Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/21**

Paper 2 AS Structured Questions **October/November 2020**

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.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

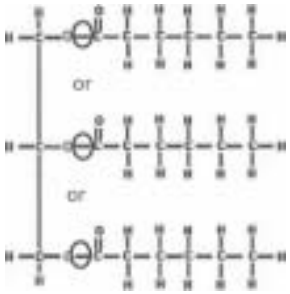
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Mark scheme abbreviations

;	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

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Question	Answer	Marks
1(a)(i)	(sister) chromatids **;** centromere **;** histone **;**	**3**
1(a)(ii)	prophase / metaphase **;** **I** late / early **A** prometaphase	**1**
1(a)(iii)	**I** *ref. to* replication or cytokinesis *any **two** from:* provides energy **;** movement of centrioles to poles **;** spindle formation / organisation of microtubules (for spindle) **;** movement of chromosomes to the, spindle equator / AW **;** separation of, (daughter) chromosomes / (sister) chromatids, to opposite poles (of the cell) / during anaphase **;** AW AVP **;** e.g. (for) condensation / AW, of, chromatin / chromosomes	**2**
1(b)	*assume reference to binary fission unless stated otherwise* *any **two** from:* DNA replication **;** **A** *idea* of, doubling / duplicating, DNA cell, elongation / gets longer **;** **A** cell increases in size cell wall formation **;** (includes) cytokinesis / described **;** *max 1 if two ideas correct describing events that only occur in mitosis*	**2**

Question	Answer	Marks
2(a)(i)	circle around any one correct bond ; **R** if circle includes the double bond O  	**1**
2(a)(ii)	condensation ; **A** dehydration (synthesis) **A** esterification three ;	**2**
2(b)(i)	macromolecule <u>and</u> extracellular enzyme ;	**1**
2(b)(ii)	4 (hours) ;	**1**
2(b)(iii)	*any **four** from:* **1** triglyceride hydrolysis / action of lipase, produces <u>fatty acids</u> ; **2** decrease in pH / described, because of production of (fatty) acids ; **3** steepest rate of (pH) decrease at start because, substrate / triglyceride, concentration highest ; **4** rate of pH decrease / AW, slows because decrease in rate of formation of fatty acids ; **5** rate of pH decrease /AW, slows because enzymes, not at optimum / <u>begin to</u> denature ; **6** rate of pH decrease slows because, substrate / triglyceride, being used up **or** substrate concentration becomes a limiting factor / AW ; **7** *ref. to* plateau at 18 hours / at pH 6.1, enzymes are denatured ; **8** *ref. to* plateau at 18 hours / at pH 6.1, as all the, triglyceride / substrate, has been, hydrolysed / AW ; **9** optimum pH for lipase activity, is pH 8 / alkaline conditions / at the start ; **10** AVP ; e.g. *ref. to* tertiary structure of lipase	**4**

Question	Answer	Marks
2(b)(iv)	*any **two** from:* (initial) decrease in pH would be more rapid **;** plateau would be reached earlier **;** AW plateau would be at the same pH (as the previous experiment) **;**	**2**

Question	Answer	Marks
3(a)(i)	blood, travels through the heart twice for every one complete, circuit (of the body) / circulation **or** blood, travels through the heart twice and through pulmonary and systemic, circulations / systems / circuits **;** **A** description of both circulations	**1**
3(a)(ii)	chordae tendineae / tendinous cords **;** **A** tendons / 'heart strings' *any **two** from:* *idea that* (atrioventricular) valve, held in position / prevented from inverting, during ventricular, systole / contraction **;** **A** AV valve *for atrioventricular valve* connect the papillary muscle to the (atrioventricular / AV), valve **;** *ref. to* tension, in the chordae tendineae / AW, (during ventricular contraction) **;** (allows valve to) prevent backflow of blood into atrium / ensure one way blood flow (through the heart) **;** *ecf max 2 marks for function if structure A is a correctly named valve (atrioventricular / tricuspid / bicuspid)*	**3**

Question	Answer	Marks
3(b)(i)	*idea of* using both antibiotics makes sure all bacteria are killed **;** if, resistance against one antibiotic occurs then, the other antibiotic will be effective / bacteria still susceptible to the other antibiotic **or** if, some bacteria are less susceptible to one antibiotic, then, the other antibiotic will be effective / bacteria still susceptible to the other antibiotic **;** *any **one** from:* antibiotics / gentamicin and penicillin G, have different sites of action / AW **;** **A** suggestion of how the antibiotics have different ways of killing *ref. to* mutations, qualified **;** e.g. need two mutations to occur to be resistant to both antibiotics probability / AW, of these two mutations occurring in the same bacterium is very small mutations must be in different genes	**2**
3(b)(ii)	*any **three** from:* course of antibiotic is not completed **;** less susceptible bacteria survive **;** **A** not all bacteria destroyed replication / population growth, increases chance of mutation **;** *ref. to* random mutation, ref to gene / allele, for resistance to gentamicin **;** suggestion of outcome of different mutations **;** e.g. changed ribosome structure so gentamicin cannot bind enzyme to breakdown gentamicin *ref. to* transmission of allele for resistance **;** e.g. vertical transmission / described horizontal transmission / described (conjugation / transformation) e.g. frequency of allele for resistance increases in the population **;** *when antibiotic next prescribed* antibiotic in the environment is the selection pressure / resistant bacteria selected for / susceptible bacteria selected against **;**	**3**

Question	Answer	Marks
4(a)(i)	plasmodesmata **;**	**1**
4(a)(ii)	*any **two** from:* *ref. to* connecting two cells **;** *in context of connecting cytoplasm* (facilitate) movement of substances between cells **;** **A** named substances *ref. to* symplast pathway **;** cell to cell communication / passage of cell signalling molecules **;** AVP **;** e.g. removes the need to cross the partially permeable cell surface membrane (when moving between cells) increases the rate of movement of substances between cells	**2**
4(b)(i)	protein coat / capsid **;** DNA or RNA / nucleic acid **;** **A** genetic material ref. to some viruses have envelope **;**	**2**
4(b)(ii)	*allow sucrose for assimilates throughout* *any **five** from:* viruses / assimilates, enter via plasmodesmata ; movement / diffusion, of assimilates into (phloem) sieve tubes, lowers water potential / AW **;** (so) water enters, by osmosis / down water potential gradient / AW **;** hydrostatic pressure increases (at source) **;** **A** turgor pressure *for hydrostatic pressure* unloading at, sink / named sink, lowers hydrostatic pressure (at sink) **;** detail ; e.g. assimilates move out and water follows osmotically pressure gradient created / higher pressure in source (than sink) / lower pressure in sink (than source) **;** (so) mass flow**;** *term to be used in context* from source to sink **;** *allow mp if terms source and sink used in correct context within complete response* AVP **;** (viruses and assimilates travel) through sieve pores	**5**

Question	Answer	Marks
5(a)	*any **one** from :* (*when the air pressure lowers inside bronchus*) holds, bronchus / airway open **;** **A** supports, bronchus / airway **;** prevents, bronchus / airway, from collapsing **;**	**1**
5(a)(ii)	*idea that* (cartilage arranged as) incomplete / C-shaped, rings in the trachea **;** *idea of* more regular distribution (of incomplete rings) along the length of trachea **;**	**1**
5(a)(iii)	*max 1 if cilia or mucus linked to incorrect cell* (ciliated epithelial cells have) cilia, to, waft / sweep / AW, mucus, away / up the trachea / AW **;** (goblet cells that) secrete mucus to trap, dust / bacteria / pathogens **;**	**2**
5(b)(i)	the larger elephant has a smaller surface area to volume ratio **; ora**	**1**
5(b)(ii)	*any **three** from:* are multicellular / have many cells **;** need a large quantity of / enough, oxygen to supply, every cell / all parts of body **;** active so high demand for, oxygen / removal of CO_2 **;** diffusion across body surface is not fast enough (to meet needs) **;** AW long diffusion distance (so diffusion is not fast enough to meet needs) **;**	**3**
5(b)(iii)	*any **four** from:* three polypeptide chains **;** (three polypeptides) form triple helix **;** **A** coil around each other **R** *ref. to* alpha helix hydrogen bonds hold the three. polypeptides / strands. together **;** the three polypeptides, lie close together / form a tight coil / are tightly wound **;** every third amino acid (in the polypeptide chain) is glycine / many glycine-proline alanine repeats / many gly-pro-ala repeats **;** glycine is found on the inside of each, polypeptide / strand**;** AVP **;** e.g. detail hydrogen bonds, between peptide bond NH (of a glycine) and C=O group in adjacent polypeptide	**4**

Question	Answer	Marks
5(b)(iv)	*allow reference to collagen fibrils instead of collagen molecules, in correct context (collagen molecules form fibrils, which form fibres)* *any **one** from:* (many) collagen molecules lie parallel **;** *no weak points because* strong / covalent, (cross) links between molecules **;** (ends of) molecules (in, fibril / fibre), are staggered **;**	**1**

Question	Answer	Marks
6(a)(i)	*in context of mutations in genes* *any **two** from:* uncontrolled, (cell) division / mitosis ; cell cycle not regulated ; programmed cell death does not occur / cell becomes immortal ; uncontrolled growth not suppressed ; *ref. to* mass of abnormal cells ; AVP ; e.g. cell cycle checkpoints impaired proto-oncogenes become oncogenes tumour suppressor genes switched off	**2**
6(a)(ii)	*any **two** from:* *ref. to* change of a single, nucleotide / base (in sequence of DNA) **or** one base substitution (mutation) ; change in one, DNA triplet / mRNA codon ; *ref. to* tRNA with a different anticodon / tRNA brings a different amino acid ; idea that different primary structure leads to different tertiary structure ;	**2**

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Question	Answer	Marks
6(b)(i)	*any **three** from:* vaccination stimulates an immune response ; antigen presentation, qualified ; e.g. TSA engulfed by, phagocyte / named phagocyte antigen binds to, specific / complementary, receptor, on, T-lymphocyte / cytotoxic T cell / killer T cell ; clonal expansion ; **A** described e.g. divides by mitosis to form a clone (receptor on) cytotoxic T cell / killer T cell, binds to TSA on tumour cell ; release of, perforin / hydrogen peroxide (to kill tumour cell) ; **A** other named e.g. granzymes AVP ; e.g. causes lysis of the cell	**3**
6(b)(ii)	*advantage any **one** relevant e.g.* tumour cells may have more than one TSA **;** stimulate a specific immune response to each TSA **;** *idea that* TSA on patient's tumour cells has the appropriate antigen *idea that* personalised treatment so more effective *disadvantage any **one** relevant e.g.* high cost of personalised treatment **;** immune system may not recognise TSA on own body cell as, foreign / non-self , the cells in the tumour may not have the TSA in the vaccine **;** patient's tumour may not be large enough to obtain enough cells for treatment **;** patient needs surgery to obtain (large quantity of) cells **;** AVP **;** e.g. *suggestion that* tumour cell may settle in a part of the body and not be destroyed	**2**