Cambridge Assessment International Education

Cambridge O Level

BIOLOGY **5090/21**

Paper 2 Theory **May/June 2022**

MARK SCHEME

Maximum Mark: 80

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 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U 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.

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.

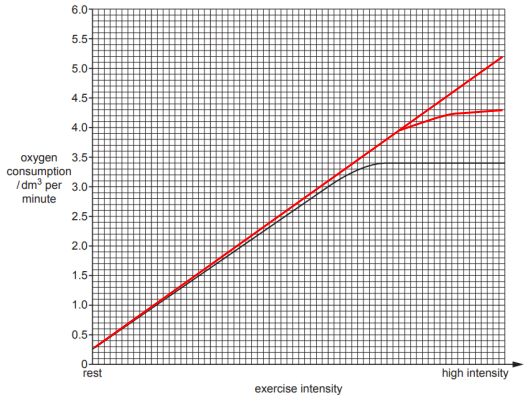
6	Calculation specific guidance Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'. For questions in which the number of significant figures required is not stated, credit should be awarded for 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 schemes will use these abbreviations:

; separates marking points
/ alternatives
() contents of brackets are not required but should be implied
R reject
A accept (for answers correctly cued by the question, or guidance for examiners)
Ig ignore (for incorrect but irrelevant responses)
AW alternative wording (where responses vary more than usual)
AVP alternative valid point (where a greater than usual variety of responses is expected)
ORA or reverse argument
underline actual word underlined must be used by candidate
+ statements on both sides of the **+** are needed for that mark

Question	Answer	Marks	Guidance
1(a)(i)	**B** = blood vessel / capillary / artery / arteriole ;	**1**	
	C = sweat gland ;	**1**	
1(a)(ii)	less blood flows **+** in blood vessel / close to skin surface ;	**1**	
	decrease in radiation / heat loss / **AW** ;	**1**	
	vasoconstriction **OR** blood vessels / arterioles / arteries / part **B +** narrow / constrict ;	**1**	
1(b)	*any **three** from:* **A** is a receptor / nerve ending ; touch / pressure / pain / temperature ; examples of uneven distribution e.g. high density in fingers / lips ; exposed areas **+** need higher sensitivity **AW** ;	**3**	
1(c)	*any **two** from:* fatty / adipose **+** tissue / cell ; less food eaten / less fat in diet / exercise; so fat used by body **+** for respiration / release energy ; body using more energy than it is taking in ;	**2**	

Question	Answer	Marks	Guidance
2(a)(i)	*lungs:* enters via nose / nasal passages **+** into larynx / trachea ; travels through bronchus / bronchi / bronchioles ; to air sacs / alveoli ; } any **two**	**2**	
	circulation: diffuses **+** into blood / into capillaries / from blood to muscle; red blood cells / haemoglobin ; transported by pulmonary vein ; pumped by heart ; through arteries / arterioles ; } any **two**	**2**	
2(a)(ii)	*any **two** from:* a larger lung capacity / stronger intercostal muscles ; stronger / thicker **+** cardiac / ventricle muscle ; cardiac muscle able to pump more blood in each cardiac cycle ; improved blood supply to heart muscle ; more haemoglobin / red blood cells ;	**2**	
2(b)(i)	aerobic ;	**1**	
	respiration ;	**1**	
2(b)(ii)	3.4 **+** dm^3 ;	**1**	
2(b)(iii)	*any **three** from:* respire anaerobically ; without oxygen / lack of oxygen ; respiration + energy released ; lactic acid ; lactic acid builds up in / affects **+** muscles ;	**3**	

Question	Answer	Marks	Guidance
2(b)(iv)	line starts close to rest point line on y axis **+** continues upwards on same straight line as before training ;  	**1**	
	maximum oxygen consumption is higher **+** reached at higher exercise intensity ;	**1**	**accept** lines that continue in a straight line or plateau.

Question	Answer	Marks	Guidance
3(a)(i)	*removal of leaves:* reduction **+** surface area / stomata ;	**1**	
	covering with transparent bag: increase humidity ;	**1**	
	to reduce transpiration **OR** evaporation / water loss ;	**1**	
3(a)(ii)	*any **two** from:* production of genetically identical offspring / clones ; mitosis ; from one parent/ **AW**;	**2**	

Question	Answer	Marks	Guidance
3(b)	*function:* xylem vessels transport water and/or minerals ;	**1**	
	adaptation: long / thin / no end cell walls / hollow tubes / no cytoplasm ;	**1**	
	function: (mechanical) support / keeps stem upright ;	**1**	
	adaptation: lignified **OR** woody / strengthened / hard **+** walls ;	**1**	
3(c)	*any **five** from:* **1** artificial selection / selective breeding ; **2** transfer pollen / pollination ; **3** from anther / stamen of one plant **+** e.g. red petal colour ; **4** to stigma / carpel /pistil of another ; **5** fertilisation **OR** gametes / genetic material **+** combined **AW** ; **6** grow seeds ; **7** select the ones with best combination of characteristics ;	**5**	

Question	Answer	Marks	Guidance
4(a)	ileum / small intestine ;	**1**	
	hepatic portal vein ;	**1**	
4(b)	*any **three** from:* lock and key ; shape **AW +** active site / enzyme / amino acids different shapes ; complementary / fits / matches ; binds **AW** to a substrate / enzyme-substrate complex / ES complex ; wrongly shaped substrates cannot fit **+** active site ;	**3**	

Question	Answer	Marks	Guidance
5(a)(i)	light /carbon dioxide from air **+** for photosynthesis **OR** more **AW +** light / carbon dioxide **;**	**1**	
5(a)(ii)	**A** = stoma ;	**1**	
	B = air/ intercellular **+** space ;	**1**	
5(a)(iii)	*any **three** from:* stomata **+** on upper surface **AW** ; gaseous exchange / air enters / air leaves ; carbon dioxide **+** for photosynthesis ; large **+** air spaces ; air space **+** leaf buoyancy / float / less dense ;	**3**	
5(b)	producer / first trophic level ;	**1**	

Question	Answer	Marks	Guidance
6(a)	*any **four** from:* virus is smaller **ORA** ; both contain genetic material ; animal cell always DNA **+** virus DNA or RNA ; animal cell has (cell surface) membrane **ORA** ; virus has a protein coat / capsid **ORA** ; animal cell has a nucleus / nuclear membrane **ORA** ; animal cell contains cytoplasm / organelles / named organelle **ORA** ;	**4**	

Question	Answer	Marks	Guidance
6(b)(i)	*any **three** from:* sexually transmitted ; blood transfer / blood transfusion **AW** ; sharing **AW +** needles / razors ; from mother to baby **+** across placenta / during pregnancy / during birth / breastfeeding ;	**3**	
6(b)(ii)	*any **three** from:* number infected increasing / more people infected in 2018 than 2000 ; rate of infection decreasing / slowing down ; correct data manipulation **+** data quoted to illustrate either point ; number treated for HIV increasing / more people treated in 2018 than 2000 ; a much bigger proportion of those infected being treated ; correct data manipulation **+** quoted to illustrate the point e.g. in 2000 less than 5% treated in 2000 and in 2018 over 60% treated ;	**3**	

Question	Answer	Marks	Guidance
7(a)(i)	crushing /grinding / chewing / increasing surface area of food ;	**1**	
7(a)(ii)	*any **four** from:* blood under pressure ; capillary **+** thin wall /one cell thick ; soluble materials / plasma **+** squeezed / leaks out ; oxygen / glucose **+** from capillary / to cells ; carbon dioxide / urea **+** from cells / to capillary / blood ; diffusion ; across cell membrane / partially permeable **+** membrane ; additional named soluble substance e.g. amino acids **+** direction of movement ;	**4**	

Question	Answer	Marks	Guidance
7(b)	*any **three** from:* bacteria ; bacteria **+** feed on **+** sugar / food ; produce acid ; acid **+** corrodes / destroys **AW +** enamel / dentine ;	**3**	
	*any **two** from:* brushing / cleaning / toothpaste ; flossing / mouthwash ; fluoride ; avoid sugar **AW** ; visit dentist ;	**2**	

Question	Answer	Marks	Guidance
8(a)	*any **four** from:* **1** both trigger responses ; **2** both work on specific effectors **AW** ; **3** nerve impulses fast **+** hormones slow ; **4** nerve impulses electrical **+** hormones chemical ; **5** nerve impulses short term effect **+** hormones longer term effect ; **6** nerve impulses travel along nerve cells / neurones **AW OR** hormones travel in blood / plasma ; **7** nerve impulses all the same / hormones are different chemicals ; **8** nerve impulses generated by receptors **AW** / hormones from glands ;	**4**	} comparative statements required **accept** faster / slower etc.

Question	Answer	Marks	Guidance
8(b)	*any **six** from:* eye <u>receptors</u> / retina / rods / cones ; impulse **+** sensory neurones ; via relay neurones ; to motor neurones ; to effector / muscle ; adrenaline **+** from adrenal glands ; travels in blood **+** to named specific target organ e.g. heart / lungs ; heart beats faster ; stimulates glycogen to be converted to glucose ; more glucose / oxygen / blood **+** to muscles ; air passageways increase in diameter ; blood diverted **AW +** to muscles ; pupils dilate ;	**6**	

Question	Answer	Marks	Guidance
9(a)	*any **five** from:* ammonium ions / urea / nitrates **+** in fertiliser / into soil ; bacteria **+** produce nitrates / nitrification ; root <u>hairs</u> **+** take up / absorb ; active transport ; transported in xylem ; produce amino acids / proteins ; humans ingest / eat **+** proteins ;	**5**	

Question	Answer	Marks	Guidance
9(b)	*advantages* replace nitrogen removed by crops ; needed for improved growth / more yield ; to feed increasing human population ; *disadvantages* production / transport is energy consuming ; promotes monoculture ; degrades soil structure ; reduces biodiversity of soil ; leaches **AW +** into rivers / lakes ; eutrophication / water pollution ; stimulates growth of plants / algal bloom ; decomposition / decay / bacteria feed on **+** algae /plants ; lack of oxygen **+** for water animals / named freshwater animal ;	**5**	