

# Markscheme

May 2017


















Biology

On-screen examination

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

Annotation	Explanation	Shortcut	Annotation	Explanation	Shortcut
	Correct point, place at the point in the response where it is clear that the candidate deserves the mark	Alt+1		No benefit of the doubt	Alt+4
AEr	Arithmetic error		NEX	No explanation given	
	Benefit of the doubt	Alt+3		Not good enough	
	Omission, incomplete	Alt+7		Not worthy of any marks	
CON	Contradiction	Alt+6	NWS	No working shown	
	Valid part (to be used when more than one element is required to gain the mark)			Test box used for additional marking comments	
	Error carried forward	Alt+8		Unclear	Alt+2
	Dynamic annotation, it can be expanded to surround work			Seen; must be stamped on all blank response areas	Alt+9
	Horizontal wavy line that can be expanded			Vertical wavy line that can be expanded	
	Highlight tool that can be expanded to mark an area of a response			Words to that effect	
	Not answered the question				

### Markscheme instructions

- 1 Mark positively. Give candidates credit for what they have achieved and what is correct. Do not deduct marks for incorrect responses.
- 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. Candidate’s work should be marked using a best fit approach. A candidate’s response should be reviewed to determine holistically the band in which the response falls. Once this has been determined, each bullet point within that band should be assessed to see if the candidate has met the requirements of the statement. Where those requirements are met, marks should be awarded, starting from the lowest available mark for that band.

Once this process has been completed if the highest (or lowest) mark available for that band has been determined, the examiner must check the band above (or below) to ensure that the initially correct determination of the band was correctly allocated. For example, there may be sufficient detail in the candidate's response to award the lowest mark of the band above.

**NB. Marks are distributed unevenly across the mark bands as candidates have to include much more detail in their responses to access the highest mark bands.**

Question	Answers	Notes	Total	Criterion
1	<p>a <b>Accept any two human senses other than hearing (2 max)</b></p> <ul style="list-style-type: none"> <li>• vision/sight/seeing</li> <li>• taste</li> <li>• smell</li> <li>• touch/feel</li> </ul>	<p>Do <b>not</b> accept eyes or other organs. Do <b>not</b> accept listening as this is included in the question.</p>	2	A
	<p>b receptor</p>		1	A
	<p>c <b>Any two from the following list in the correct order:</b></p> <ul style="list-style-type: none"> <li>• receptor <b>or</b> sense <b>or</b> a named example of a receptor</li> <li>• sensory nerve cell <b>or</b> nerves <b>or</b> peripheral nervous system</li> <li>• central nervous system <b>or</b> brain <b>or</b> spinal cord <b>or</b> relay neuron</li> <li>• motor nerve cell</li> <li>• effector <b>or</b> muscles <b>or</b> glands</li> <li>• response <b>or</b> a descriptor of a response.</li> </ul>		2	A
	<p>d cochlea</p>		1	A
	<p>e Mitosis</p> <p>Meiosis</p> <p><b>Any two valid pairs of differences (2 max), for example:</b></p> <ul style="list-style-type: none"> <li>• 2 vs 4 cells (are produced)</li> <li>• genetically identical vs not genetically identical</li> <li>• same number of chromosomes as mother cells/diploid vs halved number of chromosomes/haploid</li> <li>• somatic cells vs gametes (are produced).</li> </ul>	<p>The differences appear in separate response boxes. The order of response boxes in the candidate response is confusing.</p> <p>Award marks for <b>pairs</b> of correct differences only.</p> <p>Do <b>not</b> accept sexual vs asexual reproduction.</p>	4	A
	<p>f (anaerobic) <u>respiration</u></p> <p><u>anaerobic</u></p>	<p>Aerobic respiration is a CON, award no marks.</p>	2	A
	<p>g <b>Any three points from the following:</b></p> <ul style="list-style-type: none"> <li>• oxygen is needed for respiration</li> <li>• lack of oxygen leads to cell death <b>or</b> damage</li> <li>• <u>hair cells</u> are not muscle cells, which can switch to anaerobic respiration</li> <li>• (hair) cells are unable to generate energy/ATP in the absence of oxygen</li> <li>• lack of energy/ATP can lead to damage <b>or</b> death of (hair) cells</li> <li>• <u>hair cells</u> cannot be repaired <b>or</b> replaced.</li> </ul>	<p>WTTE</p> <p>Accept ciliated cell in place of hair cell.</p>	3	A

2	a	3900 ± 100 (Hz)		1	C
	b	<p><b>A biological advantage, for example:</b></p> <ul style="list-style-type: none"> <li>• as the loudness of sounds is increased stronger vibrations are transmitted (to the cochlea)</li> <li>• hair cells are stimulated more intensely</li> <li>• thereby more nerve signals are generated (improving hearing).</li> </ul> <p><b>A disadvantage, for example:</b></p> <ul style="list-style-type: none"> <li>• overstimulation/amplification could lead to further damage of (remaining) hair cells</li> <li>• hearing aids do not help when no functioning hair cells are left</li> <li>• hearing aids are ineffective if vibrations are not transmitted to cochlea.</li> </ul>	<p>WTTE</p> <p>Do <b>not</b> accept “using the implant allows the person to hear” alone.</p>	2	A
	c	<p><b>Either</b></p> <ul style="list-style-type: none"> <li>• <u>electrical</u> impulses/signals/stimuli</li> <li>• (because) the stimulation/signal enters the cochlea where otherwise hair cells would be generating nerve signals</li> </ul> <p><b>or</b></p> <ul style="list-style-type: none"> <li>• vibration</li> <li>• which would otherwise originate from eardrum or middle ear bones and stimulate hair cells.</li> </ul>		2	A
	d	<p><b>Any reasonable advantage, for example:</b></p> <ul style="list-style-type: none"> <li>• enables hearing</li> <li>• does not require surgery</li> <li>• low(er) cost (than implant)</li> <li>• readily available.</li> </ul> <p><b>Any reasonable disadvantage, for example:</b></p> <ul style="list-style-type: none"> <li>• expensive</li> <li>• heavy</li> <li>• uncomfortable to wear.</li> </ul>	<p>Advantage and disadvantage should not contradict each other.</p>	2	D
	e	<p><b>Any reasonable advantage, for example:</b></p> <ul style="list-style-type: none"> <li>• enables hearing (even when hair cells do not generate any nerve impulses <b>or</b> even when sound is not transmitted to the cochlea).</li> </ul> <p><b>Any reasonable disadvantage, for example:</b></p> <ul style="list-style-type: none"> <li>• expensive</li> <li>• requires surgery to fit.</li> </ul>	<p>Advantage and disadvantage should not contradict each other.</p>	2	D

3	a	Recessive/h  because parents do not have condition but child does <b>or</b> because if it was dominant the parents would be affected too		2	A						
	b	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="padding: 5px;">Mother</th> <th style="padding: 5px;">Father</th> <th style="padding: 5px;">Child</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">Hh</td> <td style="text-align: center; padding: 5px;">Hh</td> <td style="text-align: center; padding: 5px;">hh</td> </tr> </tbody> </table>	Mother	Father	Child	Hh	Hh	hh	Accept hH	3	A
	Mother	Father	Child								
Hh	Hh	hh									
c	the AA parent will pass on an A (allele) to every child  the child will always inherit an A <b>or</b> dominant allele <b>or</b> the allele inherited from the other parent will have no effect	WTTE	2	A							

4	a	red blood cell / erythrocyte		1	A
	b	(Does) the quantity <b>or</b> amount of <u>oxygen in the blood</u> <b>or</b> <u>body</u> vary with altitude?	WTTE Accept any question that links IV and DV.	1	B
	c	there are only two data points <b>or</b> there is only one trial	Do <b>not</b> accept reference to control variable.	1	C
	d	quantity of oxygen in the blood decreases as altitude increases <b>or</b> there is an inverse relationship	ORA	1	C
	e	Accept any value in the range 78-82 (units).		1	C
	f	<p><b>Any four points from the list:</b></p> <ul style="list-style-type: none"> <li>• a basic, correct reference to homeostasis</li> <li>• if there is less oxygen (in the blood)</li> <li>• (then) the body produces more hemoglobin</li> <li>• to try and increase the quantity of oxygen <u>in the blood</u></li> <li>• at higher altitude availability of oxygen decreases</li> <li>• if there is less oxygen in the air there will be less oxygen in the blood</li> <li>• the availability of oxygen in the air decreases more than the quantity of oxygen in the blood decreases</li> <li>• hemoglobin concentration increases as altitude increases.</li> </ul>	WTTE, points seen in any order	4	C



5	a	<p><b>Independent variable:</b> altitude</p> <p><b>First control variable, from:</b> age of runners, resting heart rate of runners, time of runners acclimatizing, mass of food etc</p> <p><b>Dependent variable:</b> quantity of oxygen in the blood <b>or</b> (percentage) blood saturation <b>or</b> heart rate</p> <p><b>Second, different control variable, from list above</b></p>	<p><i>Accept any reasonable control variable that can be measured.</i></p>	4	B
	b	<p>blood oxygen saturation decreases with altitude</p> <p>heart rate increases with altitude</p> <p><b>Any additional point (1 max)</b></p> <ul style="list-style-type: none"> <li>• to move blood through the body more quickly</li> <li>• to supply oxygen to meet oxygen demand</li> <li>• (because) as the altitude increases the availability of oxygen in the air decreases</li> </ul>	<p><i>WTTE</i></p>	3	C
	c	<p><b>Any two reasonable improvements, for example (2 max):</b></p> <ul style="list-style-type: none"> <li>• more than three altitudes</li> <li>• more than five people</li> <li>• another reasonable control variable.</li> </ul> <p><b>Correctly linked justifications, for example (2 max)</b></p> <ul style="list-style-type: none"> <li>• better idea of trend</li> <li>• data would be more reliable</li> </ul>	<p><i>Do not accept "use better equipment".</i></p> <p><i>Review 5(a) before awarding a mark for an additional measurable control variable.</i></p>	4	C
	d	<p><b>Any reasonable extension, for example (1 max):</b></p> <ul style="list-style-type: none"> <li>• study various ages</li> <li>• study other physiological factors.</li> </ul> <p><b>Correctly linked justification</b></p>		2	C

6	a	<p><b>Any two reasonable control variables, for example (2 max):</b></p> <ul style="list-style-type: none"> <li>• age of pika</li> <li>• sex of pika</li> <li>• time of year.</li> </ul> <p><b>Correctly linked justification (2 max)</b></p>		4	B
	b	at least three individuals		1	B
	c	<p><b>Correct headings:</b> altitude</p> <p><u>mean</u> or <u>average</u> (body) mass</p> <p><b>Both units correct:</b> m <b>and</b> g</p> <p>at least five values recorded</p>		4	C
	d	<p>correct calculation of the difference in mass: 16.6 (g)</p> <p>correct final percentage: 11.874106 <b>or</b> 11.87411 <b>or</b> 12 etc (%)</p> <p>any final value to three significant figures</p>	<p>Award <b>3</b> if only 11.9 is seen. Award (<b>2 max</b>) if 10.6 is seen.</p> <p>If working is shown and these values are not seen, use the highest and lowest values given in part (c) to calculate the % increase, do not accept the % decrease using values from (c).</p>	3	C D D
	e	<p>justification refers to trends in the data</p> <p>answer is supported by numerical data</p>		2	C

f	<p><b>One strength, for example:</b></p> <ul style="list-style-type: none"><li>• separate groups were identified</li><li>• measurements were taken at several altitudes</li><li>• trait was reliably measured.</li></ul> <p><b>One limitation, for example:</b></p> <ul style="list-style-type: none"><li>• did not check if the groups were isolated</li><li>• only looked at one mountain</li><li>• did not check whether the food was the same</li><li>• change in mass does not necessarily mean natural selection has taken place.</li></ul> <p><b>Two further points from either list (2 max)</b></p> <p><b>A concluding appraisal that the method was inappropriate</b></p>		5	C
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7	<ul style="list-style-type: none"> <li>states the problem to be studied</li> <li>some variables are referred to, that are connected to the problem, but these may not be explicitly identified</li> </ul>	1-2	21	B
	<ul style="list-style-type: none"> <li>describes the problem to be studied but this is incomplete</li> <li>formulates a hypothesis connected to the variables but not explicitly linked to the variables with no explanation</li> <li>independent <b>or</b> dependent variable <b>and</b> one control variable are identified</li> <li>incomplete description of how the variables will be manipulated</li> </ul>	3-6		
	<ul style="list-style-type: none"> <li>describes the problem to be studied</li> <li>formulates a testable hypothesis correctly linked to the variables (with no explanation) <b>or</b> formulates a (non-testable) hypothesis with correct scientific explanation</li> <li>independent variable <b>and</b> dependent variable <b>and</b> one control variable are identified</li> <li>detailed description of how the variables will be manipulated</li> <li>some equipment is stated</li> <li>method is likely to give sufficient data relevant to the problem</li> <li>any relevant comment relating to monitoring the health of the participant or an ethical concern eg keeping the test within the normal limits of the human body, informed consent</li> </ul>	7-13		
	<ul style="list-style-type: none"> <li>describes, with reasons, the problem to be studied</li> <li>formulates a testable hypothesis correctly linked to the variables <b>and</b> with correct scientific explanation</li> <li>independent, dependent <b>and</b> at least two control variables are identified</li> <li>detailed description of how the variables will be manipulated</li> <li>relevant equipment is stated</li> <li>method is likely to give sufficient data relevant to the problem</li> <li>any relevant comment relating to monitoring the health of the participant</li> <li>an ethical concern eg keeping the test within the normal limits of the human body, informed consent</li> </ul>	14-21		

8	a	fungus		1	A
	b	introduction of <u>Japanese</u> / <u>foreign</u> / <u>non-native</u> / <u>exotic</u> trees that were carrying the blight disease/fungus/infection	Not "tree" alone	2	D
	c	<b>Correct use of a term from the list:</b> xylem, phloem, transpiration, translocation  <b>Two points from the list below (2 max):</b> <ul style="list-style-type: none"> <li>• xylem <b>or</b> phloem <b>or</b> <u>transport</u> tissue is damaged</li> <li>• transport <b>or</b> transpiration <b>or</b> translocation will be affected</li> <li>• water / mineral nutrients are not transported (by damaged xylem)</li> <li>• sugars / assimilates are not transported (by damaged phloem).</li> </ul>	WTTE	3	D A
	d	<b>Similarity, for example:</b> <ul style="list-style-type: none"> <li>• both can add new traits/characteristics/features to an organism</li> <li>• both can create a new combination of genes.</li> </ul> <b>Difference, for example:</b> <ul style="list-style-type: none"> <li>• genetic engineering produces faster results</li> <li>• genetic engineering can add traits from one species to a new species.</li> </ul>		2	D
	e	(extract the) resistance / target <b>or</b> desired gene / DNA / genetic information...  ...(oxo gene) from <u>wheat</u> <b>or</b> ... <u>oxo</u> gene (from wheat)  insert the gene into the American chestnut (using enzymes)  resistance /target <b>or</b> desired gene /DNA/genetic information is transferred to the offspring	WTTE	4	D

f	<ul style="list-style-type: none"> <li>• a statement of an advantage <b>or</b> a disadvantage</li> <li>• a statement of an environmental <b>or</b> an economic impact</li> </ul>	1-2	15	D
	<ul style="list-style-type: none"> <li>• a statement of an advantage <b>and</b> a disadvantage</li> <li>• a statement of an environmental <b>and</b> an economic impact</li> <li>• the environmental <b>or</b> economic impact is linked to the advantage <b>or</b> disadvantage</li> <li>• a suggestion of how the wider ecosystem could be affected</li> </ul>	3-6		
	<ul style="list-style-type: none"> <li>• a description of an advantage <b>and</b> a disadvantage</li> <li>• a description of an environmental <b>and</b> an economic impact</li> <li>• the environmental <b>or</b> economic impact is correctly linked to the advantage <b>or</b> disadvantage</li> <li>• a correct statement of how the new genetic variant would impact the wider ecosystem linking different factors</li> </ul>	7-10		
	<ul style="list-style-type: none"> <li>• a detailed discussion of an advantage <b>and</b> a disadvantage</li> <li>• the environmental <b>and</b> the economic impacts are correctly linked to the advantage</li> <li>• the environmental <b>and</b> the economic impacts is correctly linked to the disadvantage</li> <li>• a detailed discussion of how the new genetic variant would impact the wider ecosystem linking different factors</li> <li>• a concluding appraisal of all factors discussed</li> </ul>	11-15		