

GCSE

BIOLOGY

Paper 2 Higher Tier

Mark scheme Practice Paper Series – Set 1 SGC/S1/SB/2H

Version 1.1

This mark scheme is an original resource written for sciencegcse.co.uk to accompany the Set 1 practice paper SGC/S1/SB/2H. It is not an AQA mark scheme and has not been produced or endorsed by AQA. It follows the structure and conventions of AQA GCSE science mark schemes so that students and teachers can mark the practice paper in the same way that a real paper is marked.

Marking should be carried out using the Information to Examiners on the following pages. The paper has not been standardised, so raw marks should not be converted into grades using any published grade boundaries.

Specification references are to the AQA GCSE Biology (8461) specification, sections 4.5–4.7. AO = assessment objective; WS = working scientifically; MS = mathematical skills; RP = required practical.

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 answer(s) expected, including alternative acceptable wording, in the **Answers** column
- guidance on which answers are and are not creditworthy in the **Extra information** column
- the assessment objective (AO) and specification reference for each marking point.

Award marks positively. Do not deduct marks for incorrect additional material unless it contradicts a correct answer (see 3.1). Marks are awarded for what the student has written, not for what they might have meant.

2. Emboldening and underlining

2.1 Where a list of acceptable answers is given and more than one mark is available, **any two from** (or similar) is used, followed by the acceptable answers.

2.2 A bold **and** indicates that both parts of the answer are needed to gain the mark.

2.3 Alternative answers acceptable for the same mark are separated by **or**. Different words that are acceptable within a marking point are separated by a forward slash (/).

2.4 Words in bold in the Answers column are the essential words that must be present, or their equivalent, for the mark to be awarded.

3. Marking points

3.1 Marking of lists

For a question asking for a fixed number of responses, consider the whole answer, including extra responses. Each incorrect or contradictory response cancels one correct response; ignore neutral additions. Numbered answer lines do not limit marking to the first responses. This rule does not apply to extended answers.

3.2 Marking procedure for calculations

Full marks can be awarded for a correct numerical answer without working, unless the question asks for working to be shown. If the answer is incorrect, marks may be awarded for the correct stages of working shown in the mark scheme. Anything shown in brackets in the Answers column (for example the unit) is not required for the mark.

3.3 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.

3.4 Errors carried forward

Any error in the answer to a structured question causes the loss of the mark(s) for that part only. Later parts should be marked on the assumption that the incorrect answer was correct, where the mark scheme indicates that error carried forward (ECF) applies.

3.5 Phonetic spelling

Accept misspelled or phonetic scientific terms when the intended answer is clear, unless the spelling could be confused with a different technical term. This also applies when the question asks for the name of a process or structure.

3.6 Brackets

Words shown in brackets in the Answers column are not required to gain the mark but help to set the context.

3.7 Allow

Answers that are acceptable but which would not normally be expected are shown as **allow**.

3.8 Ignore

Statements shown as **ignore** are neither creditworthy nor penalised. Mark the rest of the answer normally.

3.9 Do not accept

Statements shown as **do not accept** are incorrect and, where they contradict or replace the expected answer, mean the mark is not awarded.

4. Level of response marking instructions

Extended-response questions (questions 09.3 and 11.3 in this paper) are marked using a level of response mark scheme. The scheme has three levels, each covering two marks, plus a level descriptor and indicative content.

Step 1 – Determine a level. Read the whole answer and decide which level descriptor best fits it. Use a 'best-fit' approach: an answer does not need to meet every part of a descriptor to be placed in that level, and a weak part of the answer need not prevent it from reaching the higher level if the overall quality matches the descriptor.

Step 2 – Determine a mark within the level. Award the higher mark in the level if the answer meets the descriptor fully and the points made are well linked; award the lower mark if the answer only just meets the descriptor or contains minor errors or omissions.

The indicative content is not a checklist: students need not include every point to reach the top level, and other relevant, correct points should be credited. An answer that lists points without linking them into a coherent answer should be placed in a lower level than one that develops and connects them.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	$(300 - 35) \div 300 \times 100$ or $265 \div 300 \times 100$	allow $35 \div 300 \times 100 = 11.7$ (the percentage remaining) for 1 mark	1	AO2 4.7.5.3 MS 1c
	= 88.3 (%)	an answer of 88.3 scores 2 marks allow 88 / 88.33	1	AO2 4.7.5.3 MS 1c
01.2	any two from: (fishing) quotas – limiting the mass / number of fish (each boat) can catch - controlling the size of the mesh / holes in the nets, so that young / small fish escape (and can grow and breed) - banning fishing in some areas / at some times of the year (e.g. when the cod breed)	allow limits on the number of fishing boats / days at sea ignore 'catch fewer fish' without a method	2	AO1 4.7.5.3
01.3	(cod prefer cold water, so) the cod move to cooler water – further north / into deeper water – or fewer cod are found in the (southern) North Sea	allow the distribution of cod moves north	1	AO2 4.7.2.4
	because the warmer water affects their breeding / the survival of their eggs and young or the distribution of their food (e.g. the plankton) changes or other species that compete with cod move into the North Sea	allow the cod cannot survive / grow as well in warmer water	1	AO2 4.7.2.4
01.4	the fungus Fusarium is grown (in large vats / fermenters) on glucose syrup	allow a fungus / mould for <i>Fusarium</i> allow a source of sugar / carbohydrate for glucose syrup	1	AO1 4.7.5.4
	in aerobic conditions / with oxygen (and with a source of nitrogen, such as ammonia)	allow air is bubbled through the mixture	1	AO1 4.7.5.4
	the (fungal) biomass is harvested and purified (to make the mycoprotein)	allow the fungus is separated / filtered from the liquid and processed	1	AO1 4.7.5.4
Total			9	
02.1	(the) thermoregulatory centre	allow the hypothalamus	1	AO1 4.5.2.4
02.2	(nervous impulses from) temperature receptors in the skin	allow the skin senses the temperature of the surroundings	1	AO1 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	any three from: - sweat evaporates (from the surface of the skin) (evaporation) transfers energy from the skin (to the surroundings) (the skin is red because of) vasodilation – the blood vessels / arterioles supplying the skin capillaries widen / dilate (so) more blood flows (through the capillaries) near the surface of the skin and more energy is transferred (to the surroundings by radiation)	allow more heat is lost for more energy is transferred do not accept the capillaries move closer to the skin surface do not accept the blood vessels expand / get bigger without reference to widening	3	AO2 4.5.2.4
02.4	(letter) B		1	AO1 4.5.2.2
	(function) coordinates muscular activity / movement or balance	allow coordination / posture do not accept controls breathing / heart rate (medulla)	1	AO1 4.5.2.2
02.5	any two from: - studying patients with brain damage (and relating the damaged region to the function that is lost) electrically stimulating different parts of the brain (and observing the effect / what the person experiences) MRI scanning (to see which regions are active while a person carries out a task)	allow CT / fMRI scanning for MRI scanning ignore 'scanning' unqualified	2	AO1 4.5.2.2
Total			9	
03.1	(the) liver		1	AO1 4.5.3.3
03.2	excess amino acids (from the digestion of protein) are deaminated to form ammonia	allow the amino group is removed from the amino acids	1	AO1 4.5.3.3
	ammonia is toxic , so it is (immediately) converted to urea		1	AO1 4.5.3.3
03.3	protein molecules are too large to pass through (the walls of the capillaries / the filter into the tubule)	allow protein molecules cannot be filtered because they are too big ignore protein is not filtered without a reason	1	AO2 4.5.3.3
03.4	glucose molecules are small (enough to be filtered into the tubule)	allow glucose is filtered out of the blood	1	AO2 4.5.3.3
	(but) all the glucose is (selectively) reabsorbed (back into the blood)	allow by active transport do not accept glucose is not filtered	1	AO2 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(the concentration is detected by the brain and) the pituitary gland releases (more) ADH (into the blood)	allow anti-diuretic hormone	1	AO2 4.5.3.3 4.5.3.7
	ADH makes the kidney tubules more permeable to water, so more water is reabsorbed (into the blood)	allow less water is lost in the urine	1	AO2 4.5.3.3 4.5.3.7
	(so) a smaller volume of (more concentrated) urine is produced and the blood concentration returns to normal, (when) the release of ADH is reduced – this is negative feedback	allow drinking water for the third mark only if negative feedback or the effect of ADH is also described	1	AO2 4.5.3.3 4.5.3.7
03.6	any one from: - dialysis has to be carried out regularly / several times a week (and takes several hours each time) - the patient must control their diet (between dialysis sessions) - urea (and ions) build up between sessions, so the patient feels unwell - dialysis is expensive (in the long term) - dialysis does not cure the problem	allow dialysis is inconvenient / restricts the patient's life ignore 'less effective' unqualified	1	AO3 4.5.3.3
Total			10	
04.1	any two from: - the concentration for B rises much higher, to (about) 220 (mg per 100 cm³) compared with 140 for A - the concentration for A returns to the starting level (90) within about 2.5 hours, but for B it stays high / does not return to the starting level - the peak for B is later (1.5 hours compared with 1 hour) B starts at a higher concentration (100 compared with 90)	a comparison with data from Figure 2 is needed for each mark allow other correct comparisons using data	2	AO3 4.5.3.2 MS 4a
04.2	the pancreas (detects the high concentration and) releases insulin		1	AO1 4.5.3.2
	(insulin causes) glucose to move from the blood into the cells (of the liver and muscles)	allow glucose is taken up by the cells	1	AO1 4.5.3.2
	(excess) glucose is converted to glycogen (for storage in the liver and muscles)	do not accept glucagon	1	AO1 4.5.3.2
04.3	the pancreas releases glucagon	do not accept glycogen	1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	(glucagon causes) glycogen (in the liver) to be converted to glucose , which is released into the blood	allow glycogen is broken down to glucose	1	AO1 4.5.3.2
04.4	$(140 - 90) \div 90 \times 100 = \mathbf{55.6\%}$	allow 55 to 56 (%) an answer of 35.7 ($50 \div 140$) or 50 (the increase not divided by the starting value) scores 0 marks	1	AO2 4.5.3.2 MS 1c MS 4a
Total			8	
05.1	LH / luteinising hormone	allow the hormone with the peak on day 14	1	AO2 4.5.3.4
05.2	(FSH) causes an egg to mature in the ovary / in a follicle	allow stimulates the development of an egg	1	AO1 4.5.3.4
	(FSH) stimulates the ovaries to produce oestrogen		1	AO1 4.5.3.4
05.3	oestrogen inhibits the release of FSH (from the pituitary gland)	allow a high level of oestrogen stops FSH being released	1	AO1 4.5.3.4
	progesterone inhibits the release of FSH (and LH)	allow progesterone stops FSH being released so no more eggs mature	1	AO1 4.5.3.4
05.4	the mother is given FSH and LH to stimulate the maturation of several eggs	allow fertility drugs containing FSH and LH	1	AO1 4.5.3.6
	the eggs are collected from the mother and fertilised by sperm (from the father) in the laboratory , and the embryos that develop are inserted into the mother's uterus	both the fertilisation in the laboratory and the insertion of embryos are needed for the mark allow one or two embryos are inserted	1	AO1 4.5.3.6
	any one disadvantage from: - it is emotionally and/or physically stressful - the success rate is not high / it often does not work - it can lead to multiple births, which are a risk to the babies and the mother - it is expensive	ignore ethical objections without a reason	1	AO3 4.5.3.6
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	any one from: - temperature - volume of water (added to the cotton wool) / how damp the cotton wool was - type / species / age of the seedlings (for dishes A and B) the light intensity / distance from the lamp - time before the shoots were measured	allow same amount of water / same type of seeds ignore same number of seedlings (given in the method) ignore 'same light' (the independent variable)	1	AO2 4.5.4.1 WS 2.2 RP 8
06.2	any one from: - to calculate a mean - to identify anomalous results - to make the results more repeatable / reliable - in case some of the seedlings did not grow (well)	allow to reduce the effect of random errors / of individual differences between seedlings do not accept to make it a fair test do not accept to make the results more accurate	1	AO2 4.5.4.1 WS 2.3 RP 8
06.3	(30 ÷ 3 =) 10 (mm per day)	allow 10.0	1	AO2 4.5.4.1 MS 1a RP 8
06.4	auxin moves to / accumulates on the shaded side of the shoot	allow there is more auxin on the side away from the light do not accept auxin moves to the light side	1	AO2 4.5.4.1
	(auxin causes) the cells on the shaded side to elongate / grow more	allow the shaded side grows faster do not accept the cells divide more	1	AO2 4.5.4.1
	(so the shaded side grows longer and) the shoot bends towards the light	allow this is phototropism / a positive phototropic response only if linked to the unequal growth	1	AO2 4.5.4.1
06.5	(taller) any one from: - the shoots grow (faster / longer) to reach the light - auxin is evenly distributed / is not affected by light, so all the cells elongate (more) - light slows the elongation of the cells, so the shoots in the light are shorter	allow more auxin in the dark ignore 'because they are looking for light'	1	AO2 4.5.4.1
	(yellow) no light so chlorophyll is not made / the seedlings have no chlorophyll	allow chlorophyll needs light to form do not accept the seedlings cannot photosynthesise without a reference to chlorophyll	1	AO2 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	(gibberellins) any one from: - to end seed dormancy / make seeds germinate - to promote flowering - to increase the size of fruit	allow to make plants flower (earlier)	1	AO1 4.5.4.2
	(ethene) to control the ripening of fruit (during storage and transport)	allow to make fruit ripen (at the right time)	1	AO1 4.5.4.2
Total			10	
07.1	there is variation in fur colour (in the mice) or a mutation produced the (allele for) dark fur		1	AO2 4.6.2.2
	on the dark rock the dark mice are camouflaged / less likely to be seen and eaten by owls (whereas the pale mice are seen and eaten)	allow the pale mice are more easily hunted on the dark rock	1	AO2 4.6.2.2
	(so) the dark mice are more likely to survive and reproduce	allow the dark mice are more likely to breed	1	AO2 4.6.2.2
	(and) pass on the allele(s) for dark fur to their offspring, so over many generations the proportion of dark mice increases	allow the gene for dark fur is passed on do not accept the mice changed colour to match the rock / chose to become dark	1	AO2 4.6.2.2
07.2	many early forms of life were soft-bodied , so they left few traces / fossils behind	allow soft body parts decay and do not form fossils	1	AO1 4.6.3.5
	(and) the traces that were left have (mostly) been destroyed by geological activity (e.g. earthquakes / volcanoes / movement of rocks)	allow rocks containing early fossils have been changed or destroyed	1	AO1 4.6.3.5
07.3	archaea, bacteria, eukaryota	all three correct = 2 marks two correct = 1 mark allow (true) bacteria / eukaryotes / eukarya	2	AO1 4.6.4
Total			8	
08.1	(a nucleotide consists of) a sugar (deoxyribose) and a phosphate (group)	allow a common sugar and phosphate group	1	AO1 4.6.1.5
	(with) one of four bases attached (to the sugar)	allow A, C, G or T for one of four bases	1	AO1 4.6.1.5
08.2	T A C G G T	the whole sequence must be correct	1	AO2 4.6.1.5
08.3	three	if more than one box is ticked, no mark	1	AO1 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	any three from: - a copy of the gene / a template (mRNA) is made (in the nucleus) and moves to a ribosome carrier molecules bring (specific) amino acids to the ribosome - the amino acids are joined (together) in the order determined by the (sequence of) bases / the triplets (in the gene) (when the chain is complete) the protein folds into a specific / unique shape (so that it works as an enzyme)	allow tRNA for carrier molecules ignore transcription / translation as names without a description	3	AO1 4.6.1.5
08.5	(the mutation changes a triplet / codon so) a different amino acid is put into the protein or the sequence of amino acids changes	allow the order of amino acids is different	1	AO2 4.6.1.5
	(so) the protein folds differently / has a different shape, so the active site changes shape and the substrate no longer fits	allow the substrate cannot bind to the active site	1	AO2 4.6.1.5
08.6	any one from: - genes / chromosomes / DNA had not been discovered (so there was no known mechanism for his 'units') - his work was not widely published / read by other scientists - he was not a well-known scientist (a monk working alone) - the behaviour of chromosomes during cell division had not yet been observed	allow the microscopes of the time could not show chromosomes ignore people did not believe him unqualified	1	AO1 4.6.3.3
Total			10	
09.1	any two from: - only one parent (plant) is needed - no need to find a mate / no pollination needed, so less time and energy is used - it is faster (than sexual reproduction) many identical offspring can be produced when conditions are favourable	allow the new plants have the same (successful) characteristics as the parent ignore 'easier' unqualified	2	AO1 4.6.1.3
09.2	(sexual reproduction) produces variation in the offspring, (so) if the environment changes some (offspring) are more likely to survive / natural selection can occur	allow seeds can be dispersed to new areas / to colonise new places 'variation' alone is insufficient	1	AO1 4.6.1.3

Question	Answers		Extra information	Mark	AO / Spec. Ref.
09.3	Level 3 (5–6 marks)	A clear, logical and complete description of adult cell cloning, with the steps in the correct order from removing the nucleus from an egg cell to implanting the embryo in a host mother, and a correct explanation of why the calf is genetically identical to the high-yielding cow.		6	AO1 4.6.2.5
	Level 2 (3–4 marks)	A description that includes most of the main steps in a sensible order, but with some detail missing or one step incorrect, and some attempt to explain why the calf is a clone.			
	Level 1 (1–2 marks)	Simple statements, for example take a cell from the cow and grow a new cow from it, with little detail of the process.			
	0 marks	No relevant content.			
	Indicative content • an unfertilised egg cell is taken from another cow (or from the cow) • the nucleus is removed from the egg cell (the egg cell is enucleated) • a body cell (e.g. a skin cell / udder cell) is taken from the high-yielding cow • the nucleus of the body cell is removed and inserted into the empty egg cell • an electric shock stimulates the egg cell to divide (by mitosis) to form an embryo • when the embryo is a ball of cells it is inserted into the womb / uterus of a host mother (a surrogate cow) to continue its development • the calf is a clone because its nuclear DNA / genes came from the body-cell nucleus of the high-yielding cow, so its nuclear genetic material is identical to that cow • (so) the calf has the same alleles for milk production, although its milk yield will also depend on its environment (e.g. its diet) Credit other correct, relevant points. Do not credit embryo transplants or tissue culture as the method, or descriptions in which the egg cell is fertilised by sperm.				
Total				9	
10.1	lipase (an enzyme) breaks down / digests the fat / lipids (in the milk)	allow lipase catalyses fat breakdown	1	AO2 4.7.2.3 RP 10	
	(into) fatty acids (and glycerol), which are acidic / lower the pH	allow the fatty acids neutralise the sodium carbonate / alkali	1	AO2 4.7.2.3 RP 10	
10.2	(rate = $1 \div 200 =$) 0.005 (per second)	allow $1 \div 200$ for 1 mark if the answer is incorrect	1	AO2 4.7.2.3 MS 1b RP 10	
	(=) 5×10^{-3} (per second)	allow 5.0×10^{-3} an answer of 0.005 not written in standard form scores 1 mark an answer of 5×10^{-2} (from a time of 20 s) scores 0 marks	1	AO2 4.7.2.3 MS 1b RP 10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	from 10 °C to 40 °C the time decreases / the rate of fat breakdown increases because the molecules have more kinetic energy, so there are more frequent collisions between lipase and fat	allow the enzyme works faster at higher temperatures for 1 mark if collisions / energy are not mentioned	1	AO3 4.7.2.3 RP 10
	at 50 °C the time is much longer / the rate is much lower because the lipase / enzyme has been denatured	do not accept the enzyme is killed	1	AO3 4.7.2.3 RP 10
	(denatured means) the active site has changed shape , so the fat / substrate no longer fits (and cannot be broken down)	allow the enzyme no longer fits the substrate	1	AO3 4.7.2.3 RP 10
10.4	(water) the microorganisms / decomposers need water (to grow / for the reactions of decay), so decay is faster in damp conditions	allow decay stops / slows if the compost dries out	1	AO2 4.7.2.3
	(turning) mixes in air / oxygen , so the microorganisms can respire aerobically and decay is faster (than anaerobic decay)	allow aerobic decay is faster than anaerobic decay allow turning stops methane being produced (by anaerobic decay)	1	AO2 4.7.2.3
Total			9	
11.1	$(40 \div 550) \times 100$	allow 0.0727 for 1 mark	1	AO2 4.7.4.3 MS 1c MS 2a
	= 7.3 (%)	an answer of 7.3 scores 2 marks an answer of 7.27 or 7.272... (not to 2 significant figures) scores 1 mark	1	AO2 4.7.4.3 MS 1c MS 2a
11.2	any two from: - not all of each rabbit is eaten (e.g. the bones / fur) - not all the (ingested) material is absorbed / digested – some is egested as faeces - some absorbed material is lost as waste, e.g. carbon dioxide and water in respiration or urea (and water) in urine (large amounts of) glucose is used in respiration (to release energy for movement / to keep warm), so it is not stored as biomass	allow energy is lost as heat for the respiration point ignore 'energy is lost' unqualified	2	AO1 4.7.4.3

Question	Answers		Extra information	Mark	AO / Spec. Ref.
11.3	Level 3 (5–6 marks)	A clear, balanced evaluation that uses data from Table 7 to explain why intensive rearing produces more food, faster and more cheaply (linking the limited movement and the heated sheds to less energy transferred by the chickens, so more of the feed becomes biomass), weighs this against the disadvantages (animal welfare, disease and antibiotic use, the energy cost of heating), and reaches a justified conclusion about food security.		6	AO3 4.7.5.1 4.7.5.2 4.7.4.3
	Level 2 (3–4 marks)	An evaluation that uses some data and gives advantages and disadvantages, with some explanation of why intensive rearing is more efficient, but the conclusion is missing or weakly justified.			
	Level 1 (1–2 marks)	Simple statements, for example intensive rearing is cheaper or free-range chickens have more space, with little or no use of the data and no explanation.			
	0 marks	No relevant content.			
	Indicative content - intensively reared chickens reach 2 kg in 35 days compared with 81 days, so more chickens / more meat can be produced in a year - only 1.7 kg of feed is needed per kg of chicken compared with 3.5 kg, so less feed (and less land to grow it) is needed – the transfer of biomass is more efficient - this is because the chickens move less (limited space), so less energy is used in respiration for movement, and the sheds are heated, so less energy is used to keep warm – more of the food is stored as biomass - the cost is lower (£1.90 per kg compared with £4.20), so the meat is cheaper and more people can afford it – this helps food security - disadvantages: the chickens have only 0.07 m² each, which raises ethical / animal welfare concerns (limited natural behaviour) - disease spreads more easily when animals are crowded, so antibiotics may be used, which can lead to antibiotic-resistant bacteria - heating the sheds uses energy / fossil fuels, which costs money and adds to carbon dioxide emissions - conclusion, e.g. intensive rearing does improve food security by producing more, cheaper meat from less feed, but the welfare and environmental costs must be balanced against this (or eating less meat / more plant food would use the biomass more efficiently) Credit other correct, relevant points. Credit a justified conclusion either way. Data should be quoted with units or as comparisons; do not credit points that simply copy the table without interpretation.				
Total				10	
TOTAL FOR PAPER				100	