Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/23**

Paper 2 AS Level 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.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U 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.

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.

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.

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

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>one mark per row
A if names and labels reversed

<table>
<tr><th>description</th><th>name of part of gas exchange system</th><th>label from Fig. 1.1</th></tr>
<tr><td>supported by incomplete (C-shaped) rings of cartilage</td><td>trachea</td><td>B ;</td></tr>
<tr><td>lined by ciliated epithelium and supported by blocks of cartilage</td><td>bronchus
A bronchi</td><td>C / J ;
A C and J</td></tr>
<tr><td>lined by squamous epithelium</td><td>alveolus / alveoli</td><td>M ;</td></tr>
<tr><td>lined by ciliated epithelium, but not supported by cartilage</td><td>bronchiole(s)
I terminal / respiratory</td><td>H ;</td></tr>
</table></td><td>4</td></tr>
<tr><td>1(b)</td><td>A mutagen(s) / carcinogen(s) ; A tar A named carcinogens
B nicotine ;
C carbon monoxide ;
D tar ;
E nicotine ;</td><td>5</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>
award mp1 and mp8 anywhere in each section of the answer

cell B - mesophyll cells

mp1 photosynthesis / described ;
e.g. conversion of carbon dioxide to sugars using light energy
synthesis of complex organic compounds from inorganic compounds using light energy

adaptation – mp2 and one from mp3 to mp7

<table>
<tr><td>mp2 chloroplasts / chlorophyll / chloroplast pigments</td><td>to absorb light ;</td></tr>
<tr><td colspan="2">any one from:</td></tr>
<tr><td>mp3 large vacuole</td><td>to keep chloroplasts at the periphery ;</td></tr>
<tr><td>mp4 starch grains</td><td>as store of products of photosynthesis ;</td></tr>
<tr><td>mp5 large / moist, surface / cell wall</td><td>for evaporation of water for transpiration (stream) ;

A provides water for photosynthesis in context of water supply transpiration</td></tr>
<tr><td>mp6 thin cell wall</td><td>gas exchange / diffusion of gases ;</td></tr>
<tr><td>mp7 isodiametric / (roughly) spherical shape</td><td>prevents close packing / gives large air spaces ;</td></tr>
</table>
cell C - sieve tube element

mp8 transport / movement of, (named) sugars / (named) assimilates / photosynthates / organic substances ;
A translocation
</td><td>5</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>

*adaptation – any **two** from:*

<table>
<tr><td>**mp9** peripheral / described, cytoplasm

A ‘at the edge’ / ‘thin layer’</td><td>allowing maximum, volume / space, for transport of, phloem sap / assimilates **;**

A less / little, resistance to flow / AW</td></tr>
<tr><td>**mp10** no nucleus / few organelles / little cytoplasm
R ‘no organelles’</td><td>allowing maximum, volume / space, for transport of, phloem sap / assimilates **;**

A less / little, resistance to flow / AW</td></tr>
<tr><td>**mp11** elongate / elongated (cells, so end to end)</td><td>to make (sieve) tubes **;**</td></tr>
<tr><td>**mp12** plasmodesmata</td><td>(un)loading from / AW, companion cells / cell **A ; I** ‘between cells A and C’</td></tr>
<tr><td>**mp13** sieve pores</td><td>**A** flow between sieve tube elements **;** AW</td></tr>
<tr><td>**mp14** sieve plates</td><td>prevent, bursting / bulging **;**
A maintaining hydrostatic pressure</td></tr>
<tr><td colspan="2">**mp15** AVP for **C ;**
e.g. phloem proteins **and** defence against pathogens / sealing wounds
e.g. cell walls with cellulose microfibrils that run around the cells **and** to prevent bursting</td></tr>
</table>

</td><td></td></tr>
</table>

Question	Answer	Marks
2(b)	*mp1, 2, 4 and 6 needs idea of increases / more; this is not needed for mp3 and mp5* *any **three** from:* **1** increases surface area:volume <u>of cell</u> / increases surface area of (cell surface) <u>membrane</u> **;** **2** *idea of* more space for / increased area for / more, proton pumps / carrier proteins in context of moving protons **;** **3** pumping protons, from cytoplasm / into cell wall / into apoplast / AW **;** **A** create / increase, proton / electrochemical / concentration, gradient **4** *idea of* more space for / increased area for / more, <u>co</u>transporter proteins / carrier proteins in context **;** **5** <u>co</u>transport of sucrose / described, into companion cell / into transfer cell / into cell **A** / from mesophyll cell / from cell **B** **;** **A** secondary active transport **A** *movement of sucrose <u>and</u> protons for cotransport* **6** more space for plasmodesmata (between cell **A** and cell **C**) **;**	**3**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)(i)</td><td>A – G1 / gap 1 ;
B – S / synthesis ; A DNA replication I S1 / S2 / replication unqualified</td><td>2</td></tr>
<tr><td>3(a)(ii)</td><td>telophase ;</td><td>1</td></tr>
<tr><td>3(a)(iii)</td><td>any two from:
increase in cytoplasm / increase in number of (named) organelle(s), during interphase ; A synthesis of organelles
I cell growth

(re)formation of nuclear envelope ;
nuclear envelope, forms around each group of chromosomes ;
A nuclear membrane as an ECF if used for mp2

(movement of) organelles to be shared between two daughter cells ;

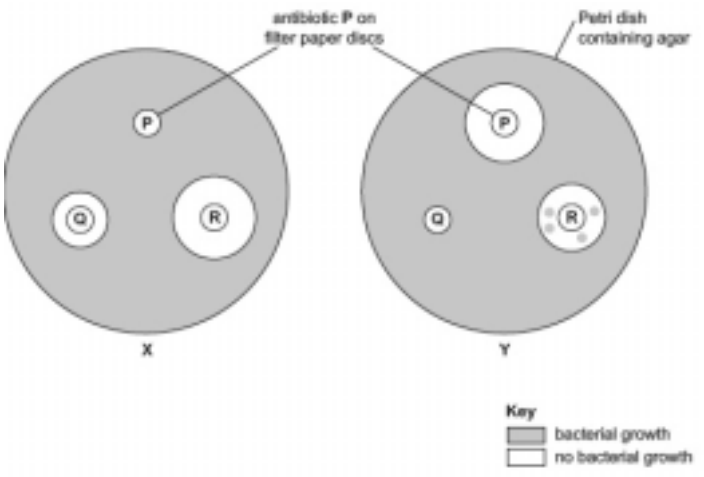
spindle, disassembles / breaks down / degrades / disappears / AW ;

cleavage furrow forms ;
A cytoplasm / cell membrane, pinches in / constricts / infolds

AVP ;
e.g. (actin) microfilaments / microtubules, form contractile ring / AW, around equator of cell / beneath cell surface membrane
A cytoskeleton for microtubules / microfilaments</td><td>2</td></tr>
<tr><td>3(a)(iv)</td><td>one mark per row
<table><tr><th></th><th colspan="3">stages of cell cycle</th></tr><tr><th></th><th>A</th><th>B</th><th>D</th></tr><tr><td>number of nuclei within the stem cell</td><td>1</td><td>1</td><td>2 ;</td></tr><tr><td>number of chromosomes ineach nucleus</td><td>12</td><td>12</td><td>12 ;</td></tr></table></td><td>2</td></tr>
</table>

Question	Answer	Marks
3(b)	**1** stem cells) continue to divide / divide repeatedly (by mitosis) **;** **A** at least one daughter cell, retains ability to divide / is a stem cell / **A** 'repeated mitosis' / **A** 'to produce more stem cells' *any **two** from mps 2-5:* *to produce cells* **2** for growth **;** **3** for repair of tissues **; R** repair of cells **4** for replacement of, worn out / old / dead, cells **;** **A** damaged cells if repair of tissues not given **5** to differentiate for formation of, tissues / organs **;** **A** specialised cells for forming, tissue / organs *and:* **6** AVP **;** e.g. *ref. to* potency of stem cells (multipotent or pluripotent)	**3**

Question	Answer	Marks
4(a)(i)	**X** – **R** *and* **Y** – **P ;**	**1**
4(a)(ii)	*any **two** from:* ***mp1** = resistance with ref. to **P** / **Q** / **R*** **Y**, is resistant to **Q** / has no resistance to **P ;** **A Y** has some resistance to (antibiotic) **R** ***mp2** = antibiotics used at different concentrations* (antibiotic) **R** may, have different concentration / be less effective, compared with **P ;** ***mp3** = reason for resistance* *ref. to* gene(s) for resistance (on plasmids) ***or*** **Y** has, cell wall / cell membrane, that prevents entry of antibiotic **Q** ***or*** **Y** has enzyme that breaks down, **Q** / **R ;** ***mp4** = action of antibiotics* *idea that* antibiotics have, different / specific, target(s) / AW **;** **A** any example of process inhibited by antibiotic, e.g. cell wall synthesis transcription translation DNA replication cell surface membrane function synthesis of folic acid	**2**

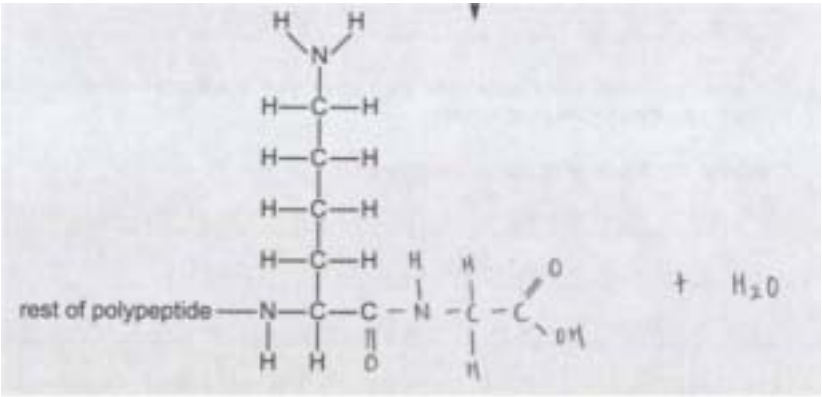
Question	Answer	Marks
4(a)(ii)	***mp5*** = AVP **;** e.g. *idea that* **P** may be bacteriocidal / (antibiotic) **R** is bacteriostatic e.g. *idea that* gene for resistance to antibiotic **R** passed by, vertical / horizontal, transmission  	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(b)</td><td>

*any **three** from:*
*to award the MP1 to MP5 you **must be able to see a difference** between the two stated clearly*

<table>
<tr><td></td><td>vaccines</td><td></td><td>antibiotics</td></tr>
<tr><td>1</td><td>(generally) are preventative / are not a treatment / are not a cure
or
use before a person, has an infection / is ill</td><td>v</td><td>are (generally) not preventative / are a treatment / are a cure
or
used when a person, has an infection / is ill ;</td></tr>
<tr><td>2</td><td>effective against bacteria and viruses (in context of different vaccines)</td><td>v</td><td>not effective against viruses / only effect against bacteria ;</td></tr>
<tr><td>3</td><td>idea of indirect effect on pathogens</td><td>v</td><td>idea of direct effect on pathogens ;
A example of effect</td></tr>
<tr><td>4</td><td>not given as a course / give once or a few times (or with boosters)</td><td>v</td><td>given as a course / over many days / AW ;</td></tr>
<tr><td>5</td><td>specific for particular, pathogen</td><td>v</td><td>(most) antibiotics act on a range of pathogens ;</td></tr>
<tr><td>6</td><td>stimulate an <u>immune response</u></td><td>or</td><td>do not stimulate an <u>immune response</u> ;</td></tr>
<tr><td>7</td><td>detail e.g. stimulate, (B- / T-) lymphocytes / production of antibodies
A stimulates production of memory cells</td><td>or</td><td>do not stimulate, (B- / T-) lymphocytes / production of antibodies ;
A no stimulation of memory cells</td></tr>
<tr><td>8</td><td>provide long-term, protection / immunity</td><td>or</td><td>do not provide long-term, protection / immunity ;</td></tr>
<tr><td>9</td><td>does not lead to resistance</td><td>or</td><td>may lead to resistance ;</td></tr>
<tr><td>10</td><td>time delay before being effective / AW</td><td>or</td><td>have effect, faster / sooner / AW ;</td></tr>
</table>

</td><td>3</td></tr>
</table>

Question	Answer	Marks
5(a)(i)	**I** *presence or absence of water* diagram shows bond between C (of lysine) and N (of glycine) **and** double bond to O shown correctly **;** glycine drawn correctly **;** **R** if R is used instead of H on glycine  	**2**
5(a)(ii)	condensation **;** **A** dehydration (reaction)	**1**
5(a)(iii)	**I** high tensile strength *any **two** from:* allows close packing of, triple helix / three polypeptides **;** **A** chains **I** tight coiling **A** 'binds more tightly' glycine, has smallest R group / R group of glycine is H / is smallest amino acid **;** **A** glycine is small glycine, is every third amino acid in the, polypeptide / chain **;**	**2**

Question	Answer	Marks
5(b)	**I** collagen is insoluble / collagen is strong *any **four** from:* **1** collagen, has high tensile strength / does not stretch / AW **;** **A** withstands large pulling forces **2** *any ref. to* use of collagen in the body **;** e.g. (walls of) arteries or veins / tendons / cartilage / skin / basement membranes / around alveoli / bones / teeth **I** hair / **R** if any *ref. to* elastic(icity) *three from* **3** triple helix has many hydrogen bonds between, polypeptides / chains **;** *mp4, 5, 6 and 7 – must be clear that answers are about molecules, but accept triple helix for molecule* **4** collagen molecules form, fibrils / fibres **;** **5** strong / covalent, (cross) links between molecules **;** **6** (ends of) molecules (in fibril / fibre) are staggered **;** **7** AVP **;** e.g. (many) collagen molecules lie parallel	**4**

Question	Answer	Marks
5(c)	*induced fit* **1** active site changes shape **;** **A** active site moulds round substrate **A** 'active site changes to fit the substrate (more closely)' **2** (so) active site becomes (fully) <u>complementary</u> shape to collagen **;** *any four from* **3** formation of, <u>enzyme-substrate complex</u> / <u>ESC</u> **;** **4** lowering of activation energy **;** **5** breakage of peptide bond **;** **6** active site returns to, pre-ESC / original, shape **and** can be reused **;** **7** AVP **;** e.g. *ref. to*, binding site / catalytic site (of active site) e.g. suggestion of how activation energy lowered, e.g. strain put on bond / alternative pathway	**5**

Question	Answer	Marks
5(d)	*description* **1** general description of effect of pH on activity **;** e.g. as pH increases the activity increases and then decreases e.g. as pH increases activity reaches a peak e.g. use of data with unit for relative activity to describe increase and decrease (see next page) **2** **2** optimum pH is 7 **;** *explanation* *any **three** from:* **3** partial denaturation in, acid **and** alkaline conditions / AW **;** **A** 'starts to denature' as alternative to partial denaturation *small changes either side of optimum* **4** (ionisable) R-groups in, active / catalytic, site affected **;** *large changes either side of optimum* **5** hydrogen bonds / ionic bonds, break / disrupted **;** **6** active site (shape) / (enzyme) tertiary structure, changes, so substrate / collagen, no longer fits into active site / fewer ESC complexes formed **;** **A** fits less well *in context of partial denaturation* **7** AVP **;** e.g. detail of R groups	**4**

Question	Answer	Marks
6(a)	*formula* (magnification =) $\frac{\text{size of image}}{\text{actual size}}$ **;** **A** M = I / A or I = A × M **A** magnification triangle length of line **X**–**Y** = 30 mm (± 2 mm) / 30 000 μm = 3.0×10^{-2} m actual length = 150 μm / 0.15 mm = 150×10^{-6} m *working* length of the image (in m, mm or cm) divided by the actual size (**A** ± 2 mm) **;** (x) 200 **; A** *answer in range* 187 – 213	**3**

Question	Answer	Marks
6(b)	**1** endocytosis / phagocytosis **;** *two from* **2** particles / bacteria, reach end of, gullet / AW **;** **3** binding / fusion / attachment, (of bacteria / food particles) to, receptors / (cell surface) membrane **;** **I** 'makes contact with' **4** membrane engulfs, bacteria / food particles **;** **5** fusion of phospholipids / membrane fusion **;** **6** (phagocytic) vacuole / vesicle, pinches off from, surface / membrane **;**	**3**
6(b)(ii)	**I** bulk transport **1** fuse / bind, with, phagosome / food vacuole / phagocytic vacuole / phagocytic vesicle **;** **A** food vacuole, etc. implied **2** contain / add, hydrolytic / digestive, enzymes **;** **A** hydrolases **A** description of one type of breakdown reaction catalysed by a lysosomal enzyme **3** an example of hydrolase or enzyme **;** e.g. protease / lipase / carbohydrase / nuclease / lysozyme	**3**