mesophyll, cells, pulls / AW, other water molecules **;** **A** transpiration pull / continuous column / unbroken column **I** continuous stream *movement to intercellular air spaces* water molecules absorb heat (energy) **;** bonds break between water molecules **;** evaporation / water to water vapour **;** **I** latent heat of vapourisation from spongy cell, walls / surfaces **;**	**4**

Question	Answer	Marks
1(d)(iii)	*two from:* transpiration occurs **;** *in context of via stomata or via cuticle* diffuses / moves / AW, to, (external) environment / atmosphere / outside / out of the leaf / from leaf surface **;** **R** evaporation / osmosis **R** from cell surface via (open) stomata (for, gas exchange / carbon dioxide entry / photosynthesis) **;** *accept* Ψ *for water potential* **I** solute potential / ref. to concentration (movement of water vapour) down water potential gradient **;** **A** down water vapour potential gradient **A** high to low water potential / to lower water potential / from higher water potential **R** from high to low water potential <u>gradient</u>	**2**

Question	Answer	Marks
2(a)(i)	A = adenine T = thymine **R** thiamine / thyamine G = guanine C = cytosine *all correct = 2 marks* *one, two or three correct = 1 mark*	**2**

Question	Answer	Marks
2(a)(ii)	*three from:* 1 complementary base pairing / complementary bases / base pairing / base pairs / complementary pairing ; 2 A with T and G with C ; 3 hydrogen bonding / hydrogen bonds ; *in context of between base pairs / holding strands together* 4 ref. to purines with pyrimidines ; 5 double ring (bases) with single ring (bases) ; **A** *idea of* longer base with shorter base 6 two (DNA), strands / polynucleotides ; **A** two chains **A** double helix (as double implies two strands) **7** strands (anti)parallel / distance between strands always the same ;	**3**
2(b)	deoxyribose ; **A** 2-deoxyribose / 2-deoxy-D-ribose	**1**
2(c)	*two from:* (information could be) sequence of amino acids ; **A** idea that a polypeptide/protein has amino acids arranged in an order / AW **I** primary structure / chains of amino acids (different) proteins have, different / specific, sequences (of amino acids) ; (up to) 20 different amino acids in proteins ; **A** approximately 20 *idea that* there is a great variety in protein structure ; **I** have many functions	**2**

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Question	Answer	Marks
3(a)	**A** antibiotic for penicillin throughout *three from:* 1 (penicillin) weakens / AW, the cell wall **;** **I** punches holes / holes made 2 (penicillin) acts, on growing cells / when cell wall being synthesised (during growth) **;** 3 inhibits / binds to / AW, enzymes / transpeptidases (for cross linkage formation) **;** **I** ref. to synthesis of peptidoglycan 4 prevents formation of cross, links / linkages (between, peptidoglycan / murein, molecules) / AW **;** *suggestions why antibiotic is less effective on Gram negative* 5 outer membrane, prevents / interferes with / protects from / AW, entry (of penicillin) **;** **A** idea of, more difficult / further, to reach peptidoglycan layer 6 proteins in outer membrane may pump out antibiotic **;** **A** presence of efflux pumps 7 enzymes may be present (in periplasm) to degrade antibiotic / AW **;** 8 suggestion that antibiotic cannot cross hydrophobic region of (outer) membrane **;** 9 AVP **;** e.g. proportionately, less / lower concentration of, penicillin reaches murein for, enzyme / transpeptidase, inhibition	**3**
3(b)(i)	ATP not required **;** **A** (metabolic) energy not required	**1**

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Question	Answer	Marks
3(b)(ii)	*four from:* 1 channel protein **;** **A** pore protein / has a pore / has a channel 2 channel / pore, can form from polypeptides **or** (protein) has quaternary structure **;** 3 hydrophilic R-groups, on amino acids lining channel / face inwards (towards channel) **;** **A** hydrophilic, lining / channel **A** water-filled, channel / AW **A** idea that passage is through hydrophilic region of protein 4 allows facilitated diffusion **;** **A** diffusion alone if in context of through the protein but **R** if via phospholipid bilayer 5 increases permeability for, movement of water / osmosis **;** **I** faster 6 no (specific) binding sites / (channel) not specific / not selective / allows more than one type of substance through / AW **;** 7 globular **;** 8 AVP **;** e.g. ref. to hydrophobic part of protein, faces / interacts with, hydrophobic, region / core / fatty acid tails ref. to hydrophilic parts of, protein / polypeptide, extend into, external environment / periplasm / aqueous regions / AW	**4**

Question	Answer	Marks
3(b)(iii)	*two from:* translation, cannot / does not, begin / occur **or** polypeptide / protein, synthesis, cannot occur **/** decreases **;** **I** ompF not made **A** chain of amino acids **R** transcription does not occur so translation does not occur **R** if in context of mutation or enzyme inhibition mRNA cannot attach to, ribosome / small subunit / ribosomal subunit **;** (first) tRNA (with UAC anticodon) / tRNA carrying met, cannot bind (to START codon) **;**	**2**
3(c)(i)	(composed of) many / chain of / polymer of / AW, monosaccharides / sugar monomers / sugar units **;** **A** glucose, molecules / residues **A** more than two / many sugars further detail **;** e.g. carbohydrate may be, branched / unbranched *in context of polysaccharide* macromolecule *in context of polysaccharide* glycosidic bonds *in context of between sugar monomers* (sugar monomers) joined by condensation reactions	**2**

Question	Answer	Marks
3(c)(ii)	*three from:* 1 specificity / specific (in correct context) **;** 2 (B / T, -) lymphocytes have receptors complementary to antigen **;** **A** immunoglobulins / antibody *as receptors for B-lymphocyte* **A** surface molecules *as receptors for T-lymphocytes* 3 (different) antigens, stimulate / activate / AW, (different) B-lymphocytes / T-lymphocytes **;** **A** antigens stimulate an immune response 4 *idea that* different antibodies, synthesised / produced / AW, for different (O) antigens / O polysaccharides / lipopolysaccharides **;** 5 memory cells will, not respond to different antigen / only respond to same antigen / AW **;** 6 different O-antigens can, be composed of different sugars **;** **A** can have different shapes	**3**

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Question	Answer	Marks
4(a)	**1 / 4 ;** **3 ;** **5 ;**	**3**
4(b)	*two from:* centromere (of each chromosome) divides **;** **A** sister chromatids separated at the centromere spindle fibres, contract / shorten **;** **A** spindle contracts (sister / identical) chromatids / daughter chromosomes, pulled / move, to opposite poles **;** **A** (sister) chromatids separated **I** chromosomes are at opposite poles centromeres, leading (towards poles) / AW **;** **A** ref. to V-shape / diagram	**2**
4(c)	*one from:* not sectioned to include (nucleus) **;** did not take up the stain / not stained (correctly) / AW **;** AVP **;** e.g. cells may be dead **I** destroyed / eliminated / AW	**1**

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Question	Answer	Marks
5(a)	*three from:* any four named structures **;** mouth / nose / nostrils / nasal passages (count as one structure) pharynx larynx trachea **A** windpipe bronchus / bronchi bronchiole / bronchioles alveolus / alveoli / alveolar ducts / alveolar sacs lungs trachea, branches / divides, into (two main) bronchi **;** correct sequence from bronchus (branching) to bronchioles to (end with) alveoli **;** further detail **; ;** e.g. trachea has, C-shaped / incomplete rings, of cartilage bronchus has cartilage, plates / AW diameters of gas exchange structures / respiratory tubes, decrease (towards alveoli)	**3**

Question	Answer	Marks
5(b)	*two from:* blood pressure, decreases / returns to normal **;** platelets no longer sticky / risk of thrombosis decreases / risk of blood clotting decreases **;** endothelial repair (more likely to be) successful **;** **A** endothelium no longer damaged **A** decreased risk of, atheroma / atherosclerosis **I** less fatty deposits heart rate, decreases / returns to normal **;** **I** heartbeat decreases AVP **;** e.g. increased peripheral circulation / AW blood vessels, not / less, constricted **A** less vasoconstriction **A** blood vessel (lumen) diameter increases / vasodilation occurs	**2**

Question	Answer	Marks
5(c)	*four from:* *assume from point of view of giving up smoking unless stated otherwise* *in lungs / at high partial pressures of oxygen* 1 (so) more oxygen taken up by haemoglobin / haemoglobin more saturated (with oxygen) / AW **;** **A** haemoglobin has, increased / normal, affinity for oxygen 2 before and after data / calculated difference in data, to support, from 10 kPa **;** 3 carbon monoxide no longer binding to haemoglobin / AW **;** **A** carboxyhaemoglobin no longer forming / ora with ref. to smoking **A** haemoglobin has a higher affinity for CO than oxygen 4 more (sites on) haemoglobin available to take up oxygen **;** *in respiring tissues* 5 more oxygen dissociates from (oxy)haemoglobin / AW, at, lower partial pressures / below 4 kPa / in (respiring) tissues (after stopping) **;** **A** haemoglobin less saturated (with oxygen) **A** haemoglobin has, less / decreased, affinity for oxygen 6 before and after data / calculated difference in data, to support **;** 7 ref. to increase in allosteric effect / regains ability for conformational change / AW **;** *health benefits after stopping* 8 more / sufficient, oxygen to, transport / deliver to, tissues / body **or** more oxygen to reach (respiring) tissues **;** **A** less, tired / fatigued **A** more able to, do work / carry out exercise / be mobile **R** more energy unless qualified with link to aerobic respiration	**4**

Question	Answer	Marks
5(d)	*two from:* *non-infectious* not from a pathogen **;** **A** bacteria / viruses / fungi *for pathogens* **A** from lifestyle **A** tar / carcinogen in smoke, causes mutation (in cells of lung) cannot be passed onto another person / not transmissable / AW **;** *disease* abnormal condition (affecting an organism) / condition that reduces the effectiveness of the functions of the organism / AW **;**	**2**

Question	Answer	Marks
6(a)	*three from:* same / similar, shape as, HMG CoA / substrate **;** <u>complementary</u> (shape) to active site (shape) **;** binds / attaches / fits into / active site (of, enzyme / HMG CoA reductase) **;** HMG CoA / substrate, cannot bind (to active site) **;** **A** no / few, enzyme/substrate complexes form mevalonic acid production, decreases / stops **;** **I** product not made AVP **;** e.g. increase in mevinolin concentration increases inhibition / ora	**3**

Question	Answer	Marks
6(b)	*two from:* *treatment of disease* **I** *statements about locating or diagnosis of disease* specific / targeted, therapy / treatment **;** **A** specific to diseased, cells / tissue **A** examples bind to / recognition of, receptors / antigens, on cell surface (of diseased cells) **;** kill the cell by stimulating the immune system / AW **;** **A** correct immune responses e.g. stimulates phagocytosis / activates B-cells attach, radioactive substance / drug (to treat / kill diseased cells) / AW **;** treat infectious diseases / bind to (antigens on) pathogens / recognition of antigens on pathogens **;** **A** viruses **I** bacteria *unless stated that they cause disease* *allow examples such as treatment of ebola or rabies or tetanus (by immunising with antibody)*	**2**