GCSE

BIOLOGY

Higher Tier Paper 2

Mark scheme Practice Paper Series – Set 2 SGC/S2/SB/2H

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This mark scheme is an original resource written for sciencegcse.co.uk to accompany the Set 2 practice paper SGC/S2/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
When a fixed number of responses is requested but extra responses are given, consider the whole list. Each incorrect response or contradiction cancels one otherwise available correct response, up to the mark limit; the score cannot fall below zero. Neutral material identified by **ignore** does not cancel a correct response. Do not apply this rule as a penalty for extra relevant detail in an extended answer.

3.2 Marking procedure for calculations
A correct final answer can receive the marks indicated in the question-specific scheme without every intermediate step being written. Do not award full marks if the working shown contradicts that answer. Where the question specifically requires a method, demonstration or working, apply that requirement. Credit correct stages when the final answer is wrong, including consequential steps where permitted. A printed unit may only be replaced by another unit when the numerical value is converted consistently.

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
Use an earlier incorrect value in a later part where ECF is allowed by the question-specific scheme. Within a calculation, credit later correct stages that use an earlier incorrect value consistently, subject to any stated limits. Do not repeatedly penalise the same error.

3.5 Phonetic spelling
Accept a misspelling when the intended scientific term is clear, including when a term is being recalled. Do not accept wording that could instead name a different scientific term.

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 04.2 and 09.3 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	ff		1	AO2 4.6.1.6
01.2	persons 1 and 2 do not have CF but their child, person 3, has CF		1	AO3 4.6.1.7 WS 3.5
	so persons 1 and 2 must each carry the allele for CF, which is not expressed / is masked by the dominant allele	allow 1 and 2 are both carriers / both Ff	1	AO3 4.6.1.7 WS 3.5
01.3	gametes from both parents: **F** and **f**		1	AO2 4.6.1.6 (HT) MS 2e
	offspring genotypes: FF, Ff, Ff, ff	allow ECF from incorrect gametes	1	AO2 4.6.1.6 (HT) MS 2e
	probability = 0.25	allow 25% / 1 in 4 / ¼ allow ECF from the Punnett square do not accept 1 : 3 / 1 : 4 / 25 : 75	1	AO2 4.6.1.6 (HT) MS 2e
01.4	person 6 (her father) has CF / is ff, so he can only pass on the allele **f**		1	AO2 4.6.1.6
	she does not have CF, so she must also have inherited **F** (from person 5) / she is Ff	allow she has one dominant and one recessive allele	1	AO2 4.6.1.6
01.5	any **one** from: • they are genetically different (from each other and from the parent cell) • they have half the number of chromosomes / only one set of chromosomes	allow four cells are produced instead of two allow 23 chromosomes instead of 46	1	AO1 4.6.1.2
		Total	**9**	
02.1	arrival of the impulse causes a chemical (neurotransmitter) to be released from the end of the first neurone	allow neurotransmitter released from vesicles	1	AO1 4.5.2.1
	the chemical **diffuses** across the synaptic gap		1	AO1 4.5.2.1
	the chemical stimulates a new electrical impulse in the next neurone	allow binds to receptors on the next neurone and starts an impulse	1	AO1 4.5.2.1
02.2	mean with music = (0.27 + 0.25 + 0.25 + 0.28 + 0.27) ÷ 5 = 0.264 (s)	an answer of 10 (%) scores **3** marks	1	AO2 4.5.2.1 MS 1c, 2b
	increase = 0.264 − 0.240 = 0.024 (s)		1	AO2 4.5.2.1 MS 1c, 2b

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	0.024 ÷ 0.240 × 100 = **10** (%)	allow ECF from an incorrect mean	1	AO2 4.5.2.1 MS 1c, 2b
02.3	any **two** from: • volunteer C had a shorter reaction time with music • only five volunteers were tested • the differences are small compared with the differences between volunteers		2	AO3 4.5.2.1 WS 3.7
02.4	the second set of tests may have been affected by practice (faster) or tiredness / boredom (slower)	allow the order of the tests is a variable that was not controlled	1	AO3 4.5.2.1 RP WS 2.7
	half the volunteers should do the test with music first / the order should be random	allow rest between the two sets of tests	1	AO3 4.5.2.1 RP WS 2.7
		Total	**10**	
03.1	methane	allow CH_4	1	AO1 4.7.2.3
03.2	methane is only produced by **anaerobic** decay / by microorganisms in the absence of oxygen	allow the microorganisms respire anaerobically	1	AO2 4.7.2.3
	if air / oxygen got in, aerobic decay would happen, which produces carbon dioxide instead of methane	allow oxygen would kill / inhibit the microorganisms that produce methane	1	AO2 4.7.2.3
03.3	the temperature is lower in winter		1	AO1 4.7.2.3
	so the microorganisms / their enzymes work more slowly, so decay is slower	allow the microorganisms grow / reproduce / respire more slowly	1	AO1 4.7.2.3
03.4	120 × 0.65 = 78 (m^3 each day)	an answer of 546 (m^3) scores **2** marks allow 120 × 7 = 840 for 1 mark	1	AO2 4.7.2.3 MS 1c
	78 × 7 = **546** (m^3)		1	AO2 4.7.2.3 MS 1c
03.5	the digested material contains **mineral ions**, e.g. nitrates (released by decay)	allow it is a (natural) fertiliser	1	AO1 4.7.2.3
	which the plants absorb and use for growth, e.g. nitrates to make proteins		1	AO1 4.7.2.3
		Total	**9**	
04.1	the pancreas does not produce (enough) **insulin**		1	AO1 4.5.3.2

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td></td><td>so the blood glucose concentration would be too high / could not be controlled</td><td></td><td>1</td><td>AO1
4.5.3.2</td></tr>
<tr><td>04.2</td><td colspan="2"><table>
<tr><td>Level 3
(5–6 marks)</td><td>A detailed and logical description of the main steps: isolating the gene, cutting with enzymes, inserting into a vector (plasmid), transferring the vector into the bacterium, and growing the bacteria to produce insulin.</td></tr>
<tr><td>Level 2
(3–4 marks)</td><td>A description that includes some of the main steps, for example cutting out the gene and putting it into a plasmid, but with some steps missing or out of order.</td></tr>
<tr><td>Level 1
(1–2 marks)</td><td>Simple statements about genetic engineering, for example the human insulin gene is put into bacteria.</td></tr>
<tr><td>0 marks</td><td>No relevant content.</td></tr>
</table></td><td>6</td><td>AO1
4.6.2.4 (HT)</td></tr>
<tr><td></td><td colspan="2">Indicative content
• the gene for insulin is identified in human DNA
• enzymes are used to cut out / isolate the insulin gene
• a plasmid is removed from a bacterium
• the same enzyme cuts open the plasmid (leaving matching ends)
• the insulin gene is inserted into the plasmid (vector)
• enzymes join the gene into the plasmid
• the plasmid is put back into a bacterium
• the genetically modified bacteria are grown / cloned in large numbers (in a fermenter)
• the bacteria use the gene to make human insulin
• the insulin is extracted and purified
To reach Level 3 the answer must include the use of enzymes and a vector, and growing the bacteria.</td><td></td><td></td></tr>
<tr><td>04.3</td><td>50 000 × 0.75 = 37 500 (g)</td><td>an answer of 3.75×10^4 (g) scores 2 marks</td><td>1</td><td>AO2
4.6.2.4
MS 1b</td></tr>
<tr><td></td><td>= 3.75×10^4 (g)</td><td>allow 3.8×10^4
allow 1 mark for 37 500 not in standard form</td><td>1</td><td>AO2
4.6.2.4
MS 1b</td></tr>
<tr><td colspan="3">Total</td><td>10</td><td></td></tr>
<tr><td>05.1</td><td>so that light did not affect the direction of growth</td><td>allow so that the only factor affecting the direction of growth was gravity
allow to prevent phototropism</td><td>1</td><td>AO3
4.5.4.1
RP
WS 2.2</td></tr>
<tr><td>05.2</td><td>all seven points plotted correctly</td><td>allow ± half a small square
five or six points plotted correctly = 1 mark</td><td>2</td><td>AO2
4.5.4.1
RP
MS 4c</td></tr>
<tr><td></td><td>a smooth curve of best fit through the points</td><td>do not accept points joined with straight lines (dot to dot)</td><td>1</td><td>AO2
4.5.4.1
MS 4a</td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	13 (hours)	allow 12.8 to 14.0 allow a value read correctly from the student's own line	1	AO2 4.5.4.1 MS 4a
05.4	auxin collects on the **lower** side of the root	allow auxin moves to the lower side because of gravity	1	AO1 4.5.4.1
	in roots, auxin **inhibits** cell elongation / growth		1	AO1 4.5.4.1
	so the cells on the upper side elongate / grow more than the cells on the lower side, so the root bends downwards	allow the upper side grows faster	1	AO1 4.5.4.1
05.5	put the same number of seedlings, set up in the same way, on a clinostat in the dark	allow use a second Petri dish on a clinostat	1	AO3 4.5.4.1 RP WS 2.2
	the roots would keep growing horizontally / would not bend downwards	allow the roots grow straight	1	AO3 4.5.4.1 RP WS 2.2
05.6	any **one** from: • as rooting powders (for cuttings) • to promote growth in tissue culture	ignore uses of gibberellins or ethene	1	AO1 4.5.4.2 (HT)
		Total	**11**	
06.1	as the temperature increases, the date of first flowering is earlier	allow negative correlation	1	AO3 4.7.3.5 WS 3.5
	use of data, e.g. a rise of 1.7 °C (from 8.2 to 9.9 °C) and flowering 17 days earlier (from day 128 to day 111)	must include values from the table	1	AO3 4.7.3.5 WS 3.5
06.2	change in date = 128 − 111 = 17 (days) and change in temperature = 9.9 − 8.2 = 1.7 (°C)	an answer of 10 scores **2** marks	1	AO2 4.7.3.5 MS 1a, 1c
	17 ÷ 1.7 = **10** (days per °C)	allow −10 / 10 days earlier	1	AO2 4.7.3.5 MS 1a, 1c
06.3	the flowers open before the insects are active, so fewer flowers are pollinated		1	AO2 4.7.3.5
	so fewer seeds / fruits are produced, so fewer new hawthorn plants grow / the population may decrease		1	AO2 4.7.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	any **one** from: • other factors may also have changed, e.g. rainfall / light / carbon dioxide concentration • a correlation does not show that one factor causes the other		1	AO3 4.7.3.5 WS 3.5
06.5	any **three** from: • loss of habitat, e.g. low-lying areas are flooded as sea levels rise • changes in the distribution of species, e.g. species move to cooler areas • changes in migration patterns • reduced biodiversity / species become extinct • pests or organisms that carry disease spread to new areas	ignore changes in flowering time	3	AO1 4.7.3.5
		Total	**10**	
07.1	warning colouration (in animals)	allow warning colours	1	AO1 4.6.3.2
07.2	any **one** from: • the theory challenged the idea that God made all the animals and plants on Earth • there was not enough evidence at the time to convince many scientists • the mechanism of inheritance and variation was not known (until about 50 years later)	allow genes / DNA had not been discovered	1	AO1 4.6.3.1
07.3	any **four** from: • the two populations were **isolated** / could not interbreed • there was genetic **variation** in each population (caused by mutations) • the conditions in the two seas were different, e.g. food, predators, temperature • **natural selection**: the shrimps best suited to the conditions in each sea survived and reproduced • and passed on their (advantageous) **alleles** • (over a long time) the populations became so different that they could no longer interbreed to produce **fertile** offspring	allow the land stopped the populations mixing	4	AO1 (2) AO2 (2) 4.6.3.2
07.4	3 ÷ 60 × 100	an answer of 5 (%) scores **2** marks	1	AO2 4.6.3.2 MS 1c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	= **5** (%)		1	AO2 4.6.3.2 MS 1c
07.5	supports the statement: only 5% of the pairs from different seas produced offspring, compared with 82% and 78% of the pairs from the same sea	allow ECF from 07.4	1	AO3 4.6.3.2 WS 3.5
	does not prove it: some pairs from different seas did produce offspring, and we do not know whether these offspring were fertile	allow the shrimps may behave differently in tanks than in the sea allow only 60 pairs were tested	1	AO3 4.6.3.2 WS 3.5
		Total	**10**	
08.1	3	allow third (trophic level) allow secondary consumer	1	AO1 4.7.4.1
08.2	organisms contain different (and varying) amounts of **water**	allow so that the biomasses can be compared fairly	1	AO2 4.7.4.2
	when the mass stops changing, **all** the water has been removed (so only the dry biomass is left)		1	AO2 4.7.4.2
08.3	a bar 8 small squares wide drawn directly above the seaweed bar	allow bars that are not centred ignore the height of the bars	1	AO2 4.7.4.2 MS 4a
	a bar 1 small square wide drawn directly above the periwinkle bar	allow ± half a small square for each bar	1	AO2 4.7.4.2 MS 4a
	bars labelled periwinkle and shore crab	allow labelled as trophic levels 2 and 3	1	AO2 4.7.4.2 MS 4a
08.4	80 ÷ 600 × 100	an answer of 13.3 (%) scores **2** marks	1	AO2 4.7.4.3 MS 1c, 2a
	= **13.3** (%)	allow 1 mark for 13.33… / 13 (%) (not given to 3 significant figures) allow 1 mark for 0.133	1	AO2 4.7.4.3 MS 1c, 2a
08.5	decomposers **secrete enzymes** (into the environment / onto the seaweed)		1	AO1 4.7.4.1
	the enzymes break down (large) molecules into **small soluble** molecules, which **diffuse** into the decomposer	allow the products are absorbed by the decomposer	1	AO1 4.7.4.1
		Total	**10**	
09.1	A – cornea		1	AO1 4.5.2.3

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td></td><td>B – iris</td><td></td><td>1</td><td>AO1
4.5.2.3</td></tr>
<tr><td></td><td>D – retina</td><td></td><td>1</td><td>AO1
4.5.2.3</td></tr>
<tr><td>09.2</td><td>any three from:
• the ciliary muscles relax
• the suspensory ligaments are pulled tight
• the lens is pulled thin / becomes less rounded
• the light is refracted less / only slightly</td><td>do not accept the lens contracts or relaxes
ignore changes to the pupil / iris</td><td>3</td><td>AO1
4.5.2.3</td></tr>
<tr><td>09.3</td><td colspan="2"><table>
<tr><td>Level 3
(5–6 marks)</td><td>A detailed and well-reasoned evaluation that compares the advantages and disadvantages of at least three of the methods, uses data from the table (for example costs over time and risks), and reaches a conclusion that is supported by the evaluation.</td></tr>
<tr><td>Level 2
(3–4 marks)</td><td>Some advantages and disadvantages of at least two methods are compared, with some use of data from the table. A conclusion may be given but it is not fully supported.</td></tr>
<tr><td>Level 1
(1–2 marks)</td><td>Simple statements about advantages or disadvantages of one or more methods, for example glasses are cheap. There is little or no use of data and no supported conclusion.</td></tr>
<tr><td>0 marks</td><td>No relevant content.</td></tr>
</table></td><td>6</td><td>AO3
4.5.2.3
WS 1.4</td></tr>
<tr><td></td><td colspan="2">Indicative content
• glasses have the lowest cost: about £750 over 10 years (a new pair every 2 years)
• glasses have a very low risk, but they can be lost or broken and can steam up
• contact lenses cost £300 each year: about £3000 over 10 years
• contact lenses cannot be seen, but there is a risk of eye infection every year that they are used, and they must be kept clean
• laser surgery costs £2400 once: after about 8 years it costs less than contact lenses
• laser surgery is permanent, so nothing needs to be worn or replaced, and the person is old enough (over 18)
• laser surgery has a risk of a serious problem (1 in 1000), and the eyes may feel dry for a few months
• lens replacement is the most expensive (£4800) and has the highest risk (1 in 500)
• lens replacement is usually only used for severe myopia, so it is not needed for mild myopia
• conclusion, e.g. glasses are the cheapest and safest choice; laser surgery is the most convenient long-term choice; lens replacement is the least suitable
To reach Level 3 the answer must use data from the table and must include a conclusion that is supported by the evaluation. Any reasoned conclusion can be credited.</td><td></td><td></td></tr>
<tr><td colspan="3">Total</td><td>12</td><td></td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	leopard		1	AO2 4.6.4
10.2	the cheetah and the puma share a more recent **common ancestor**		1	AO3 4.6.4 WS 3.5
	their branches join closer to the present (than the branches of the cheetah and the lion)	allow the cheetah and lion only share an ancestor further back in time	1	AO3 4.6.4 WS 3.5
10.3	any **one** from: • common names differ between countries / languages / regions • one species may have several common names / the same common name may be used for different species • scientific names are the same all over the world, so scientists know exactly which species is meant	allow to avoid confusion	1	AO2 4.6.4
10.4	any **one** from: • many early forms of life were soft-bodied, so left few traces • traces have been destroyed by geological activity • fossils only form in particular conditions • many fossils have not been found yet		1	AO1 4.6.3.5
10.5	a new disease / change in the environment could affect all cheetahs in the same way	allow new predator / competitor	1	AO2 4.6.3.6
	because none (or few) may have alleles that would help them survive	allow so the whole population could die out	1	AO2 4.6.3.6
10.6	100 000 − 7100 = 92 900 and 2020 − 1900 = 120 (years)	an answer of 774 scores **2** marks	1	AO2 4.6.3.6 MS 1a
	92 900 ÷ 120 = **774** (cheetahs per year)	allow 770 / 774.2 allow 1 mark for 92 900 seen	1	AO2 4.6.3.6 MS 1a
		Total	**9**	
		TOTAL FOR PAPER	**100**	