AQA GCSE Biology | 8461

SPECIFICATION POINT 4.5.2.3

# The eye (biology only)

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Higher** |
| Question groups | **9** |
| Available paper years | **2009–2023** |

## Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

**Name:** _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

### 4.5.2.3 The eye (biology only)

**Answer 01 · Mark scheme**

March 2009 | BLY1BP | Original Q4 | Legacy

| | | | | |
|---|---|---|---|---|
| Four | **2** | **4** | **4** | **3** |

**Answer 02 · Mark scheme**

November 2009 | BLY1AP | Original Q4 | Legacy

No matching mark scheme was available in the supplied archive for this question.

4.5.2.3 The eye (biology only)



## Question 1

| question | answers | extra information | mark |
|---|---|---|---|
| 1(a)(i) | colour of light / bulb / lamp | allow wavelength for colour<br>allow bulb alone<br>do **not** accept light / colour unqualified | 1 |
| 1(a)(ii) | any **one** from eg<br>• temperature<br>• light intensity **or** distance between lamp and plant / tube<br>• carbon dioxide<br>• other light in room<br>• mass / size / amount / age / type of pondweed<br>• volume / amount of water | <br>allow heat<br>allow amount / brightness of light<br>ignore light unqualified<br>allow symbols<br>allow use a dark room<br>allow same piece of pondweed<br>ignore pondweed unqualified<br>ignore reference to time | 1 |
| 1(a)(iii) | improved reliability<br>**or**<br>can spot anomalies / changes | allow for reliability **or** less likely to lose count<br>allow reference to calculating a mean / average<br>ignore reference to accuracy / precision / fair | 1 |
| 1(b)(i) | green | | 1 |

**Question 1 continues on the next page**

4.5.2.3 The eye (biology only)



**BLY2H**

**Question 1 continued**

| question | answers | extra information | mark |
|---|---|---|---|
| **1(b)(ii)** | any **two** from:<br>• least / less bubbles / gas / oxygen / mean<br>• least / less photosynthesis<br>• least / less glucose / sugar / carbohydrate / food made | ignore references to colour<br>reference to least / less needed only once, in context, for **2** marks<br>only penalise no once, ie no bubbles = **0** mark<br>no bubbles so no photosynthesis = **1** mark<br>allow most / more green light reflected (by chloroplasts) | 2 |
| **Total** | | | **6** |

### 4.5.2.3 The eye (biology only)

**Answer 03 · Mark scheme**

January 2011 | BLY2H | Original Q1 | Legacy

**BLY2H**

4.5.2.3 The eye (biology only)

Answer 04 · Mark scheme

June 2012 | BL2HP | Original Q3 | Legacy

## Question 3

| question | answers | extra information | mark |
|---|---|---|---|
| 3(a)(i) | (white) clover | | 1 |
| 3(a)(ii) | reed sweet-grass | allow reed<br><br>allow grass | 1 |
| 3(a)(iii) | (only) found in swamp and aquatic zones **or** only found in water **or** doesn't grow in marsh | ignore wet conditions | 1 |

**3(b)** — 6

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.

| 0 marks | Level 1 (1-2 marks) | Level 2 (3-4 marks) | Level 3 (5-6 marks) |
|---|---|---|---|
| No relevant content. | There is a basic description which describes how a quadrat **or** a metre tape could be used to collect data | There is a clear description of how a quadrat **and** a metre tape could be used to collect data along a line | There is a clear, logical and detailed description of a method that will produce valid, repeatable results across / at intervals along the stream. |

**examples of procedural points made in the response:**

- use of tape measure to produce transect
- placing of quadrats
- transect placed across stream
- score presence of each plant species
- use quadrat at regular intervals along tape
- repeat transect several times (≥ 3)
- along stream
- at random **or** regular intervals

| Total | | | 9 |
|---|---|---|---|

### 4.5.2.3 The eye (biology only)

**Answer 04 · Mark scheme**

June 2012 | BL2HP | Original Q3 | Legacy

**BL2HP**

4.5.2.3 The eye (biology only)

Answer 05 · Mark scheme

June 2013 | BL1HP | Original Q7 | Legacy

## Question 7

| question | answers | extra information | mark |
|---|---|---|---|
| 7(a) | | in this order only | |
| | **A** cytoplasm | | 1 |
| | **B** (cell) membrane | do **not** accept (cell) wall | 1 |
| 7(b)(i) | synapse | | 1 |
| 7(b)(ii) | (as) chemical | accept neurotransmitter or named<br>ignore references to how the chemical is passed<br>do **not** accept electrical | 1 |
| 7(c) | | ignore references to synapses<br>accept 'nerve cell' for neuron(e) throughout<br>penalise 'nerve' for neurone once only | |
| | (from light-sensitive cell to connecting neurone) to sensory neurone | | 1 |
| | (sensory neurone) to brain / CNS | allow (sensory neurone) to relay neurone / spinal cord | 1 |
| | (brain / CNS) to motor neurone | allow (relay neurone / spinal cord) to motor neurone | 1 |
| | (motor neurone) to (eyelid) muscle | ignore effector | 1 |
| **Total** | | | **8** |

### 4.5.2.3 The eye (biology only)

**Answer 06 · Mark scheme** June 2018 | 8461/2H | Original Q1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.1** | releasing saliva when food enters the mouth<br><br>withdrawing the hand from a sharp object | | 1<br><br>1 | AO2<br>4.5.2.1 |
| **01.2** | bright light | allow described method of increasing light<br><br>ignore light unqualified<br><br>allow correctly named drug eg morphine / heroin | 1 | AO1<br>4.5.2.3 |
| **01.3** | iris | | 1 | AO1<br>4.5.2.3 |
| **01.4** | muscle contraction | allow muscles shorten<br><br>ignore radial / circular<br><br>ignore muscles relax / constrict<br><br>do **not** accept muscles expand<br><br>do **not** accept ciliary muscle contracts | 1 | AO1<br>4.5.2.3 |

4.5.2.3 The eye (biology only)

Answer 06 · Mark scheme

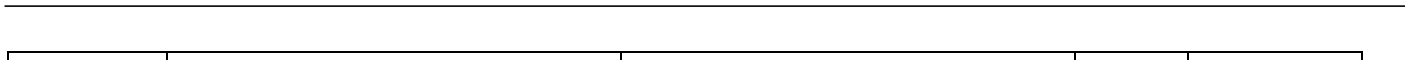


| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 01.5 | **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account. | 4–6 | AO1 4.5.2.1 |
| | **Level 1**: Facts, events or processes are identified and simply stated but their relevance is not clear. | 1–3 | |
| | **No relevant content** | 0 | |
| | **Indicative content**<br><br>• receptor detects stimulus<br>• eg receptor detects pressure<br>• receptor generates impulses / electrical signals<br><br>• neurones conduct impulses / electrical signals<br>• neurone A conducts impulses to spinal cord<br>• neurone A = sensory neurone<br>• synapse between neurones<br>• chemical (/ neurotransmitter) crosses synapse<br>• chemical stimulates impulse(s) in neurone B<br>• neurone B = relay neurone<br>• neurone C = motor neurone<br><br>• effector carries out response<br>• eg muscles of the arm / leg contract<br>• muscles contract **or** gland secretes chemicals<br><br>to access **level 2**, candidates need to consider, in terms of the indicative content, the receptor, the neurones and the effector in the correct sequence | | |
| **Total** | | | **11** |

### 4.5.2.3 The eye (biology only)

**Answer 06 · Mark scheme**

June 2018 | 8461/2H | Original Q1



4.5.2.3 The eye (biology only)

Answer 07 · Mark scheme

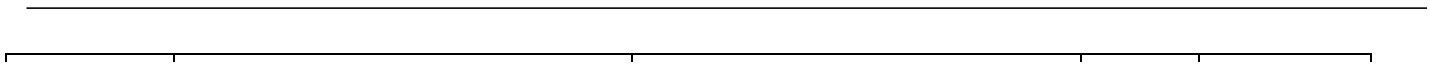
June 2019 | 8461/2H | Original Q4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.1 | ciliary muscles contract | | 1 | AO1 4.5.2.3 |
| | (so ciliary muscles have a) smaller diameter | | 1 | |
| | (so) suspensory ligaments loosen / slacken | do **not** accept 'relax' | 1 | |
| | (so) lens thickens **or** lens becomes more curved / rounded | allow lens becomes fatter<br>ignore lens becomes bigger | 1 | |
| | (thicker) lens is more convergent | allow light rays bent (inwards) more **or** light refracted more | 1 | |
| | light rays / image focused on retina | allow light rays meet on retina | 1 | |
| 04.2 | eye(-ball) is (too) short **or** lens cannot be thickened enough | allow ciliary muscles (too) weak **or** lens not (sufficiently) elastic | 1 | AO1 4.5.2.3 |
| | (so) light 'focuses' behind retina | allow (so) image forms behind retina | 1 | |
| 04.3 | convex / converging lens | allow shape described eg thicker in middle | 1 | AO1 4.5.2.3 |
| | light rays bent / refracted (inwards) more | allow changes direction of light rays further inwards | 1 | |
| | light rays focused on retina | allow light rays brought to a point on retina<br>**or** light rays converge on retina<br>**or** focused /clear image forms on retina | 1 | |
| **Total** | | | **11** | |

### 4.5.2.3 The eye (biology only)

**Answer 07 · Mark scheme**

June 2019 | 8461/2H | Original Q4



4.5.2.3 The eye (biology only)

Answer 08 · Mark scheme

November 2020 | 8461/2H | Original Q6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.1 | A | | 1 | AO1<br>4.5.2.2 |
| 06.2 | cerebral cortex | allow cerebrum<br>allow cerebral hemisphere(s)<br>ignore D | 1 | AO1<br>4.5.2.2 |
| 06.3 | any **three** from:<br>• can ask people to do different tasks (while taking scan)<br>• to see which part of brain is active / inactive<br>• to compare with a person without brain damage<br>• to see (exactly) where the damage is<br>• (traditional) MRI scanner cannot be used if people can't stay still | allow can ask person to do a (specific) task<br>allow to see which part of the brain is working<br>allow examples such as children **or** patients with Parkinson's disease<br>allow may be better for people who are claustrophobic | 3 | AO3<br>4.5.2.2 |
| 06.4 | (cells in) retina sensitive to light<br>impulse passes along (sensory) neurone<br>(along) optic nerve | allow retina detects light<br>allow rods / cones detect light<br>allow electrical signal **or** electrical message passes along (sensory) neurone<br>allow chemical transmission across synapse | 1<br>1<br>1 | AO1<br>4.5.2.1<br>4.5.2.3 |

4.5.2.3 The eye (biology only)

Answer 08 · Mark scheme

November 2020 | 8461/2H | Original Q6

| Question | Answers | Mark | AO / Spec. |
|---|---|---|---|
| 06.5 | **Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account. | 5–6 | AO2 |
| | **Level 2:** Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear. | 3–4 | AO2 |
| | **Level 1:** Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking. | 1–2 | AO1 |
| | **No relevant content** | 0 | 4.5.2.3<br>4.6.2.1<br>4.6.2.2<br>4.6.3.1<br>4.6.3.4<br>4.7.1.3<br>4.7.1.4 |
| | **Indicative content**<br><br>• mutation (in gene / DNA)<br>• randomly **or** due to chance<br>• causes new / different protein / (visual) pigment to be made<br>• in the retina of bird<br>• (so more) variation in the wavelengths of light birds retinas could detect<br><br>• birds with the mutation **or** birds able to detect UV are more likely to see fruits (that reflect UV)<br>• birds with the mutation **or** birds able to detect UV are more likely to see where small mammals are or have been<br>• therefore get more food (small mammals or fruit)<br>• avoid being eaten (by small mammals)<br>• out competing those birds without the mutation **or** birds not able to detect UV<br><br>• so more likely to survive **and** reproduce **or** have offspring<br>• by natural selection<br>• passing on allele / gene / mutation to offspring<br>• repeated over many generations<br><br>For Level 3 a link to UV vision is required | | |
| **Total** | | | **14** |

### 4.5.2.3 The eye (biology only)

**Answer 08 · Mark scheme**

November 2020 | 8461/2H | Original Q6

4.5.2.3 The eye (biology only)

Answer 09 · Mark scheme

June 2023 | 8461/2H | Original Q2

## Question 2

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| **02.1** | accommodation | | 1 | AO1 4.5.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| **02.2** | B | | 1 | AO1 4.5.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| **02.3** | E | | 1 | AO1 4.5.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| **02.4** | becomes fatter / thicker / wider | allow more convex / curved / rounded<br>ignore larger / smaller | 1 | AO1 4.5.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| **02.5** | any **two** from:<br>• (muscles in the iris) contract<br>• reduce size of pupil<br>• reduces (amount of) light entering | <br>allow (muscles in the iris) shorten<br>ignore circular / radial muscles<br>ignore (muscles in the iris) relax<br>do **not** accept ciliary muscles contract<br>allow constrict pupil<br>allow reduce size of aperture / gap / hole<br>allow reduces (amount of) light reaching retina | 2 | AO1 4.5.2.3 |

4.5.2.3 The eye (biology only)

Answer 09 · Mark scheme

June 2023 | 8461/2H | Original Q2

| Question | Answers | Mark | AO / Spec Ref. |
|---|---|---|---|
| 02.6 | **Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced. | 3–4 | AO2 |
| | **Level 1:** The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced. | 1–2 | AO1 |
| | **No relevant content** | 0 | |
| | **Indicative content**<br><br>• identification of method eg ruler drop<br>• correct details of method chosen eg hold ruler above thumb<br>• repetitions – at least two more times<br>• repeat with (at least 2 more) other students<br><br>• tested without coffee **and** with coffee **or** with different amounts of coffee<br>• calculate mean value with coffee and without coffee<br>• compare results with and without coffee<br><br>• correct control variables for method chosen, eg:<br>o same age<br>o sex<br>o BMI<br>o amount of sleep<br>o volume / concentration / type of coffee<br>o time interval between drinking and testing<br>o control variable within method described<br><br>For **level 2** reference to collecting results with and without coffee along with how the investigation is designed to create valid results is required | | 4.5.2.1 RPA7 |

| | |
|---|---|
| **Total Question 2** | **10** |

4.5.2.3 The eye (biology only)

Answer 08 · Examiner comments

November 2020 | 8461/2H | Original Q6

**Question 6 (standard, standard/high & high demand)**

This question was about the brain and vision, and applications to the use of MRI scanners and to the evolution of a sight adaptation in birds. Many students lacked precision in their explanations for **06.3**. In order to explain the advantage of the functional MRI (fMRI) scanner, using the given information, the majority of successful students stated that it would enable doctors to see which part of the brain was active / inactive in a certain situation in order to ascertain the location of any brain damage. Some were more explicit and explained that the context for this would be having the patient perform a particular task. Some suggested, correctly, that the scan could be compared with one from a person without brain damage, or that the fMRI scanner could be used on a person who had difficulty staying still such as a young child or a person with Parkinson's.

**06.4** was not answered at all well by many students. The question asked for how the brain received information from the eye, *not* how the eye produced an image or made adjustments for different light intensities, *nor* for the coordination of any response, some or all of which were included in the answers of many. Several important details were also omitted in many answers – eg light is not just focused on 'the back of the eye' but on the *retina*, and the latter is actually *sensitive* to the light or contains *receptors* rather than just being the passive recipient of an image; *impulses* are then sent along *neurones* (not just 'messages' or 'signals' in 'nerves') in the *optic nerve*.

Given that some birds had an adaptation allowing them to detect UV light, and that some fruits and the urine of small mammals reflected UV light, students had to explain how this feature in the birds might have evolved in **06.5**. Many students suggested correctly that a mutation might have occurred in an ancestral bird, although very few went on to state that this would have been a random occurrence. Very few students related this to a possible structural change in the cells of the retina. However, many did realise that the mutation, or ability to detect UV, would enable the birds to see fruits and thus obtain more food than non-mutant birds and/or see where small mammals had been and hence either avoid predation or manage to catch these mammals as food. Many students then went on to explain that the birds with UV vision would be more likely to survive and reproduce, passing on their favourable allele (or 'the mutation') to their offspring, perhaps over many generations, and that this was an example of natural selection. Some students interpreted this as a 'speciation' question and hence gave an answer they had prepared previously. Students need to read the question carefully in order to assess what aspects of their knowledge may be applied *appropriately* in answering it. The question differentiated very well across the entire ability range of the students.

4.5.2.3 The eye (biology only)

Answer 09 · Examiner comments

June 2023 | 8461/2H | Original Q2

## Question 2

This was the second of three questions common to both the Foundation and Higher Tier papers. It was about the functioning of the eye and included a description of an investigation of reaction time.

02.1 Three-quarters of students correctly selected accommodation as the term relating to adjustment of focus.

02.2 An even higher proportion knew that the image would be focused on structure B in Figure 3 (the retina).

02.3 Almost all knew that structure E (the ciliary muscle) would contract to focus on a near object.

02.4 Students experienced some difficulty in describing what happened to the shape of the lens when focusing on a near object. Acceptable terms included becoming fatter / thicker / rounder or more convex or more curved. Terms such as ‘larger’ were considered ambiguous and ‘more concave’ (used by many) was simply incorrect. Around half the students gave acceptable answers.

02.5 Given that the iris contains muscles, students had to desribe the role of these muscles for assisting in clear vision when moving into a brightly-lit area. Some evidently did not read the question carefully and described the precise opposite – moving into a dimly-lit area. Many were confused between iris muscles and ciliary muscles. Reference to radial and circular muscles were ignored as this went beyond the detail required by the Specification. Students were required to give two details from the muscles contracting, reducing the size of the pupil and a decrease in the amount of light entering the eye. Most scored at least one mark but fewer than half gained two.

02.6 This was an extended response style of question in which students had to plan an investigation to test the effect of drinking coffee on reaction time. Most opted for the ruler drop practical but the level of detail included was highly variable. The instruction in the question was ‘You should include...how to make the investigation valid’ which incorporates the concepts of control variables, repetitions and the calculation of mean values. Although many students omitted such details, around 50 percent scored full marks.