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BIOLOGY

9201/2

Paper 2

Mark Scheme

June 2022

Version: 1.0 Final Mark Scheme



2 2 6 Y 9 2 0 1 2 / M S

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	cell wall		1	AO1 3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	mitochondria		1	AO1 3.1.1a

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	ethanol		1	AO1 3.2.6m

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	without / no oxygen	ignore breathing	1	AO1 3.2.6i

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	46 – 20		1	AO2 3.2.6m 6.3(3)
	26 (cm ³)	allow a correctly calculated value from incorrect readings ignore unit	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	yeast was killed or enzymes (in the yeast) denatured	ignore no CO ₂ produced or respiration stopped allow description of denaturing	1	AO2 3.2.4b

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	use a (thermostatic) water bath	allow description of Bunsen burner and beaker of water allow use an incubator	1	AO4 3.2.6m 6.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	record the start position of the plunger or push the plunger in to zero or record the initial / starting volume	allow calculate the difference between the end value and the start value for 2 marks	1	AO4 3.2.6m 6.1
	record the position of the plunger at the end (of the experiment) or record the final volume		allow measure the movement of the plunger for 1 mark	
	after set / named time	ignore time unqualified	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	energy		1	AO1 3.2.6k

Total Question 01	12
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Question	Answers	Mark	AO/ Spec. Ref								
02.1	<table border="0" style="width: 100%; text-align: center;"> <thead> <tr> <th>Feature</th> <th>How it helps</th> </tr> </thead> <tbody> <tr> <td>Hard outer surface</td> <td>to grip onto plants</td> </tr> <tr> <td>Spear-like structure</td> <td>pierce cells to feed</td> </tr> <tr> <td>Clawed limb</td> <td>to protect from physical damage</td> </tr> </tbody> </table> <p>do not accept more than one line from a box on the left</p> <p>all 3 correct for 2 marks 1 or 2 correct for 1 mark</p>	Feature	How it helps	Hard outer surface	to grip onto plants	Spear-like structure	pierce cells to feed	Clawed limb	to protect from physical damage	2	AO2 3.3.2df
Feature	How it helps										
Hard outer surface	to grip onto plants										
Spear-like structure	pierce cells to feed										
Clawed limb	to protect from physical damage										

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	<p><i>adaptation 1</i> (waterproof coating) reduces water loss</p> <p><i>adaptation 2</i> (reduced surface area) reduces heat loss or reduced surface area reduces water loss or reduced size avoids predators</p> <p><i>adaptation 3</i> moved to an environment more favourable or can travel without using energy</p>	<p>if no other mark awarded, allow protection from predators / damage for 1 mark</p> <p>allow move to where it is warmer or move to where there is more water / food</p>	1 1 1	AO2 3.3.2def

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	<p>any one from:</p> <ul style="list-style-type: none"> • can still reproduce (when no males are available) • can reproduce quicker • no energy / time wasted / needed in finding a mate • no competition for a mate 	ignore no need to find a mate	1	AO3 3.5.1a

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	cut gene from tardigrade chromosome / DNA / nucleus		1	AO1 AO2 3.5.5bc
	transfer to plant chromosome / DNA / nucleus		1	
	<p>then any two from:</p> <ul style="list-style-type: none"> • correct reference to enzyme • correct reference to vector • transfer during early stage of (plant) development 		2	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	tissue culture	allow cuttings	1	AO1 3.5.5a

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	any two from: <ul style="list-style-type: none"> • more food produced • fewer people dying from starvation • greater profit (for farmer) • can grow plants in areas with low rainfall or plants survive with less water(ing) 		2	AO3 3.5.5de

Total Question 02	13
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	(frog) egg		1	AO4 3.1.2 6.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	virus		1	AO4 3.1.2 6.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	30 (mm) / 3 (cm)	allow answer in range of 29 mm / 2.9 cm to 31 mm / 3.1 cm	1	AO2 3.1.2 6.3 (1,10,17)
	$800 = \frac{30}{\text{real size}}$	allow substitution of incorrectly / not converted value	1	
	$\text{real size} = \frac{30}{800}$	allow rearrangement of equation implied at any stage	1	
	0.0375 (mm)	allow answer using incorrectly / not converted value	1	
	37.5 (µm)	allow correctly calculated value from student's measurement allow conversion to µm at any stage	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	any one from: <ul style="list-style-type: none"> • they are too small to see with a light microscope • have not used an electron microscope • microscope does not have sufficient magnification / resolution • not stained (for ribosomes) 	ignore they are too small	1	AO3 3.1.1 6.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	there are fewer people to catch / pass on the infection or vaccinated / immune people will not spread the virus or it is (more) difficult for a disease to spread if there are fewer people left to infect	allow gives herd immunity	1	AO2 3.4.7d

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	virus DNA / genetic material changes	allow virus has mutated	1	AO1 AO2 3.4.7eh
	or virus genes mutate	do not accept reference to the virus causing the mutation		
	(resulting in) different antigens / (surface) proteins	allow a new strain of the virus is produced	1	
	(which) existing / old antibodies do not match / recognise the new virus		1	

Total Question 03	12
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	fat	in either order	1	AO1 3.2.4ac
	protein		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	3.8	allow range from 3.75 to 3.85	1	AO3 3.2.4b 6.3(11)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	enzyme / pectinase denatured	allow (so active site / enzyme) can no longer fit / bind to the substrate	1	AO2 3.2.4b
	shape of active site changes		1	
	(so active site / enzyme) can no longer fit / bind to pectin		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	to enable a (valid) comparison or to ensure validity		1	AO4 3.2.4b 6.1
	(because) a change in temperature would change the (rate of) pectinase / enzyme activity or (because) a change in temperature would change (the rate of) decay		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	5 days		1	AO4 6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	GM tomatoes flattened less than non-GM tomatoes or GM results always lower than non-GM		1	AO2 AO3 6.1 6.3 (11,12)
	non-GM flattened by 2.5 (mm) more (than GM) after 20 days	allow non-GM flattened by 3.9 (mm) (whereas) GM flattened by only 1.4 (mm) or change in flattening of non-GM tomatoes was 2.9 (mm) compared to GM which changed by 0.4 (mm)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	results for GM tomatoes are more precise	allow non-GM results are less precise or the greater the distance flattened the less precise the measurements become	1	AO4 6.1 6.4
	(because) error bars for GM tomatoes are smaller or there is less variation in the results for GM tomatoes	allow because (in non-GM results) the error bars are larger (than GM tomatoes)	1	

Total Question 04	13
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	genes	allow alleles	1	AO1 3.5.3a

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	<p>any one from:</p> <ul style="list-style-type: none"> • chromosomes / DNA / genes not seen / discovered / known • other theories accepted at the time • not considered to be a scientist • no proof (of existence) / lack of evidence 	allow he was only a monk	1	AO3 3.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	there are no white flowers in first generation		1	AO2 3.5.3eg
	<p>or</p> <p>they are all purple flowers in first generation</p> <p>must have been an allele for white flower colour in first generation</p> <p>or</p> <p>effect of allele for white flower colour masked in first generation</p>	<p>alternative route:</p> <p>plants in the first generation must be heterozygous because white flower allele is not expressed (1)</p> <p>(but) white flower allele is expressed in the second generation when two recessive alleles are present (1)</p>	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4		if alternative symbols used and defined, allow all points if not defined, do not accept for mp1 and mp2		AO2 3.5.3g
	gametes correct: Aa and Aa		1	
	offspring genotypes correctly derived: AA Aa Aa aa	allow student's genotypes correctly derived from incorrect gametes	1	
	phenotypes correctly identified AA Aa = purple <u>and</u> aa = white	allow correct phenotypes from incorrect gametes	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	3(:1)	allow a correct ratio from student's incorrect derivation in question 05.4	1	AO2 3.5.3g 6.3(6)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	297 ÷ 105	allow rounding / truncation	1	AO2 3.5.3g 6.3 (6)
	2.82857....		1	
	2.83 (: 1)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	(due to) chance or predicted ratio is only a probability	ignore idea of small numbers not representative ignore anomaly or random or coincidence do not accept due to errors	1	AO3 3.5.3g

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	two different alleles (for a characteristic)	allow has one recessive and one dominant allele ignore not homozygous ignore Aa ignore colours	1	AO1 3.5.3f

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.9	<p>cross purple flowered plant with a white flowered plant</p> <p>if any / some of next generation are white flowered then plant is heterozygous</p> <p>or</p> <p>(with a large sample size) if all are purple flowered then plant is homozygous</p>	<p>do not accept there will be more white flowers in next generation</p>	<p>1</p> <p>1</p>	<p>AO4 AO2 3.5.3ef 6.1</p>

Total Question 05	15
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(cardiac) muscle / muscular		1	AO1 3.2.3b

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	arrow(s) showing flow from pulmonary vein to left atrium		1	AO3 3.2.3hi
	from left ventricle out / up / to aorta		1	
		if no other mark awarded allow arrow showing movement from atrium to ventricle on either side of heart for 1 mark		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	D		1	AO3 3.2.3h

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	any two from: <ul style="list-style-type: none"> • blood flows backwards • full amount of blood does not leave the heart • heart must work harder • can cause blood clots 	allow blood coming into heart mixes with blood that has not left the heart	2	AO3 3.2.3fh

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	<p>blood flow reduced</p> <p>less oxygen / glucose is supplied to the cells (of the body)</p> <p>(so) less respiration</p> <p>(and) less energy released / transferred (which makes person tired)</p> <p>or</p> <p>so heart muscle cannot contract (properly)</p> <p>or</p> <p>heart failure / attack can occur</p>	<p>do not accept energy produced / made / created</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>AO1</p> <p>AO2</p> <p>3.2.3a</p> <p>3.2.6abf</p>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.		5-6	AO3 3.2.3f
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.		3-4	AO3 3.2.3f
	Level 1: Relevant points are made. They are not logically linked.		1-2	AO3 3.2.3f
	No relevant content		0	
	Indicative content <i>Advantages of biological valve:</i> <ul style="list-style-type: none"> • less likely to require medication • reduced risk of side effects from medication • reduced risk that clots may form or reduced risk of blocked blood vessels • reduced risk of heart attacks or strokes • does not produce a (clicking) noise <i>Disadvantages of biological valve:</i> <ul style="list-style-type: none"> • made from animal tissue so possible objections from patient on religious / ethical grounds • not as durable as mechanical or may not last the lifetime of the patient or may require replacing • possible transfer of disease from animal • may be rejected • may need to take immunosuppressant drugs <i>Advantages of procedure:</i> <ul style="list-style-type: none"> • quicker / easier operation • less invasive or shorter recovery time • (possibly) cheaper operation costs • reduced operation / anaesthetic risks <i>Disadvantages of procedure:</i> <ul style="list-style-type: none"> • risks of using a stent eg stent breaking, valve tearing • not proven as a long-term treatment or long-term effects unknown • new procedure so could be unknown risks 			
Total Question 06	16			

Question	Answers	Extra information	Mark	AO / Spec.
07.1	(X =) 1.8(0)	allow 1.75 to 1.85	1	AO2 3.2.5 6.3 (3,11)
	(Y =) 3.1(0)	allow 3.05 to 3.15	1	
	(X÷Y =) 0.58	allow 0.581 / 0.5806 allow correct calculation using values in range for X and for Y	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	line drawn above patient B	allow line drawn above patient B which levels off at same level as B	1	AO3 3.2.5 6.3 (12)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<p>07.3</p>	<p>swimming programme described for one group but second / control group do not swim</p>	<p>allow a group tested before swimming training and after swimming training</p>	<p>1</p>	<p>AO3 AO4 3.2.5 3.2.6</p>
	<p>measure of success eg number of asthma attacks or use of spirometer to obtain a measurement of lung function</p>		<p>1</p>	<p>6.1</p>
	<p>any two from:</p> <ul style="list-style-type: none"> • all young people have asthma or same degree of asthma • test group participate in same intensity / rate / duration of swimming • both / all groups with similar characteristics eg age / gender • equal spread of characteristics eg same number at each age / height / mass or same ratio of males to females 		<p>2</p>	
	<p>large number of people (n x 100 if specified)</p> <p>or continue investigation for several months</p> <p>or calculation of a mean</p> <p>or statistical analysis</p> <p>or production of a graph</p>		<p>1</p>	

<p>Total Question 07</p>	<p>9</p>
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