biolmMOEENGTZ0XXXX

Markscheme

May 2025

Biology

On-screen examination

19 pages

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.
	Omission, incomplete
CON	Contradiction
	Valid part (to be used when more than one element is required to gain the mark)
	Error carried forward
	Dynamic annotation, it can be expanded to surround work
	Underline tool that can be expanded
	Highlight tool that can be expanded to mark an area of a response

Annotation	Explanation
	Not good enough
	The candidate has given a response but it is not worthy of any marks
	Text box used for additional marking comments
	Seen; must be stamped on all blank response areas and on duplicate pages of concatenated responses
	Vertical wavy line that can be expanded
	Words to that effect
	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 underlined 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.

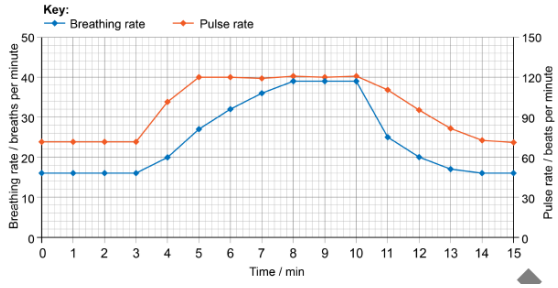
17 The order of marking points does not have to be the same as in the Answer column unless stated otherwise.

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.

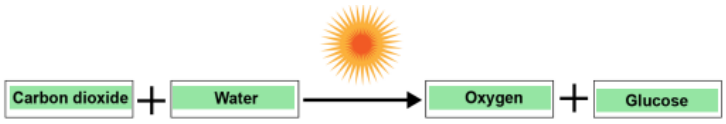
Question		Answers	Notes	Total	
1	a	Virus		1	A
	b	Vertebral column ***or*** backbone ***or*** spinal cord ***or*** spine Birds ***or*** amphibians ***or*** reptiles ***or*** fish	*Accept pharyngeal slits* *dorsal nerve cord* *notochord* *post-anal tail*	2	A
	c	Jaguar Members of the same genus ***or*** both are *Panthera*	*Do not award mp2 if an incorrect species is selected*	2	A
	d	Lion and jaguar ***and*** the sequences are most similar	*8 out of 10 bases are the same*	1	A
	e	Natural selection ***or*** speciation ***or*** survival of the fittest ***Any one point from the list [max 1]*** • (random) mutations • sexual reproduction • meiosis	*WTTE* *Do **not** accept evolution alone. Allow a mechanism that leads to evolution for mp1*	2	A
	f	Amino acids	*Accept ribosomes or rough endoplasmic reticulum*	1	A
	g	Glucagon ***or*** Insulin (Glucagon) raises **or** (insulin) lowers blood sugar	*Accept adrenalin or cortisol or growth hormone or thyroxine in place of glucagon* *Accept a correctly linked mechanism that supports the change in blood sugar.* *Only award mp2 if a correct hormone has been identified*	2	A
	h	Homeostasis		1	D

2	**a**	From a high concentration (in the lungs) to a low concentration (in the blood) ***or*** Down a concentration gradient Through the (alveolar) membrane ***or*** wall ***or*** cell ***or*** capillary	*Do not accept red blood cell*	**2**	A
	b	Red blood cells ***Accept any response from the list [max 1]*** • (oxy)hemoglobin • circulatory system • blood vessels ***or*** arteries ***or*** capillaries	*Accept RBC*	**2**	A
	c	 Increased pulse rate Increased breathing rate One correct data point is used correctly (so) faster (cellular) respiration ***or*** more energy released ***Any further point from the list, [max 1]*** • supplies cells ***or*** muscles ***or*** tissues with more O_2 • supplies cells ***or*** muscles ***or*** tissues glucose faster • removes ***or*** returns CO_2 to the lungs faster	*Accept ATP*	**5**	A

	d	Victor Highest number of white blood cells		**2**	A
	e	***Accept any two reasonable suggestions, for example [max 2]*** • age • fitness • stress • medical history • medication • ethnicity	*Do **not** accept sex or current health status or white blood cell count or red blood cell count or platelet count as this information is provided in the question*	**2**	A

3	**a**	A		**1**	C
	b	Used as a control experiment ***or*** To see if the plants germinated when no light was present	*WTTE*	**1**	C
	c	***One similarity, for example [max 1]*** • both species had seeds that germinated • increasing light intensity increases the percentage germination in A and B • maximum germination at 100% intensity for both species ***One difference, for example [max 1]*** • there were always more seeds germinated for species A than for species B (at all light intensities) • at 50% light intensity 4 seeds of species A germinated compared to only 3 for species B • species B cannot germinate without light • all seeds germinated at 100% light intensity for species A	*ORA* *Accept other correct pairs of values*	**2**	C
	d	Species C does not require light to germinate ***or*** Light intensity does not affect germination for species C		**1**	C
	e	To control (all) other variables ***or*** So that other variables do not affect the results	*Accept named variables* *WTTE*	**1**	C
	f	***Species Y***: 90% ***Species Z***: 80%	*Award 1 mark if both correct but unit is missing*	**2**	C

	g	85% light intensity allows maximum germination for Species Z ***or*** species Z has optimum germination below 85% ***Any one marking point from the list below [max 1]*** • don't know the optimum light intensity for Species Y (between 80 and 90) • 85% was not tested • close to the optimum for species Y ***and*** uses less energy ***or*** lowers energy costs	*Accept 85% as an average if link to reduction in energy use or cost is clear*	**2**	C

4	**a**	 All correct		**1**	A
	b	***Independent variable***: Light intensity ***Dependent variable:*** Length ***or*** height of plant ***or*** stem ***Any two reasonable control variables, for example [max 2]*** • temperature (of the container) • same type of plant • same growth medium • humidity (of the container) • same volume of water (added)	*Do not accept (plant) growth alone*	**4**	B
	c	(increase in light intensity causes) an increase in photosynthesis (which) produces more glucose ***and*** which is used for growth	*Accept sugar or food for glucose, do not accept energy*	**2**	B
	d	***Measurement:*** 45 (mm) ***Average:*** 42 (mm)	*ECF*	**2**	C
	e	Add units to the table		**1**	C
	f	Maximum growth is achieved at 90% ***or*** somewhere between 60% and 90% ***or*** light is no longer a limiting factor ***or*** something else is a limiting factor	*WTTE*	**1**	C

	g	**Accept any reasonable suggestion, for example *[max 1]*** • increase the temperature or grow at optimum temperature • increase the carbon dioxide concentration • add (named) fertilizer or minerals to the soil • grow for a longer time		**1**	C
	h	The results from 30 to 90 ***or*** up to 90 support the hypothesis Beyond 90 ***or*** at 100 the results do not support the hypothesis ***or*** Plant growth became constant above 90%		**2**	C

<table>
<tr><td rowspan="3">5</td><td>a</td><td>To change temperature</td><td>WTTE

Do not accept “to control temperature” unless linked to IV</td><td>1</td><td>B</td></tr>
<tr><td>b</td><td><table><tr><th>Temperature / °C</th><th>Increase in average length of plant stems after 15 days / mm</th></tr><tr><td>30</td><td>9</td></tr><tr><td>35</td><td>21</td></tr><tr><td>40</td><td>42</td></tr><tr><td>45</td><td>43</td></tr><tr><td>50</td><td>2</td></tr></table>
y axis scale has even increments

x axis labelled with Temperature and ºC and y axis labelled with <u>Increase</u> in (average) length (of plant stems after 15 days) and mm

Four points plotted correctly</td><td>Accept degree as symbol or word</td><td>3</td><td>C</td></tr>
<tr><td>c</td><td>As the temperature increases, plant growth increases (until temperature = 45°C or length = 43 mm)

Due to increased (rate of) photosynthesis

Plant growth is reduced beyond 45(°C)

(Temperature causes) enzymes to denature or stomata to close

(so) photosynthesis or transpiration or gas exchange stops thus plant growth stops</td><td>Award mp1 and mp3 for correct use of term optimum in relation to plant growth between 40-50°C.

WTTE</td><td>5</td><td>C</td></tr>
</table>

6			**16**	

	1	2	3	4	***Notes***
Variables	Explicitly states appropriate: IV ***or*** DV	Explicitly states appropriate: IV ***and*** DV	Explicitly states appropriate: IV ***and*** DV ***and*** one CV	Explicitly states appropriate: IV ***and*** DV ***and*** two CVs	*Only requirement is to state using the terminology of IV, DV and CV. No need to explain further.* ***IV:*** *Soil pH* ***Do not accept*** *pH alone, or pH of solutions* ***DV:*** *For example, length or height or mass of plant* ***Do not accept*** *plant growth alone as it is not clear what is being measured. Accept plant growth when clarification of what is measured can be found in the response.* ***CV:*** *For example, plant species, temperature of the growing container, light intensity, mass of soil, volume of solution use, duration of experiment, initial plant length* *Control variables must be qualified in the variable section. For example,* ***do not accept*** *temperature or light alone.* ***Do not accept "****keeping equipment the same" as a CV.*
Equipment	Specified equipment considers DV ***or*** CV	Specified equipment considers DV ***and*** CV			*Equipment needs to be correct for the given situation and stated CVs.* ***Do not accept*** *equipment that is mentioned in the question / instructions.*

Method	Method is linked to IV ***or*** DV	Method is linked to IV ***and*** DV but is incomplete	Method linked to IV ***and*** DV ***and*** can be followed	Method linked to IV ***and*** DV ***and*** can be followed ***and*** include details on how to control main CVs	*A method that does not include how to vary the IV is incomplete.* *Limited information about CVs mean that data is unlikely to be relevant*
Data	Any reference made to different variations of the IV	At least five variations of the IV ***or*** at least three trials	At least five values of the IV ***and*** at least three trials	At least five values of the IV between 3.5 and 10 ***and*** at least three trials ***and*** takes an average	*The values of the five or more variations should be explicitly stated for 3 or 4 marks*
Safety	Relevant safety precaution ***or*** statement relating to safety	Relevant justified safety precaution linked to a specific hazard or risk			*Do not accept general considerations not linked to the specific investigation, e.g. wear a mask, tie hair back*

7	**a**	***Any two reasonable suggestions, for example [max 2]*** • cost effective • still collects useful data • easy to employ • citizen scientists can be utilized		**2**	D
	b	Grassland		**1**	D
	c	***Any reasonable suggestion, [max 1]*** • change of land usage (agriculture, urbanisation) • destruction of (grassland) habitat (including nesting sites) • increased predation • competition for resources • greater human interference – mowing, leisure • fewer conservation efforts	*ECF from part (b)*	**1**	D

<table>
<tr>
<td></td>
<td>d</td>
<td>
<table>
<tr><th></th><th>How the data can be used</th></tr>
<tr><td>Breeding site locations</td><td>• tracks possible changes in breeding locations (over time)
• timing of breeding
• identifies which species use the same breeding sites
• can identify what is eaten when breeding
• preferred breeding conditions can be investigated
• establish protections while breeding</td></tr>
<tr><td>Feeding site locations</td><td>• tracks possible changes in feeding locations (over time)
• timing of feeding
• information on the route taken
• which species use the same feeding sites
• what is eaten
• preferred feeding conditions can be investigated
• establish protections while feeding</td></tr>
<tr><td>Population estimation</td><td>• changes in populations
• predictions or population modelling
• population distributions or where the birds live/thrive
• ratio of young to adult
• can help to identify causes of population change</td></tr>
<tr><td>Lifespan and survival rate</td><td>• changes over time
• predictions or trends in lifespan changes
• health data, causes of death or factors that affect lifespan
• the effect of human or natural impacts
• monitoring of species close to extinction</td></tr>
</table>
</td>
<td>WTTE</td>
<td>4</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>e</td>
<td>Any reasonable suggestion, for example [max 2]
• habitats of breeding sites destroyed
• breeding sites move (further north) or new feeding sites found
• migration happens at different times
• food is not available (at the same time each year)
• regional variation
• some may not need to migrate anymore</td>
<td>Award max 1 for destruction</td>
<td>2</td>
<td>D</td>
</tr>
</table>

8			**16**	D

How the use of radio and satellite technology has advanced our approach to conservation of animals

Mark	Descriptor	Examples
1	A statement	***Statements*** • knowledge of feeding sites • understand migration patterns • track endangered species • can pinpoint the exact location of animals ***Support*** • create national parks to protect feeding sites • less interference with the animals • evaluate success of conservation programmes • do not need to disturb them in the wild
2	A statement with further support ***or*** Two statements	
3	Two statements with further support for one	
4	Two statements with further support for both	

Ethical considerations about the use of animal tracking devices with justification		
Mark	**Descriptor**	**Examples**
1	An ethical consideration	***Consideration*** • collars are heavy • animals cannot give consent • location data could be misused • trackers emit radio waves or batteries ***Support*** • heavy collars might change their behavior or restrict movement • animals do not have a choice to participate in research • hunters or poachers could find the animals more easily • long-term exposure to radio waves or battery acid might be harmful
2	Two ethical considerations ***or*** One ethical consideration with support	
3	Two ethical considerations with support for ***one***	
4	Two ethical considerations with support for ***both***	

Political considerations for a tracker that can be used over a large area		
Mark	**Descriptor**	**Examples**
1	A political consideration	***Consideration*** • animals do not respect national boundaries • tracking data could be misused • fosters collaboration • who owns the data? ***Support*** • different countries have different conservation laws or traditions • misused for other uses, e.g. whaling, poachers, spying • scientists from different countries must work together to examine tracking data • could lead to conflict when countries do not want to share information
2	Two political considerations ***or*** One political consideration with support	
3	Two political considerations with support for ***one***	
4	Two political considerations with support for ***both***	

Economic consideration of radio and satellite technology for tracking animals		
Mark	**Descriptor**	**Examples**
1	An economic consideration	***Consideration*** • high cost of technology • will never make a profit ***Support*** • money used for this cannot be used to address more pressing issues • technology is not available to all governments. • requires a large investment of government funds • (but) information is valuable and requires funding
2	An economic consideration with support	

Concluding appraisal		
Mark	**Descriptor**	**Examples**
1	A concluding opinion	***Opinion: a relevant comment*** • it's good because we can learn about migration routes of animals. • it's bad because there are already too many satellites in space ***Appraisal: a relevant comment that considers two or more aspects with some detail*** • it's good because although it's expensive, it enables us to learn more about different animals • it's bad because it can potentially impact the behaviour of animals and uses natural resources that could be used for other things
2	A concluding appraisal with justification	