Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **October/November 2019**

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** 2019 series for most Cambridge IGCSE™, Cambridge International A and 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.

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

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Question	Answer	Marks
1(a)	label line to phloem in one vascular bundle **;**	**1**
1(b)	transport / translocation, of, assimilates / photosynthates / sucrose / sugars / amino acids / other named nutrient **; I** food from, source / areas of synthesis, to, sink / areas of growth / areas of (high) activity / areas of storage **;** **A** areas where they are needed *for sink* **I** 'where they used'	**2**
1(c)(i)	epidermis / epidermal **;** **I** upper / lower	**1**
1(c)(ii)	eyepiece graticule **;** **I** stage micrometre	**1**
1(d)	*drawing max 2:* regular shaped cell and cell wall drawn in **;** central vacuole drawn **;** *labels:* *max 2 if animal structures also labelled* *max 1 for labels if incorrect non-cellular structure included* *e.g. vascular bundle / stoma* large / permanent, vacuole **;** **A** central vacuole **A** vacuole *if clearly drawn as large* tonoplast **;** **R** *if drawn as double membrane* (cellulose) cell wall **;** **R** chitin / murein plasmodesma(ta) **;** chloroplast **;** **A** granum / thylakoid *i.e. chloroplast not labelled but internal structures correctly labelled* **A** if drawn with a single or double membrane starch, grain / granule **;** **A** amyloplast	**5**

Question	Answer	Marks
2(a)	EMRO and SEARO / Eastern Mediterranean and South-East Asia (Regions)	**1**
2(b)	*max 1 (tar data mark or nicotine makes platelets sticky) if tar / CO also stated* *any two from:* (AFRO) has more nicotine **;** **R** has more, tar / tar and nicotine / CO and nicotine (*see below)* nicotine makes platelets sticky / AW **;** **A** damages endothelial lining (so turbulent blood flow) so increases clotting risk **R** if also state tar makes platelets sticky 0.92 and 0.77–0.79 mg (per cigarette) **or** 9.2 v. 7.7–7.9 mg (per cigarette) **or** (AFRO) 1.3–1.5 mg (per cigarette) higher **;** *correctly extracted numerical data for tar is alternative to gain mp 3 ecf* 12.5–12.7 v. 11.3–11.5 mg / (AFRO) 1.0–1.4 mg higher	**2**
2(c)	*allow, Hb / hb, for haemoglobin and allow CO for carbon monoxide* *any four from:* **1** haemoglobin, has a higher affinity for / binds more readily with, carbon monoxide (than oxygen) **;** **A** carbon monoxide displaces oxygen from haemoglobin **A** carbon monoxide binds to Hb and decreases its affinity for oxygen **2** carboxyhaemoglobin formed **;** **3** binding is, (mainly) irreversible / permanent / (more) stable (than oxygen binding) / AW **;** **4** decreases saturation of haemoglobin with oxygen (in the lungs) / less haemoglobin available to bind oxygen **;** **A** less oxyhaemoglobin formed / less oxygen binds to haemoglobin *cigarette smoke:* **5** low concentration of oxygen in inhaled cigarette smoke **;** **6** *ref. to* (in airways), narrowed lumen / inflammation / increased mucus / accumulated, mucus **;** **A** bronchial constriction **7** (so) lower concentration of / less, oxygen, reaching alveolus / in alveolar air **or** (so) less oxygen, diffuses / AW, (from alveolus) into bloodstream / reaches red blood cells / reaches haemoglobin (in red blood cells) **;** **R** *ref. to* consequence of emphysema *must be in context of mp 5 or 6* **8** AVP **;** e.g. nicotine causes vasoconstriction and reduces blood supply (to extremities)	**4**

Question	Answer	Marks
3(a)	*any two from:* **1** higher / better, resolution **A** higher resolving power **I** clearer resolution **or** greater ability to distinguish between two points / AW **;** *ignore wavelength values if stated as wavelength but **R** if stated as resolution values* **2** *ref. to* resolution values **;** e.g. able to see points closer together than 200 nm (range 100–300 nm) can see, points up to 0.5 nm (0.0005 µm) apart (range 0.2–1.0 nm) can see structures larger than 0.5 nm **3** thinner sections can be obtained **;** **A** idea that complete image will be in better focus **4** able to see, ribosomes / membranes / detail <u>within</u> organelles **;**	**2**
3(b)	*any three from:* **1** (shape of) red blood cell is biconcave *accept biconcave from a diagram* **or** (shape of) erythroblast is, cuboidal / spherical / not biconcave / irregular / AW **;** **2** red blood cell has no nucleus / erythroblast has nucleus **;** **3** erythroblast has, mitochondria / organelles / named organelles **or** red blood cell has no, mitochondria / organelles / named organelles **;** **4** red blood cell has more haemoglobin / erythroblast has less haemoglobin **;** **I** *ref. to* haem *statement only about erythroblast*: **A** erythroblast has no haemoglobin *statement only about rbc: must say <u>more</u> haemoglobin* *statement with both:* **A** red blood cell has haemoglobin, erythroblast has no haemoglobin **5** AVP **;** e.g. erythroblast, is larger / basophilic red blood cell is more flexible	**3**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(c)(i)</td><td>3 structures correct and involvement, incorrect / not stated, allow 1 mark three correct rows
I extra rows added with additional structures

<table>
<tr><td>nucleus / chromosome</td><td>(has) gene / DNA, coding for protein
or (for) transcription / mRNA synthesis ;
A produces ribosomes if stated as made in nucleolus</td></tr>
<tr><td>nucleolus</td><td>produces, rRNA / ribosomes / ribosomal subunits ;</td></tr>
<tr><td>ribosome
A ribosomal subunit</td><td>(site of) polypeptide / protein, synthesis
A described I makes amino acids
A to synthesise enzymes

or (for) translation

or binding of, mRNA / tRNA ;</td></tr>
<tr><td><u>rough</u> endoplasmic reticulum
A rough ER / RER
R wrong word for ‘rough’ if RER also stated</td><td>site of, polypeptide / protein, synthesis
A described
A to synthesise enzymes

or (for) translation

or (for) attachment of ribosomes

or protein / post-translational, modification
A examples

or protein transport ;
I packaging proteins</td></tr>
<tr><td>transport vesicle</td><td>to move protein from RER to Golgi (body / apparatus / complex) ;</td></tr>
<tr><td>Golgi (body / apparatus / complex)</td><td>for, protein / post-translational, modification / AW ;
A examples
I packaging proteins</td></tr>
<tr><td>mitochondrion</td><td>provides / produces, ATP for, tRNA aminoacylation / charging amino acids before attachment to tRNA ;</td></tr>
</table></td><td>3</td></tr>
<tr><td>3(c)(ii)</td><td>carbonic anhydr<u>ase</u> ;
R carbon anhydrase / anhydrase</td><td>1</td></tr>
</table>

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Question	Answer	Marks
3(d)	*assume spherocytosis type 2 unless stated otherwise* *any two from:* spherical means reduced surface area (to volume ratio) (so less oxygen diffuses in) **;** **A** SA *for surface area* *idea of* further distance for oxygen to reach, (some) haemoglobin molecules / centre of red blood cell **;** not enough time to reach, same level of / 98%, saturation of haemoglobin **;** *idea of blood flowing through* *ref. to* spherical shape / larger / less flexible, so less able to pass through, (pulmonary capillary) network / AW **;**	**2**
3(e)	*any three from:* *(water potential gradient created / loss of equal water potentials, so)* *similarities* **1** water enters cells, by osmosis / down the water potential gradient / from high to low water potential **;** **A** Ψ for water potential **2** both type of cell, swell / increase in size **;** *differences* **3** spherocytosis cells, burst / lyse, more easily / before red blood cells **;** **A** spherocytosis cells burst more quickly **A** spherocytosis cells burst and red blood cells do not burst **4** AVP **;** e.g. spherocytosis cells already more swollen spherocytosis cells have more pressure exerted (on their cell surface membrane) than normal red blood cells AW *idea of* spherocytosis cells unable to take in as much water and stay intact ref. to less stable / less support for membrane, so weaker membrane (for spherocytosis cells) **I** less flexible	**3**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td>
<table>
<tr><th>polymer</th><th>constituent monomer</th><th>type of bond between monomers</th></tr>
<tr><td>amylose</td><td>glucose</td><td rowspan="2">glycosidic
glycosidic ;
A glucosidic

I details of bond</td></tr>
<tr><td>cellulose</td><td>glucose</td></tr>
<tr><td>collagen</td><td>amino acid ;
R protein (amino acid)</td><td>peptide</td></tr>
<tr><td>DNA</td><td>DNA nucleotide</td><td>phosphodiester ;</td></tr>
<tr><td>glycogen</td><td>(α-)glucose ;
R β-glucose</td><td>glycosidic</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>4(b)</td><td>two from

1 amylose composed of α-glucose (monomers) <u>and</u> cellulose composed of β-glucose (monomers) ;

2 (amylose) α-1,4 v. (cellulose) β-1,4 (glycosidic) bonds ;
R if amylose stated to have α-1,6 bonds
I ref. to cellulose also has hydrogen bonds
If mp 1 and 2 not stated allow one mark for amylose has α-glycosidic bond and cellulose has β-glycosidic bond

3 (cellulose) adjacent, monomers / glucose(s), rotated through 180° ; AW
R ref. to heads / tails

4 amylose has an (energy) storage function v. cellulose has structural function / description relating to cell wall ;</td><td>2</td></tr>
</table>

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Question	Answer	Marks
4(c)	*max 2 from mp 1 and 2 if transcription described or mix and match transcription and replication* *any five from:* **1** DNA (double helix / molecule) unwinds **;** **I** unzips **R** DNA, strand / α helix, unwinds **2** hydrogen bonds break between, base pairs / bases / strands **;** **A** hydrogen bonds break between nucleotides *only if clear that two strands are separated* **3** both strands used as templates **;** *concise statement* **4** DNA polymerase, qualified **;** e.g. involved in polynucleotide formation / phosphodiester bond formation / catalyses synthesis **R** joins phosphates **5** *ref. to* (free) activated (DNA) nucleotides / AW **;** **A** phosphorylated nucleotides **R** RNA nucleotides **6** complementary (DNA) nucleotides added **;** **R** RNA nucleotides **A** described in terms of complementary base pairing **A** A pairs with T and C pairs with G **7** *idea that* process, occurs / continues, along whole DNA molecule **;** **8** *ref. to* Okazaki fragments / movement of polymerase in one direction / nucleotides added in one direction **;** **A** correct ref. to leading and lagging strands **9** each newly formed molecule contains one original and one newly synthesised strand **;** **10** AVP **;** e.g. replication bubbles form / described *ref. to* repair / proofreading *ref. to* helicase (unwinding) / ligase (joining Okazaki fragments) *in correct context* **R** ligase joining phosphates process occurs, step-by-step / sequentially / AW *ref. to* RNA primers	**5**

Question	Answer	Marks
5(a)	**1** prevents formation of, cross links / cross linkages (between, peptidoglycan / murein, chains) **;** **A** peptide cross links **A** links between, murein / polymer, chains **I** peptide bonds **I** formation of peptidoglycan **R** if cellulose chains stated **2** (penicillin) inhibits, transpeptidase action / enzyme involved in forming cross links **;** **A** alternative correct names for transpeptidase **3** weakens cell wall **;** **A** cell wall unable to withstand (turgor) pressure **A** cell wall loses strength **R** idea that penicillin, punches / makes, holes, to weaken **4** (cell), lysis / bursts / ruptures / AW (so bacterium killed) **;** **5** acts, on growing bacteria / when bacteria are increasing in size (when cell wall needs to be synthesised) **;** **I** growing, wall / peptidoglycan chains	**3**
5(b)	*(Plasmodium / P.), ovale / falciparum / malariae / vivax ; correct spelling* **I** *if Plasmodium is written after the species name* *if more than one given, all must be correct*	**1**
5(c)	*any one valid suggestion:* male does not, need protein for egg production / produce eggs **;** **R** larvae **I** male does not reproduce male does not have mouthparts for piercing skin **;** AW e.g. no 'needle' to pierce skin (to suck blood) adult male does not feed **;** adult male feeds (only) on, plants / nectar **;** blood is toxic to males **;** can't detect presence of, humans / mammals **;** male does not produce anticoagulant (for blood) **;**	**1**

Question	Answer	Marks
5(d)	*accept mosquito or vector for Anopheles* *accept, pathogen / parasite, for Plasmodium* *max 2* **1** *idea that* individuals / people, taking antibiotics for bacterial diseases will pass on antibiotics to *Anopheles* when it feeds **;** e.g. blood taken by *Anopheles* contains antibiotics **2** (so) antibiotics kill bacteria (in *Anopheles* gut) **;** *must be in context of gut bacteria* **3** decreased / no, competition between, *Plasmodium* and (gut) bacteria (so more *Plasmodium* survives) **;** **4** higher survival of *Plasmodium* makes effective (*Anopheles*) immune response more difficult **;** AW *(so Anopheles more likely to pass on Plasmodium)* *max 2* **I** ref. to antibiotic resistance **5** use of antibiotics may increase, incidence / number of cases of, malaria **;** **6** and **7** *two marks for* examples of what doctors need to consider **;** e.g. need to balance antibiotic intake with increased risk of malaria transmission *idea that* do not want to stop people taking antibiotics / antibiotics needed to fight (bacterial) infections treat for malaria before giving antibiotics for (non-serious / non-life threatening) bacterial infections only prescribe antibiotics that have, no / low, impact on bacteria in *Anopheles* (gut) (consider) avoiding use of antibiotics to treat malaria **8** AVP **;** e.g. need to research which antibiotics have this effect look for alternatives to antibiotics to treat bacterial infections	**3**

Question	Answer	Marks
5(e)	*any four from:* **1** (*Plasmodium*) is a, eukaryote / protoctist, so has many antigens **;** **R** bacterium / virus, is a eukaryote **or** (*Plasmodium*) has many genes coding for (different) antigens **;** **I** antigenic variation **2** *idea that* different *Plasmodium* species have different antigens **;** **I** antigenic variation **I** strains *for species* **3** (*Plasmodium*) has different stages of life cycle (within human) with different antigens / shows antigenic variation **;** **4** antigenic concealment / *Plasmodium* spends part of life cycle within host cells / AW **;** **A** short time in blood plasma **A** spends time inside, red blood cells / liver cells **5** need to find the antigens that give the strongest immune response **;** **6** need to, develop / use, more than one type of vaccine **;** **A** cannot use only one type of vaccine **7** AVP **;** e.g. mutations will give changed antigens need to find antigens present in, all / most, stages of life cycle *difficulties in producing a generic vaccine max 2* **8** costly to produce / need to keep costs low / developing countries need to be able to afford vaccine **;** **9** needs to have a long shelf life / be stable / be easily stored (e.g. without cold storage) / AW **;** **10** (immunity) needs to be long-lasting / aim to avoid boosters / need to develop a single dose vaccine **;** AW	**4**

Question	Answer	Marks
6(a)	**I** maintains length of chromosomes / prevents chromosome shortening *any two from:* permit continued replication **;** prevent loss of genes **;** **I** prevents gene damage genetic material is neutral **A** genetic / coded, information *for genes* **A** information on DNA **A** protein coding regions of DNA **A** exons protect ends of chromosomes from being, degraded / AW **;** AVP **;** e.g. prevents ends of chromosomes from being attached to each other not mistaken for a break in DNA that needs repairing	**2**
6(b)	*Idea that,* mitosis / cell cycle / (DNA) replication / (cell) division, occurs in both cell types (continuously / regularly / AW) **;** **R** uncontrolled mitosis **R** meiosis	**1**
6(c)	induced fit **;**	**1**
6(d)	*allow low(er) rate for 0.2 μmol dm^{-3} and high(er) rate for 1.6 μmol dm^{-3}* *any two from:* comparison in terms of <u>active site(s)</u> **;** e.g. (low rate) active sites, not all occupied / spare / not all saturated **or** (high rate) active sites all occupied / no spare active sites / active sites saturated bod 'active sites are limited' comparison in terms of enzyme-substrate complexes formed (per unit time) e.g. (low rate) few(er) ES complexes formed **or** (high rate) many / more, ES complexes formed **;** **A** (low rate) few(er) collisions between enzyme and substrate ora (low rate) substrate concentration limiting factor **or** (high rate) limiting factor is, enzyme concentration / not substrate concentration**;**	**2**