CAMBRIDGE
International Education

Cambridge International AS & A Level

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 2024**

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 May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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 descriptions 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
A	accept (for answers correctly cued by the question, or by extra guidance)
R	reject
I	ignore
( )	the word / phrase in brackets is not required, but sets the context
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
AVP	alternative valid point

Question	Answer	Marks
1(a)(i)	capsid **;** **A** capsomere **A** protein coat	**1**
1(a)(ii)	RNA / DNA **;** *(actual is RNA)* **I** viral **R** dsRNA / dsDNA / mRNA / tRNA / rRNA	**1**
1(b)(i)	50 (nm) **;** **A** 50 / 52.5 / 55 / 57.5 / 60 nm working showing use of correct formula, A = I / M **;** *length* **X**–**Y** */ ÷ magnification*	**2**
1(b)(ii)	ability to distinguish between two points **;** AW	**1**
1(c)	malaria is transmitted by *Anopheles* (rather than *Aedes*) **;** *plus any **two** from:* *max 1 if incorrect context stated for malarial transmission* both are transmitted by vectors **;** both are transmitted by mosquitoes **;** both, are blood-borne diseases / vectors feed on blood **;**	**3**

Question	Answer	Marks
1(d)(i)	*max three if no correct ref. within response to, memory cells / immunological memory* **A** T- / B-cells, for, T- / B- lymphocytes *any **three** from*: **1** proteins are, non-self / foreign, antigens **;** **2** proteins / antigens, stimulate a primary immune response **;** **3** T-lymphocyte / B-lymphocyte, binding / recognition / clonal selection / activation / described in terms of receptor **;** **4** clonal expansion / cell divides by mitosis to produce a clone / AW ; **5** formation of memory, (T- / B-) lymphocytes **;** *mps 3, 4, 5 in context of primary immune response* **6,7** further detail **;** e.g. (artificial) active immunity (T- / B-) memory cells, remain in, circulation / the body, for a long time **or** memory cells are long-lived (for secondary response) larger numbers of lymphocytes (specific to Zika virus) greater chance of encountering, Zika virus / pathogen / antigens secondary immune response is, stronger / faster (than primary immune response) faster production / higher concentration, of (specific) antibody (so) person does not have symptoms of disease when infected with (actual) Zika virus	**4**
1(d)(ii)	*any **two** from:* *ref. to* herd immunity **;** **A** a large proportion of the population is immune (to Zika virus disease) **;** detail**;** e.g. *context is less likely / less chance of / less risk of* people without immunity / unvaccinated people, less likely / unlikely, to be in contact with an infected person **ora** infected person unlikely to be in contact with a non-immune person *idea of* increased chance of breaking the transmission cycle AVP **;** e.g. can achieve a high percentage cover if R_0 high, greater percentage of population need vaccinating **ora**	**2**

Question	Answer	Marks
2(a)	*max 1 in molecule section if mps from collagen fibre included as features of a molecule* *max 1 in fibre section if mps from molecule included as features of collagen fibre* ***or*** *if polypeptide described in molecule section and all features in fibre section are descriptive for a collagen molecule* *any* ***five*** *from*: *molecule (to max 4)* **1** three, helical / AW, polypeptides / chains **I** quaternary structure **or** triple helix **;** **2** (helical chains) tightly wound **;** **3** hydrogen bonds between, polypeptides / chains **;** **4** (generally) every third amino acid (in each, polypeptide / chain) is glycine **;** *fibre (to max 4)* **5** cross links / covalent bonds , between molecules **;** **6** molecules arranged in parallel **;** **7** molecules (in fibril / fibre) are, staggered / ends not aligned **/** AW **;** **8** AVP **;** e.g. detail of H bonds collagen fibre can be composed of collagen fibrils made of (parallel) collagen molecules glycosylated (amino acids in polypeptide) / hydroxylated	**5**
2(b)(i)	α-glucose / alpha glucose **;**	**1**
2(b)(ii)	label to glycosidic bond labelled **G ;**	**1**
2(b)(iii)	$NH_2CH_2CHCH_2CH_2$ circled and labelled **R ;**	**1**
2(c)	correct named tissue or structure **;** e.g. blood vessels / cartilage / bone / ligaments / skin / tendons (is/are) weaker / deformed / easily broken / AW **;** **A** description of how function is affected	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><th>feature</th><th>artery</th><th>capillary</th><th>vein</th></tr>
<tr><td>smooth muscle</td><td>✓</td><td>X</td><td>✓</td></tr>
<tr><td>endothelium</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>tunica media</td><td>✓</td><td>X</td><td>✓</td></tr>
</table>
; ; ;
one mark per correct row
if 0 or 1 mark, check columns to allow max 2</td><td>3</td></tr>
<tr><td>3(b)(i)</td><td>labelled arrows for
oxygen, leaving alveolar space / entering capillary lumen
and
carbon dioxide, leaving capillary lumen / entering alveolar space ;</td><td>1</td></tr>
<tr><td>3(b)(ii)</td><td>any four from:

1 blood arriving (in alveolar capillaries), is deoxygenated / has low(er) partial pressure of oxygen ;
A low, concentrations / levels, of oxygen or oxygen-poor

2 oxygen taken up by haemoglobin (from plasma) / formation of oxyhaemoglobin ;

3 idea that newly oxygenated blood is, constantly / continually, removed ;
A oxygenated blood passed to pulmonary vein
A oxygen that diffuses, from alveoli / into blood, is transported away (by blood flow)
4 (because of) many / large network of capillaries ; context is alveolar capillaries

5 ventilation / breathing / inhalation and exhalation / AW, qualified ;
e.g. allows (more) oxygen in (to alveolar space)
idea of constantly replaces alveolar air

6 AVP ; e.g. ventilation maintains a large concentration difference between alveolar space and capillary</td><td>4</td></tr>
<tr><td>3(c)</td><td>pulmonary vein ;

semilunar ; A aortic <u>and</u> pulmonary

coronary ;</td><td>3</td></tr>
</table>

Question	Answer	Marks
4(a)	*Max 3 for suberin, max 3 for lignin* *any **four** from*: **1** lignin / suberin, is, hydrophobic / (partially) impermeable to water / AW **;** e.g. waterproof / barrier to water *suberin* **2** suberin found in, Casparian strip / endodermal cells / endodermis **;** **3** water must move from apoplast (pathway) to, symplast (pathway) / cytoplasm (at endodermis) **;** **4** allows control of solutes / AW, before entering, endodermal cells / xylem **;** **A** helps to prevent, toxins / bacteria / AW, entering xylem *in context of mp3* *lignin* **5** lignin found in, cell walls of xylem vessel elements / walls of xylem vessels **;** **A** xylem / vessel, elements **6** *idea of* lignin / lignified wall, prevents water leaving xylem **/** loss of water from xylem **;** **7** lignified walls, prevents, (inward) collapse of / compression of / AW, xylem **;** **R** bursting **8** provides strength / secondary thickening, for (structural) support (of xylem) **;** **9** AVP **;** e.g. *ref. to* lignin as part of endodermis adhesion of water molecules to hydrophilic parts of lignin prevents collapse of water column **/** AW lignification causes death of xylem vessel elements *context of producing empty xylem vessels for transport*	**4**

Question	Answer	Marks
4(b)	*max 4 if no reference to laccase / monolignols* *allow substrate(s) for monolignols* *any **five** from*: **1** laccase uses induced fit **;** **2** *idea that* active site shape not fully complementary to (shape of) monolignols **;** **3** active site changes shape to, fit / bind to, monolignols **;** AW **4** becomes fully <u>complementary</u> **;** **5** forming enzyme-substrate complex **;** **6** lowers, activation energy / energy of activation**;** **7** suggestion of how activation energy is lowered **;** **8** laccase returns to original shape, after product leaves active site / for re-use / AW **;** **9** AVP **;** e.g. *suggestion that,* copper ions are, cofactors / necessary for enzyme action *suggestion that* monolignols are held in place by (temporary) H bonds	**5**
5(a)	*any **two** from*: cells secrete ligands **or** transport of ligands, through blood / in circulatory system **;** ligands bind to (complementary / specific) <u>receptors</u> **;** *context of target cells* (binding) sets off reactions within the (target) cell / triggers secondary messengers / sets off an enzyme cascade **;** **A** cyclic AMP for secondary messengers	**2**
5(b)	(non-competitive inhibitor) binds to, allosteric site / site other than active site / AW **;** (binding causes) change in shape of active site **;** active site no longer complementary to the substrate / AW **;**	**2**
5(c)(i)	Palbociclib / p21Cip1 **;** (in S phase), stops DNA replication occurring / DNA replication occurs **or** identical /sister, chromatid formed in S phase **;** **A** *idea of* p21Cip1 disrupts normal DNA replication (in S phase)	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(c)(ii)</td><td><u>RO-3306</u>, qualified
1 cell cycle stops (in G_2) after mitochondria have, divided / increased in number
or
mitochondria, divide / increase in number, in (G1 and) G2 / before mitosis ;
A no, mitosis / cytokinesis, so numbers of mitochondria remain high

2 idea that DNA replication will have occurred / sister chromatids will have formed, in S phase, but the cell cannot carry out mitosis ;</td><td>2</td></tr>
<tr><td>5(d)</td><td>cell cycle is stopped before, mitosis / cytokinesis / cell division ;

idea of stops uncontrolled cell division (increasing tumour size) ;</td><td>2</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>6(a)</td><td>must have correct matching information about mRNA <u>and</u> DNA

any three correct (rows) from:

<table>
<tr><th>mRNA</th><th>DNA</th></tr>
<tr><td>one strand / single-stranded / one polynucleotide chain</td><td>two strands / double-stranded / two polynucleotide chains ;
A double helix</td></tr>
<tr><td>RNA, bases not paired / base pairing not present</td><td>DNA base pairing present ;</td></tr>
<tr><td>ribose (sugar)</td><td>deoxyribose (sugar) ;</td></tr>
<tr><td>uracil, (adenine, cytosine, guanine) (base(s) / nucleotide(s))</td><td>thymine, (adenine, cytosine guanine) (base(s) /nucleotide(s)) ;</td></tr>
<tr><td>shorter / fewer nucleotides</td><td>longer / more nucleotides ;</td></tr>
</table></td><td>3</td></tr>
<tr><td>6(b)(i)</td><td>P <u>and</u> B ;</td><td>1</td></tr>
<tr><td>6(b)(ii)</td><td>C <u>and</u> G ;
held together by three hydrogen bonds (same as the artificial base pairs) ;</td><td>2</td></tr>
</table>