Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **May/June 2020**

MARK SCHEME

Maximum Mark: 60

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

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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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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.

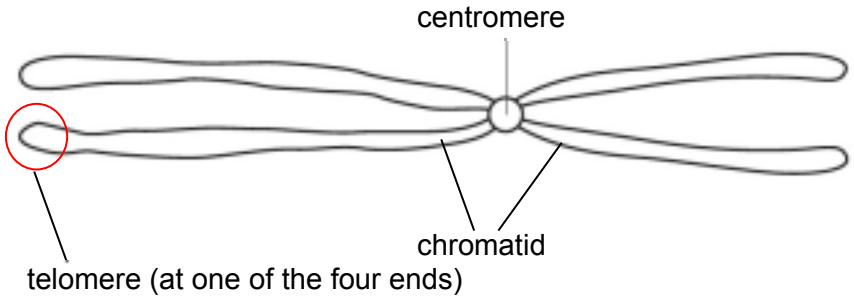
Mark scheme abbreviations:

;	separates marking points
/	alternative answers for the same marking point
R	reject
A	accept
I	ignore
AVP	any valid point
AW	alternative wording (where responses vary more than usual)
ecf	error carried forward
underline	actual word underlined must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument

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Question	Answer	Marks
1(a)	glycosidic ;	1
1(b)	*any one from:* no double, bond / bonds, in hydrocarbon chain ; each carbon (atom) in the hydrocarbon chain is bonded to two hydrogen atoms ; there is, a full complement / maximum number, of hydrogen atoms on the hydrocarbon chain ; **A** aliphatic chain *for hydrocarbon chain* **A** hydrogens *for hydrogen atoms*	1
1(c)	β-glucose / beta-glucose ; **R** B-glucose	1
1(d)	**C** ;	1
1(e)	**E** ;	1
1(f)	*any one from:* **A** and **C** are, polar / hydrophilic ; **A** has many, OH / hydroxyl groups **B** is, non-polar / hydrophobic ; **A** has, only one OH / no groups, that interact with water	1

Question	Answer	Marks
2(a)	**P** – chromosomes, arranged randomly / AW *or* *idea that* chromosomes present but not (yet) visible as consisting of two sister chromatids (joined by centromere) ; **A** description related to idea of chromosomes becoming visible / chromatin condensing **Q** – chromosomes are, arranged / aligned / AW, at the, (cell / spindle) equator / metaphase plate ; **A** equatorial plate **R** – no chromosomes visible / nucleolus is present / chromatin not condensed / euchromatin present ;	3

Question	Answer	Marks
2(b)(i)	*drawing* two chromatids of identical length joined at the centromere **;** *labels* chromatid **;** *one label line is sufficient* **R** if second line drawn to arm of sister chromatid centromere **;** telomere **;**  	**4**
2(b)(ii)	histone(s) **;** **A** highly basic (protein)	**1**
2(b)(iii)	*accept spindle fibres / microtubules as alternative to spindle* *max 2 if stages are named and are incorrect* *any three from:* (prophase) attachment to centromere of each chromosome **;** **A** *ref. to* kinetochore *in correct context* (prophase) arranging / orientating / AW, chromosomes at the, equator / metaphase plate / AW **;** **A** *ref. to* metaphase in correct context (anaphase) centromere division / separation of sister chromatids **;** (anaphase) pulling, chromatids / daughter chromosomes, apart / towards poles **;** (because) spindle fibres contract / (as) lengths of microtubules decreases / microtubules are disassembled **;** (elongates in telophase to) push, poles / nuclei, apart **;**	**3**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)(i)</td><td>one mark for units
one mark per column

<table>
<tr><td></td><td>V_{max}
μmol min^{-1}</td><td>K_m
mmol dm^{-3} ;</td></tr>
<tr><td>J</td><td>60</td><td>0.2</td></tr>
<tr><td>K</td><td>50 ;</td><td>0.2 ;</td></tr>
</table></td><td>3</td></tr>
<tr><td>3(a)(ii)</td><td>K compared with J
max 3 from mp4–mp8

any four from:
1. rate of reaction is lower at all substrate concentrations ;
2. ref. to greater difference as substrate concentration increases ;
3. rate of reactions for J and K compared at two substrate concentrations to support mp1 or mp2
or
manipulated data at two substrate concentrations to support mp2 ;

4. less efficient / acts more slowly / AW ;
5. active site is still binding substrate ;
6. idea that active site is less effective at catalysing reaction
7. or
enzyme has lower affinity for substrate ;

8. (replaced / changed) amino acid is important in, shape / structure, of active site ;
9. AVP ; e.g. how the mutation may have changed interaction between substrate and, active / catalytic, site e.g. ref. to hydrogen bonding / transfer of electrons</td><td>4</td></tr>
<tr><td>3(b)</td><td>each polypeptide shows primary, secondary and tertiary structure ;
A description of levels of structure
both (forms of G6PD / enzyme) composed of more than one polypeptide (so have quaternary structure) ;</td><td>2</td></tr>
</table>

Question	Answer	Marks
4(a)	*any four from:* carbaminohaemoglobin **;** **A** combined with haemoglobin hydrogencarbonate ions / HCO_3^- **;** **R** HCO_3 CO_2 dissolved in the plasma **;**	**2**
4(b)	*any four from:* 1. correct direction of movement for oxygen <u>and</u> carbon dioxide **;** e.g. oxygen, moves from, alveolus / **W**, to, capillary / blood / red blood cells, <u>and</u> carbon dioxide moves from, capillary/ blood /plasma to alveolus / blood to **W** **;** 2. diffusion of, oxygen / carbon dioxide / respiratory gases **;** **A** movement down, partial pressure / concentration, gradient **A** from high(er), partial pressure / concentration, to low(er), partial pressure / concentration **I** along a concentration gradient 3. use of data from Table 4.1 to support movement of oxygen or carbon dioxide **;** *needs ref. to kPa once* *allow ecf from mp2* 4. (diffusion) through, alveolar wall / squamous epithelium **;** 5. (diffusion) through, endothelium / capillary wall **;** 6. AVP **;** e.g. haemoglobin binding oxygen	**4**
4(c)	*any four from:* alveoli / alveolar walls, stretch / expand, during, inspiration / AW **;** arteries / arterioles / blood vessels, stretch / expand, as blood, volume / pressure, increases **;** stretch to prevent (alveoli / arteries), bursting / rupture / AW **;** **A** prevent overstretching recoil during expiration **/** AW, to help, expel / force out, air **;** ***AW*** *in context of alveoli* recoil to apply pressure to blood so maintaining blood pressure **;** *in context of arteries* AVP **;** e.g. allows trachea / bronchus / bronchioles, to expand during inspiration	**4**

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Question	Answer	Marks
4(d)(i)	$\frac{50}{86} \times 100$; 58(%) ; *if extracted values are different allow ecf for calculated answer* *accept ± 1 mm when reading from graph (49 to 51 and 85 to 87)*	**2**

Question	Answer	Marks
4(d)(ii)	*allow 'volume of blood' for 'mean volume of blood per kg body mass'* *any four from:* *description to max 3* 1. trend is / overall / AW, increase in volume of blood, over time / AW *or* increase in volume of blood over time except between 0 and 1–2 months **;** 2. trend is / overall / AW, increase in red blood cell volume, over time / AW **;** *or* increase in red cell volume over time except between 7–8 and 12 months **;** 3. *ref. to* percentage of mean blood volume represented by red blood cells / haematocrit **;** e.g. fluctuates / mainly increasing / decreases between 1–2 and 3–4months / decreases between 7–8 and 12 months **;** *4.* any comparative use of, figures / percentages **;** *to support mp1, mp2 or mp3* *explanation to max 3* 5. lower partial pressure of oxygen at high altitude / less oxygen in inhaled air **;** 6. lower oxygen saturation of haemoglobin / haemoglobin has lower oxygen affinity **;** 7. compensation *or* *idea that* changes occur to make up for less, oxygen taken in / transported to tissues **R** *idea of* body getting more oxygen than at sea level 8. (over time) more red blood cells produced so more haemoglobin / AW **;** 9. (over time) proportion of red cells / concentration of haemoglobin, increases so, take up / AW, greater volume of oxygen **;** **A** more red blood cells per unit time passes through, lungs to take up oxygen / tissues to deliver oxygen 10. AVP **;** e.g. *ref. to* erythropoietin / EPO	**4**

Question	Answer	Marks
5(a)(i)	*Mycobacterium tuberculosis* or *Mycobacterium bovis* ;	1
5(a)(ii)	*max1 if no reference to, infected / uninfected* airborne droplets, breathed / sneezed / AW, out by infected person ; breathed in / inhaled / inspired, by uninfected person ; **or** *in context of M. bovis only* contaminated meat / unpasteurised milk, from infected, cattle / cows ; ingested by uninfected person ;	2
5(b)	*max 4 if no ref. to, (mature) B-lymphocytes / plasma cells, producing / secreting, antibodies* *any five from:* *ref. to* fusion of lysosomes releasing hydrolytic enzymes ; intracellular digestion / described ; e.g. hydrolysis of, (named) cell wall components / proteins / nucleic acids / lipids *ref. to* processing antigens to present on, cell surface membrane / cell surface ; **A** macrophage becomes an, antigen presenting cell / APC ; antigen, recognition / binding, by, B-lymphocytes / T-lymphocytes ; detail ; e.g. clonal selection / have receptors complementary to antigen / specificity of, B-lymphocytes /T- lymphocytes to (non-self) antigen ; **A** immunoglobulin / antibody as receptor for B-lymphocytes clonal, expansion / proliferation ; **A** described e.g. divides by mitosis to form a clone of cells B-lymphocytes, mature to / form, plasma cells that secrete antibodies ; T-helper cells release cytokines ; Cytokine action ; e.g. stimulates, humoral / B-lymphocyte, response	5

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Question	Answer	Marks
5(c)	*any three from:* long-term immunity **;** B and T memory cells remain in the body for, a long time / a lifetime **;** memory cells for secondary (immune) response **;** secondary response is faster / more effective (than primary immune response) **;** (so) higher concentration antibodies / quicker production antibodies **;** *Idea of* more (specific) memory cells in the body than (specific) lymphocytes before primary response **;** increase chance that pathogen encountered more rapidly (to mount a response) **;** AVP **;** e.g. pathogen destroyed before symptoms of illness are caused	**3**
5(d)	*any three from:* *Mycobacterium* / TB bacterium, is an intracellular parasite / lives inside host cells **;** antibodies have no effect on bacteria inside cells **;** only when bacteria are in the, plasma / tissue fluid **;** *idea that* vaccination is not a global occurrence **;** e.g. not part of vaccination programme in many countries only some countries have as part of their vaccination programme BCG is not very effective (for adults) / some people do not respond to BCG **;** BCG does not have the same effectiveness across the world **;** many countries, have no herd immunity / do have enough people that are immune, to prevent spread **;** ref. *to* civil disturbance / AW, collapse of health services **;** AVP **;** *idea that* travellers / tourists / immigrants / displaced people, may be infected with TB and transmit it to host population (that does not have, a vaccination programme / herd immunity)	**3**

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Question	Answer	Marks
6(a)	adenine and guanine ;	1
6(b)	anticodon ;	1
6(c)	CAG / cytosine, adenine, guanine ; **A** GAC	1
6(d)	hydrogen bonds form (between complementary bases) ;	1

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