GCSE

BIOLOGY

8461/1H

PAPER 1 HIGHER TIER

Mark scheme

June 2018

Version: 1.0

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 Assessment Writer.

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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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- 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 two 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.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise 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.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 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.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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	toxins / poisons (secreted by / from / in bacteria)		1	AO1 4.3.1.3
01.2	any **two** from: • wash hands after using toilet / being sick **or** wash hands before preparing / handling food **or** do not prepare food (whilst infected) • isolate yourself • disinfect clothes / surfaces • do not share utensils / cutlery / towels	ignore 'wash hands' unqualified ignore reference to coughing / sneezing allow examples of how isolation could be achieved	2	AO2 4.3.1.1
01.3	antibiotics	allow named examples of antibiotics	1	AO1 4.3.1.8
01.4	immune system is damaged / weakened **or** immune system doesn't function properly white blood cells cannot kill bacteria / *Salmonella* (as effectively)	allow immunocompromised allow lack of / no white blood cells allow no / fewer antibodies so bacteria not killed **or** less phagocytosis so bacteria not killed **or** no / fewer antitoxins to counter toxins	1 1	AO2 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	any **one** from: • (give chickens) antibiotics • don't sell infected chickens / eggs • keep infected chickens isolated / indoors • slaughter the infected chickens	allow (give chickens) monoclonal antibodies allow don't sell the chickens / eggs ignore don't sell chickens / eggs allow keep the chickens indoors ignore keep chickens indoors ignore vaccination / chlorination / disinfection	1	AO1 4.3.1.3
01.6	(cleaning liquid) B **and** greater reduction in number of bacteria (after cleaning) in both locations	ignore few bacteria in both locations allow neither / both **and** idea of experimental error	1	AO3 4.1.1.6 4.3.1
01.7	radius (of area with no bacteria growing)	allow diameter (of the area with no bacteria growing) ignore πr^2 unqualified allow idea of placing agar plate onto graph paper and counting the squares not covered with bacteria	1	AO2 4.1.1.6

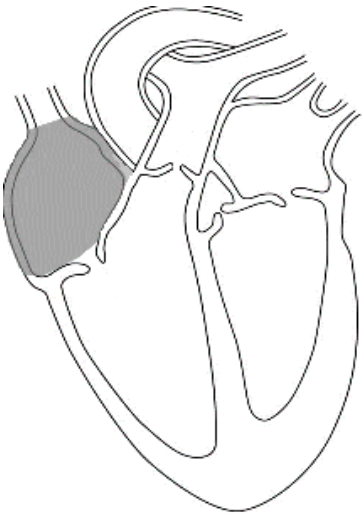
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	repeat **and** look to see if results are similar	ignore repeat unqualified allow repeat **and** look to see if results are different allow repeat and see if there are anomalies ignore repeat and identify anomalies ignore repeat and compare unqualified	1	AO3 4.1.1.6
01.9	any **one** from: • toxicity / side / health effects • effect on other types of bacteria / pathogens • interaction with other cleaners • ease of use • dilution factor of each cleaner (vs. cost) • time cleaner is effective for	 ignore harmful / dangerous allow reference to allergies allow not tested on other types of bacteria ignore germs ignore concentration unqualified ignore how long the cleaner lasts for allow reference to odour of cleaning liquid ignore reference to cost unqualified ignore environmental effects / flammability	1	AO3 4.1.1.6
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any **one** from: • respiration • formation of proteins • formation / breakdown of glycogen • breakdown of (excess) protein **or** formation of urea • photosynthesis **or** formation of glucose / starch (in plants)	allow other correct reference to metabolic reactions in cells ignore reference to digestion ignore formation of carbohydrates	1	AO1 4.4.2.3
02.2	males have a higher metabolic rate than females after five years of age the mean metabolic rate of females decreases faster than males up to 25 years of age	each additional tick negates a mark	1 1	AO3 4.4.2.3
02.3	$\frac{17}{53} \times 100$ 32.075472… 32.1	an answer of 32.1 scores **3** marks allow correct rounding of this to at least 4 significant figures allow a correct reduction to 3 significant figures from an incorrect calculation for marking point 2	1 1 1	AO2 4.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	any **two** from: • (person) R heart rate rose / increased more slowly than (person) S • (person) R heart rate levelled off whereas (person) S continued to increase • (person) R heart rate rose less (overall / after 5 minutes of exercise) than S	allow converse allow correct use of figures eg R increased (overall) by 39 bpm / 65% and S by 54 bpm / 69% ignore lack of units	2	AO3 4.4.2.2
02.5	correct scale and axis labelled all points plotted correctly (to within ± ½ square) line joined point to point or correct curved line of best fit	allow min(s) do **not** accept 'm' the zero is not required on the *x*-axis allow 4 or 5 correct plots for **1** mark	1 2 1	AO2 4.4.2.2
02.6	$\frac{132 - 78}{12}$ 4.5 (minutes) / 4½ minutes / 4 minutes 30 seconds / 4:30	an answer of 4.5 minutes scores **2** marks allow $\frac{54}{12}$ allow sequential deductions of 12 four or five times do **not** accept 4:50 **or** 4 minutes 50 seconds	1 1	AO2 4.4.2.2

Question	Answers	Mark	AO / Spec. Ref.
02.7	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3 4.4.2.2
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • two groups of people - non-smokers and smokers • have at least five people in each group or large groups • get each person to do (named) exercise • controlled variables: - same number of people in each group or large groups - same gender - same level of activity / exercise - same age - no health issues / illnesses - same type of exercise - same time for exercise • record heart rate for each person before and after exercise • calculate increase in heart rate for each person after exercise • compare results for each group for **level 3**, students should refer to at least 5 smokers and 5 non-smokers, carrying out exercise with control variables and a means of determining an increase in heart rate for **level 2**, students should refer to 'groups' of smokers and non-smokers exercising		
Total			**20**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **two** from: • carbon dioxide • water • glucose • amino acids • lactic acid	allow proteins / hormones / antibodies / vitamins / minerals / ions / fatty acids / glycerol ignore sugar / enzymes / nutrients / waste	2	AO1 4.2.2.3
03.2	more haemoglobin (therefore) more oxygen can be carried / transported (for) more (aerobic) respiration of muscle (cells) **or** more energy released for muscle (cells)	**max 2** marks if 'more' is not given allow less anaerobic respiration / lactic acid / oxygen debt / fatigue in muscle (cells) ie addition of 'debt do **not** accept energy produced	1 1 1	AO1 4.2.2.3 4.4.2.2 AO2 4.2.2.3 4.4.2.2 AO1 4.2.2.3 4.4.2.2
03.3	pulmonary artery vena cava		1 1	AO1 4.2.2.2
03.4	B		1	AO1 4.2.2.2

03.5	any **three** from: • arteries have a thick**er** layer of muscle (tissue) **or** veins have a thinn**er** layer of muscle (tissue) • arteries have a thick**er** layer of elastic tissue **or** veins have a thinn**er** layer of elastic tissue • arteries have a narrow**er** lumen **or** veins have a wid**er** lumen • arteries do not have valves **and** veins have valves	if neither marking points 1 or 2 awarded, allow arteries have a thick wall **and** veins have a thin wall **or** arteries have a thick**er** wall **or** veins have a thinn**er** wall for **1** mark do **not** accept 'cell wall' allow descriptions of 'lumen' allow **only** veins have valves	3	AO1 4.2.2.2
03.6	allow an X drawn anywhere in grey shaded area below: 	if a large X is drawn, award the mark if the intersection touches the grey area if a label line is used, award marks if the end of the label line touches the grey area allow label 'pacemaker' ignore label 'right atrium'	1	AO1 4.2.2.2
03.7	an irregular heart beat	allow arrhythmia allow fibrillation ignore heart failure do **not** accept cardiovascular disease / heart murmur	1	AO1 4.2.2.2
Total			**13**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(yes, because) the mass change (of egg 4) is much lower than the others	allow because it / egg 4 has gained (over) 50% less mass than the others allow it / egg 4 has gained 1.5 g and the others have all gained more than 3 g (unit required)	1	AO3 4.1.3.2
04.2		an answer of 4.6 / 4.56 / 4.558 scores **2** marks		AO2 4.1.3.2
	$\frac{75.7 - 72.4}{72.4} \times 100$	or equivalent	1	
	4.6 (%)	allow 4.558 / 4.56 (%) allow any correct rounding of 4.558011049723757	1	
04.3	(mass increased because) water entered by osmosis		1	AO2 4.1.3.2
	from a dilute solution in the beaker to a more concentrated solution in the egg (cell)	allow from an area of high water concentration in the beaker to an area of low water concentration in the egg (cell) allow ref to water potential allow ref to 'strong' and 'weak' solutions ignore along / across concentration gradient do **not** accept 'amount' in place of concentration	1	AO2 4.1.3.2
	through a partially permeable membrane	allow semi-permeable / selectively permeable membrane	1	AO1 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	use five (or more) different concentrations of salt / sugar solution (in beakers)	allow any number of concentrations provided it is more than four	1	AO3 4.1.3.2
	(by) plotting percentage change (in mass / volume) on / using a graph		1	
	determine the concentration where the curve / line crosses the zero percentage change (in mass / volume)		1	
04.5	(ions are moved) from an area of low concentration to high concentration	allow against the concentration gradient allow in terms of solution do **not** accept molecules	1	AO2 4.1.3.3
	(by) active transport		1	AO1 4.1.3.3
	(which) requires using energy	do **not** accept idea of energy being created	1	AO1 4.1.3.3
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(mouthpiece) has pierced / entered the phloem **or** (the aphid) has been feeding from the phloem		1	AO2 4.2.3.2
05.2	yellow leaves due to lack of chlorophyll	ignore 'choroplasts' ignore magnesium is needed to make chorophyll	1	AO1
	(therefore) less / no light absorbed (by chlorophyll)		1	AO2
	(therefore) lower rate of / no photosynthesis	do **not** allow 'energy is produced by photosynthesis'	1	AO1
	(therefore) plant makes less / no sugar / glucose		1	AO1
	(therefore) plant converts less / no sugar / glucose into protein (for growth, so growth is stunted)	allow less glucose / sugar converted into cellulose (cell wall) allow less energy for protein synthesis	1	AO1 4.3.3.1 4.4.1.1 4.4.1.3
05.3	inject the protein / it into a mouse		1	AO1 4.3.2.1
	combine lymphocytes with tumour / cancer cells to make hybridoma (cells)	ignore white blood cells allow T or B lymphocytes ignore tumour unqualified	1	
	find a hybridoma which makes a monoclonal antibody specific to PVY		1	
	(the scientist) clones (the hybridoma) to produce many cells (to make the antibody)	do **not** allow cloning of original stem cells allow many rounds of cloning / mitosis	1	
Total			**10**	

Following updated research information and communications with parents of children with cystic fibrosis, we have decided to withdraw the question on this topic from this paper.

It has been decided not to provide a replacement question as it would not be possible to determine accurately how a replacement question would have performed if it had been part of the original paper taken in 2018.

The following statistics may help you to make effective use of the remainder of the paper:

	Mean mark (maximum mark)
06.1	0.47 (1)
06.2	0.65 (1)
06.3	2.27 (6)
06.4	1.27 (2)
06.5	0.69 (1)
06.6	1.33 (2)
06.7	0.56 (4)
06.8	0.42 (1)
Question 6	7.66 (18)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1		an answer of 560 / 559.8 / 559.78 / 559 (cm^3) scores **3** marks an incorrect answer for one step does not prevent allocation of marks for subsequent steps		AO2 4.2.2.1
	(for calcium) $\frac{500}{605} \times 1000 = 826.446281$ (cm^3)	allow any correct rounding to minimum 3 significant figures allow alternative route with correct rounding	1	
	(for vitamin B-12) $\frac{500}{4.5} \times 2.4 = 266.67$ (cm^3)	allow alternative route with correct rounding	1	
	560 / 559.8 / 559.78 / 559 (cm^3)	allow only correct answer based on values given for vitamin B-12 and calcium	1	

07.2	**Level 2**: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO1 4.2.2.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content • Biuret reagent (allow $CuSO_4$ and NaOH) tests for protein • add Biuret reagent to milk • solution will turn (from blue) to lilac if positive • iodine solution tests for starch (ignore iodine unqualified) • add iodine solution to milk • solution will turn (from orange / brown) to blue / black if positive • Benedict's reagent tests for sugars • add Benedict's reagent to milk and boil / heat (allow any temperature above 60 °C) • solution will turn (from blue) to (brick) red / brown / orange / yellow / green if positive for **level 2**, reference to all three food tests is required		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	lipase breaks down fat into fatty acids (and glycerol)	do **not** accept if 'glycerol' is contradicted	1	AO2 4.2.2.1
	(and) fatty acids lower the pH		1	
	(and when) fatty acids cause the pH to be below 10 (the indicator becomes colourless)		1	
07.4	observation of colour change is subjective / based on opinion	ignore human error unqualified ignore experimental error or examples of this	1	AO3 4.2.2.1
07.5	bile emulsifies fats	allow a correct description of emulsification (ie breaks fat from large droplets into smaller droplets) do **not** accept a description of chemical breakdown	1	AO1 4.2.2.1
	creates a larger surface area (of fat)		1	AO2 4.2.2.1
	(so) lipase can break down fat (to produce fatty acids) more quickly / effectively	allow fatty acids produced by action of lipase more quickly	1	AO3 4.2.2.1
Total			**16**	