

Markscheme

May 2022

Biology

On-screen examination



15 pages

This markscheme is **confidential** and for the exclusive use of examiners in this examination session.

It is the property of the International Baccalaureate and must **not** be reproduced or distributed to any other person without the authorization of the IB Global Centre, Cardiff.

The following are the annotations available to use when marking responses.

Annotation	Explanation
>	Correct point, place at the point in the response where it is clear that the candidate deserves the mark. For use in analytically marked questions only.
λ	Omission, incomplete
CON	Contradiction
	Valid part (to be used when more than one element is required to gain the mark)
ECF	Error carried forward
0	Dynamic annotation, it can be expanded to surround work
~~~	Horizontal wavy line that can be expanded
	Highlight tool that can be expanded to mark an area of a response

Annotation	Explanation
NGE	Not good enough
0	The candidate has given a response but it is not worthy of any marks
T	Text box used for additional marking comments
SEEN	Seen; must be stamped on all blank response areas and on duplicate pages of concatenated responses
~	Vertical wavy line that can be expanded
WITE	Words to that effect
✓ 1 ✓ 2 ✓ 3 ✓ 4	Award 1, 2, 3, 4 marks. For use in holistically marked questions only

## **Markscheme instructions**

- 1 Mark positively. Give candidates credit for what they have achieved and what is correct. Do not deduct marks for incorrect responses. Do not deduct marks for spelling errors.
- 2 Follow the markscheme provided and award only whole marks.
- **3** Each marking point appears on a separate line.
- 4 The maximum mark for each subpart is indicated in the "Total" column.
- 5 Where a mark is awarded a tick should be placed in the text at the precise point where it is clear the candidate deserves the mark.
- 6 Each marking point in a question part should be awarded separately unless there is an instruction to the contrary in the Notes column.
- 7 A question subpart may have more marking points than the total allows. This will be indicated by the word "*max*" in the Answer column. Further guidance may be given in the Notes column.
- 8 Additional instructions on how to interpret the markscheme are in bold italic text in the Answer column.
- 9 Alternative wording may be indicated in the Answer column by a slash (/). Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.
- 10 Alternative answers are indicated in the Answer column by "*or*". Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.
- 11 If two related points are required to award a mark, this is indicated by "*and*" in the answer column.
- 12 Words in brackets () in the Answer column are not necessary to gain the mark.
- 13 Words that are <u>underlined</u> are essential for the mark.
- 14 In some questions a reverse argument is also acceptable. This is indicated by the abbreviation ORA (or reverse argument) in the Notes column. Candidates should not be rewarded for reverse arguments unless ORA is given in the Notes column.
- 15 If the candidate's response has the same meaning or is clearly equivalent to the expected answer the mark should be awarded. In some questions this is emphasized by the abbreviation *WTTE (or words to that effect)* in the Notes column.
- 16 When incorrect answers are used correctly in subsequent question parts the follow through rule applies. Award the mark and add ECF (error carried forward) to the candidate response.
- 17 The order of marking points does not have to be the same as in the Answer column unless stated otherwise.
- 18 Marks should not be awarded where there is a contradiction in an answer. Add CON to the candidate response at the point where the contradiction is made.
- **19** Do not penalize candidates for errors in units or significant figures unless there is specific guidance in the Notes column.
- 20 Questions with higher mark allocations will generally be assessed using a level response method using task specific clarifications developed with reference to the criteria level descriptors. A candidate's work should be reviewed to determine holistically the mark for each row of the holistic grid and a mark awarded for each row.

Question		Answers	Notes	Total	Crit
1	a	1. Does the cell have a nucleus FE Central vacuole? F Plant cell Animal cell Toroit Animal cell Animal cell Animal cell Toroit Animal cell Animal cel		1	A
	b	<ul> <li>Accept any reasonable suggestion, for example [max 1]</li> <li>does it have chloroplasts?</li> <li>does it have a cell wall?</li> </ul>	Do <b>not</b> accept references to colour, shape or vacuole	1	A
	с	Mitochondrion	Accept mitochondria	1	А
	d	Controls what enters <b>or</b> exits the cell <b>or</b> Separates the cell from the outside	WTTE Do <b>not</b> accept references to protection. Do <b>not</b> accept any reference to cell wall – this is a CON	1	A
	e	Tissues are made out of cells Cells in a tissue are similar (and) work together (to perform a shared function) or Different tissues perform different functions	WTTE, Accept named examples of cells and tissues	3	A

2	-	System 4: Nonyous system			
Z	a	System 1: Nervous system			
		System 2: Reproductive system		2	A
	b	Metabolism		1	Α
				•	
	С	Breaks into smaller pieces			
		or Existence line			
		Easier to swallow			
		To increase the surface area			
			WITE	3	Α
		(so) chemical digestion is faster	Do <b>not</b> accent easier	2 1 3 1 4	
		or			
		(to) allow enzymes to work faster			
	d	Sugars <b>or</b> a named sugar	Accept disaccharide or		
			monosaccharide	1	Α
	е	Accept any two correct features [max 2]			
		<ul> <li>folds or villi or micro villi or finger-like projection or long length</li> </ul>			
		good blood supply			
		<ul> <li>walls of villi or small intestine are one cell thick or semi permeable</li> </ul>			
		lacteal			
				4	Α
		Accept any two correct explanations [max 2]		-	
		large surface area for absorption			
		<ul> <li>to carry nutrients to cell or maintains concentration gradient</li> </ul>			
		<ul> <li>short diffusion distance or efficient transfer of nutrients</li> </ul>			
		<ul> <li>absorbs / transports fatty acids and glycerol</li> </ul>			

3	а	<ul> <li>Accept any reasonable natural source, for example [max 1]</li> <li>decaying or dead plants or animals</li> <li>animal waste</li> <li>soil or dirt</li> </ul>	WTTE, do <b>not</b> accept named nutrients	1	A
	b	<ul> <li>Direct sources: accept any reasonable answer, for example [max 1]</li> <li>fish farm</li> <li>sewage treatment plants</li> <li>industrial plants</li> <li>Indirect sources: accept any reasonable answer, for example [max 1]</li> <li>residential runoff</li> <li>runoff from farms</li> <li>runoff from industrial plants</li> <li>runoff from sewage plant</li> </ul>	WTTE	2	A
	С	Nutrients reaching water source from named source Providing the algae with increased nutrients (so) the algae reproduce more	Accept examples of nutrients WTTE WTTE Do <b>not</b> accept grow. Do <b>not</b> accept algal bloom. Do <b>not</b> award the third mark unless the second is awarded. Do <b>not</b> accept increase in the population of algae	3	A
	d	Algal bloom blocks out sunlight Aquatic plants die due to lack of (sunlight for) <u>photosynthesis</u> Organic material broken down by bacteria causes oxygen in water to be depleted Oxygen depletion leads to death of aquatic organisms	WTTE Accept named organisms	4	A

4	а	The colour of the solution <b>or</b> food colouring (added to water)		1	В
	b	Volume (of water in beaker) Final and initial volumes	Accept quantity / amount / cm³ of water Accept decrease in volume (of water)	3	в
		Time (over which change occurred) <b>or</b> duration of experiment	or change in volume (of water)		
	c	<ul> <li>Accept any two reasonable control variables, for example [max 2]</li> <li>temperature of the environment</li> <li>temperature of the water</li> <li>species of plant</li> <li>wind / air movement</li> <li>dimensions of plant stem</li> <li>surface area of plant leaves</li> <li>light intensity / distance of light (from plant)</li> </ul>	WTTE Do <b>not</b> accept quantity / amount of light	2	В
	d	<ul> <li>Accept any two improvements from the list [max 2]</li> <li>stem was identified</li> <li>solution identified as water</li> <li>specified the numbers of dyes used / greater than 5 dyes used</li> </ul> Accept any two correctly linked justifications from the list [max 2] <ul> <li>different parts of the plant may be affected differently</li> <li>shows this is controlled, enables repetition of the experiment</li> <li>gives information about how the IV is manipulated</li> </ul>	Do <b>not</b> accept group two posed a question	4	С
	e	Two significant figures used instead of one (so) smaller rounding errors <b>or</b> the measurements are more precise Inclusion of a control (control) enables a comparison to be made with no dye <b>or</b> normal water	WTTE Ignore "accurate" WTTE	4	С

f	<ul> <li>Accept any suggestion from the list [max 1]</li> <li>it is not clear if they followed the same method</li> <li>too many variables were not explicitly controlled or monitored.</li> <li>differences in the precision of data recorded</li> <li>the two groups had different research questions</li> </ul>	Do <b>not</b> accept the inclusion of control as not following the same method. Accept number of decimal places, do <b>not</b> accept accuracy	1	С
g	Water cannot evaporate directly from the beaker Change in volume is due to transpiration <i>or</i> Evaporation does not affect the volume of water lost		2	С

- 10 -	
--------	--

	1	2	3	4	
1.V (Variables)	Some variables are referred to that are connected to the problem, but these are not explicitly identified	IV or DV (allow rate here for max 2) and one CV is identified	IV <b>and</b> Measurable DV <b>and</b> one CV is identified	IV <b>and</b> Measurable DV <b>and</b> two CV are identified	
2.H (Hypothesis)	Formulates a hypothesis connected to the variables but not explicitly linked to the DV with no explanation	Formulates a hypothesis correctly linked to the DV with no explanation	Formulates a hypothesis correctly linked to the DV with correct scientific reasoning		
3.M (Manipulation / method)	Attempt at a method but detail is insufficient to collect relevant data	Detail of method is incomplete but some relevant data could be collected	Detail of method is sufficient to follow and similar data could be collected	Detail of method is sufficient to repeat the experiment	17
4.D (Data)	Plans to conduct at least three trials <b>or</b> measures for at least five different conditions of IV	Plans to conduct at least three trials <b>and</b> measures for at least five stated conditions of IV	Plans to conduct at least three trials <b>and</b> measures for at least five stated conditions of IV <b>and</b> includes a control condition		
5. J (Justification)	Plans to calculate average <b>or</b> rate	Justification of calculation of average <b>or</b> rate			
6.S (Safety)	A relevant safety consideration linked specifically to a stated hazard				

– 11 –	bio	ImMOEE	NGTZ0X	XXX
ves on a plant				
<b>]</b> nt		2	С	
e [max 1] ed	WTTE	1	С	

а	<ul> <li>Accept one point from the first list [max 1]</li> <li>too difficult / time-consuming to sample all leaves on a plant</li> <li>to increase the accuracy of results</li> <li>to allow the calculation of averages</li> <li>Accept one point from the second list [max 1]</li> <li>to ensure the sample represents the whole plant</li> <li>to avoid (sampling) bias</li> <li>to avoid intentionally selecting certain leaves</li> </ul>		2	С
b	<ul> <li>Accept any reasonable response, for example [max 1]</li> <li>the leaf might not be representative</li> <li>the leaf might be damaged or dead or diseased</li> </ul>	WTTE	1	С
C	Table Object         Maize leaf sample       Number of stor         1       7         2       9         3       8         4       8         5       10         6       5         7       10         8       6         9       8         10       9		1	С
d	Any correctly calculated average eg 80/10 = 8 Stomatal density is calculated: 88.88() <b>or</b> 88.89	ECF from part c Award one mark max if average value is not used and correct working for stomatal density is shown ECF from 1 st marking point. Award two marks max for 88.88	3	С
	Correctly rounded to 89 (mm ⁻² )	Award three marks if only 89 is seen. ECF from 1 st marking point		

6

е	Qualitative		1	С
f	<ul> <li>Accept any reasonable suggestion, for example [max 1]</li> <li>pondweed grows underwater</li> <li>transpiration does not take place</li> <li>gases diffuse through the epidermis (and not stomata)</li> </ul>	WTTE Do <b>not</b> accept it is an aquatic plant	1	С
g	<ul> <li>Sunflowers have stomata on both sides</li> <li>Water lilies have stomata on one side or the top only</li> <li>A further three explanatory points [max 3] <ul> <li>(because) transpiration happens in both sunflowers and water lilies</li> <li>no stomata on the surface in contact with water</li> <li>gas exchange occurs between stomata and air or not between stomata and water</li> <li>high stomatal density on the top of water lily leaves or water lilies have a greater stomatal density than sunflowers</li> <li>water lilies do not need to limit water loss or sunflowers do need to limit water loss</li> </ul> </li> </ul>		5	С

7	а	The interconnected food chains in an ecosystem	1	D
	b	Enzymes break the <u>bonds</u> (between the building blocks)		
		Enzymes speed up the break down of plastics WTTE		
		<ul> <li>Any further mark from the list [max 1]</li> <li>(by) lowering activation energy</li> <li>specific enzymes will break down specific plastics</li> <li><i>Terminology mark</i> <ul> <li>a correct use of one of the terms: catalyse, catalyst, active site, substrate, product, induced fit, lock-and-key, catabolic</li> </ul> </li> </ul>	4	D
	C	1.       2.       Can       digest       a         V       V       V       V       V         Populations       Individuals in a       V       V       V         produce more offspring than the environment can support, so there is come another.       Individuals with characteristics of individuals with characteristics from one another.       Individuals with characteristics of individuals who reproduce become more common in the population.         One of boxes 2, 3 or 4 correctly placed       Boxes 2, 3 and 4 all correctly placed       Individuals	2	D

_	14	—
---	----	---

8	а			•	•	· · · · · · · · · · · · · · · · · · ·		
		Properties and uses	A statement of one physical property <b>or</b> use	A statement of two physical properties or a statement of one physical property and statement of why this property is useful	A statement of at least two physical properties <b>and</b> statement of why each of these two properties are useful	4		
		Environmental consequences	One environmental consequence is stated	Any two different consequences are stated <b>or</b> a common consequence is stated with further discussion	A consequence with further discussion is given for one method <b>and</b> a different consequence for the second method is stated <b>or</b> A common consequence is stated but with further discussion specific to each method	A different consequence with further discussion is given for each method	13	D
		Economic impacts	One impact is stated	Any two different impacts are stated <b>or</b> a common impact is stated with further discussion	An impact with further discussion is given for one method <b>and</b> a different impact for the second method is stated <b>or</b> A common impact is stated but with further discussion specific to each method	A different impact with further discussion is given for each method		
		Concluding appraisal	Gives a concluding opinion about how best to recycle plastics	Gives a concluding appraisal with opinion that includes specific detail <b>or</b> a comparison of methods				

b	Accept any reasonable suggestion, for example [max 2]		
	<ul> <li>government actions (taxes, policy changes)</li> </ul>		
	education (raise awareness of impact of pollution)		
	behavioural changes (choose alternatives, clean-up, reuse)		
	Accept any correctly linked justification [max 2] • incentives would reward or penalize behaviours • knowing the impact of pollution • recognizing how personal responsibility leads to change	4	D