AQA GCSE Biology | 8461

SPECIFICATION POINT 4.1.2.3

# Stem cells

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **7** |
| 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.

### 4.1.2.3 Stem cells

**Answer 01 · Mark scheme**

January 2009 | BLY2F | Original Q3 | Legacy

| question | answers | extra information | mark |
|---|---|---|---|
| **3**(a) | 2 and 3 | | 1 |
| **3**(b) | cell **P** has an X chromosome; cell **R** has a Y chromosome | | 1 |
| **3**(c) | any **two** from:<br>• (formed from) different egg / 2 eggs<br>• (formed from) different sperm / 2 sperm<br>• have different genes / alleles / chromosomes / DNA | <br><br><br>allow genetics | 2 |
| **3**(d)(i) | stem cells | | 1 |
| **3**(d)(ii) | the cells divide<br>the cells differentiate | | 1<br>1 |
| **3**(d)(iii) | (medical) research / named eg growing organs<br>**or**<br>medical / patient treatment | allow (embryo) cloning<br>do **not** allow designer babies / more babies | 1 |

**Question 3 continued on next page…**

4.1.2.3 Stem cells



**COMPONENT NUMBER: BLY2F**

**COMPONENT NAME: Additional Science / Biology**

**STATUS: Final**

**DATE: January 2009**

**Question 3 continued…**

| question | answers | extra information | mark |
|---|---|---|---|
| **3**(d)(iv) | any **one** from:<br>• ethical / moral / religious objections<br>• potential harm to embryo | ignore cruel / not natural / playing God<br>allow deformed<br>ignore harm to mother | 1 |
| **Total** | | | **9** |

4.1.2.3 Stem cells

Answer 01 · Mark scheme



**COMPONENT NUMBER: BLY2F**

**COMPONENT NAME: Additional Science / Biology**

**STATUS: Final**

**DATE: January 2009**

4.1.2.3 Stem cells

Answer 02 · Mark scheme

June 2009 | BLY2F | Original Q5 | Legacy

## Question 5

| question | answers | extra information | mark |
|---|---|---|---|
| **5**(a) | chromosomes | | 1 |
| **5**(b) | diagram showing four separate chromosomes two long and two short (as in diagram 1) | allow each chromosome shown as two joined chromatids<br>do **not** allow if chromosomes touching each other | 1 |
| **5**(c)(i) | any **two** from:<br>• can grow into any type of tissue / named tissue<br>• used in medical research<br>• used to treat human diseases<br>• large numbers can be grown | | 2 |
| **5**(c)(ii) | any **two** from:<br>• expensive<br>• grow out of control / ref cancers<br>• may be rejected<br>• need for drugs (for rest of life) | | 2 |
| **Total** | | | **6** |

### 4.1.2.3 Stem cells

**Answer 02 · Mark scheme**

June 2009 | BLY2F | Original Q5 | Legacy

**BLY2F**

### 4.1.2.3 Stem cells

**Answer 03 · Mark scheme**

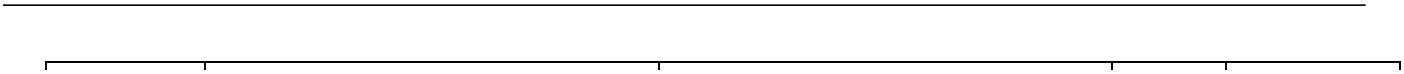
June 2015 | BL2FP | Original Q1 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 1(a) | **A** = nucleus<br><br>**B** = (cell) membrane | allow phonetic spelling | 1<br><br>1 | AO1<br>2.1.1a, d |
| 1(b) | for repair / growth **or** to replace cells | ignore new cells / skin | 1 | AO1<br>2.7.1j |
| 1(c)(i) | embryos | | 1 | AO1<br>2.7.1k |
| 1(c)(ii) | paralysis | | 1 | AO1<br>2.7.1l,m |
| **Total** | | | **5** | |

### 4.1.2.3 Stem cells

**Answer 03 · Mark scheme**

June 2015 | BL2FP | Original Q1 | Legacy



### 4.1.2.3 Stem cells

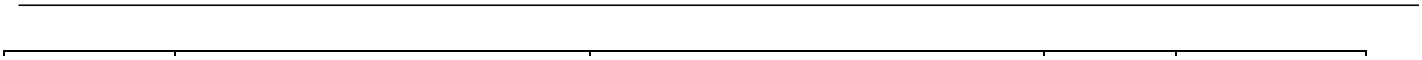
**Answer 04 · Mark scheme** June 2019 | 8461/1F | Original Q2

| | | | | |
|---|---|---|---|---|
| **02.1** | the movement of particles from a high concentration to a low concentration | | 1 | 4.1.3.1 AO1 |
| **02.2** | (gills) have (many) projections<br><br>(for) large(r) surface / area<br><br>**or**<br><br>(gills) are on the outside of the body (1)<br><br>for good access to water (1) | allow description of projections<br>allow have lots of / five gills | 1<br><br>1 | 4.1.3.1 AO2 |
| **02.3** | differentiation | | 1 | 4.1.2.3 AO1 |
| **02.4** | mitosis | do **not** accept meiosis | 1 | 4.1.2.2 AO1 |
| **02.5** | hair | | 1 | 4.1.2.2<br>4.1.2.3<br>AO1 |
| **02.6** | axolotls are cheap to feed<br><br>axolotls are easy to breed | | 1<br><br>1 | 4.1.2.3 AO3 |
| **02.7** | D | | 1 | 4.2.2.2 AO1 |
| **02.8** | trachea | allow windpipe<br>allow cartilage (ring) | 1 | 4.2.2.2 AO1 |
| **02.9** | pulmonary artery | | 1 | 4.2.2.2 AO1 |
| **Total** | | | **11** | |

### 4.1.2.3 Stem cells

**Answer 04 · Mark scheme**

June 2019 | 8461/1F | Original Q2



**Answer 05 · Mark scheme**

November 2020 | 8461/1F | Original Q2

The full source mark scheme begins on page 16. Follow original question 2 in that document.

4.1.2.3 Stem cells

Answer 06 · Mark scheme

June 2022 | 8461/1F | Original Q2

## Question 2

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.1** | $\frac{1}{4}$ | | 1 | AO2<br>4.1.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.2** | 10 | | 1 | AO2<br>4.1.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.3** | grows<br>replicates<br>divides | must be in this order | 1<br>1<br>1 | AO1<br>4.1.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.4** | C | | 1 | AO3<br>4.1.2.2 |

4.1.2.3 Stem cells

Answer 06 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.5** | 10% | | 1 | AO2<br>4.1.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.6** | circulatory system | | 1 | AO1<br>4.2.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.7** | cardiovascular disease / CVD<br><br>**or**<br><br>(coronary) heart disease / CHD | allow heart attack<br><br><br><br>allow any correctly named heart condition eg arrhythmia, hole in the heart | 1 | AO1<br>4.2.2.4<br>4.1.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.8** | any **one** from:<br><br>• unethical<br><br>• (against) religious / cultural / personal beliefs<br>• the method is not (fully) tested<br><br>• risk of infection<br><br>• (heart cells) may be rejected | <br><br>allow examples of unethical such as destroying a (potential) life<br>allow against God's will<br>ignore religion unqualified<br>allow the method might not work<br>allow may cause side effects | 1 | AO2<br>4.1.2.3<br>4.2.2.4 |

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

4.1.2.3 Stem cells

Answer 07 · Mark scheme

June 2023 | 8461/1F | Original Q6

## Question 6

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| **06.1** | a group of the same / similar cells<br>**or**<br>a group of cells with a (similar / specific) function | ignore a group of cells unqualified<br><br>ignore examples of tissue functions | 1 | AO1<br>4.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| **06.2** | meristem (tissue) | | 1 | AO1<br>4.1.1.4<br>4.1.2.3<br>4.2.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| **06.3** | willow | ignore named parts of willow | 1 | AO1<br>4.3.1.9 |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| **06.4** | any **one** from:<br>• (berries are) easy to access / pick<br>• easier to extract chemical<br>• taking berries will not harm the plant | ignore berries are not underground<br><br>allow taking leaves / roots might damage / kill the plant (so it cannot produce more chemical)<br><br>allow idea that the lower mass / amount (of chemical) will be less toxic / harmful<br><br>allow greater mass of berries than of leaves / roots | 1 | AO3<br>4.2.3.1 |

4.1.2.3 Stem cells



| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| 06.5 | (0.6 × 1.2 =) 0.72 | allow conversion to mg at any point in calculation | 1 | AO2 4.3.3.1 |
| | (0.72 × 2 =) 1.44 | | 1 | |
| | 1.44 × 1000 | allow conversion of a correct mass calculated for berries / roots | 1 | |
| | 1440 (mg) | allow a correct answer using an incorrect conversion factor of a multiple of 10 | 1 | |
| | **alternative route**<br>(2 × 1.2 =) 2.4 (1)<br>(2.4 × 0.6 =) 1.44 (1)<br>1.44 × 1000 (1)<br>1440 (mg) (1) | | | |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| 06.6 | any **one** from:<br>• lack of chlorophyll | allow lack of chloroplasts | 1 | AO1 4.3.3.1 4.3.1.2 4.3.1.4 |
| | • lack of magnesium (ions) | allow lack of mineral (ions) **or** named example such as iron / nitrate / potassium / zinc (ions)<br>ignore lack of nutrients / nitrogen<br>allow lack of water<br>allow incorrect pH of soil<br>allow acidic / alkaline soil<br>allow (named) infection<br>allow lack of light<br>allow other correct suggestions | | |

4.1.2.3 Stem cells

Answer 07 · Mark scheme

June 2023 | 8461/1F | Original Q6

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| 06.7 | any **two** from:<br>• to check toxicity<br>• to check dosage<br>• to check its efficacy | <br>allow to check it is safe<br>allow to check for side effects<br>allow to check it is not poisonous / dangerous / harmful<br>allow to check how much is needed<br>allow to check it works<br>allow to check it does not interact with other drugs | 2 | AO1<br>4.3.1.9 |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| 06.8 | (writers / companies may get) financial gain<br>**or**<br>(competitor may suffer) financial loss | <br><br><br>ignore because the report has not been peer reviewed<br>ignore have not used a double-blind trial | 1 | AO3<br>4.3.1.9 |

| Question | Answers | Extra information | Mark | AO / Spec Ref. |
|---|---|---|---|---|
| 06.9 | have the claims peer reviewed | | 1 | AO1<br>4.3.1.9 |

| Total Question 1 | 13 |
|---|---|

4.1.2.3 Stem cells



AQA

# GCSE
# BIOLOGY
# 8461/1F

Paper 1 Foundation Tier

**Mark scheme**

June 2020

Version: 1.0 Final Mark Scheme

*jun2084611F/MS*

### 4.1.2.3 Stem cells



MARK SCHEME – GCSE BIOLOGY – 8461/1F – JUNE 2020

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.

Further copies of this mark scheme are available from aqa.org.uk

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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, level of demand 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.

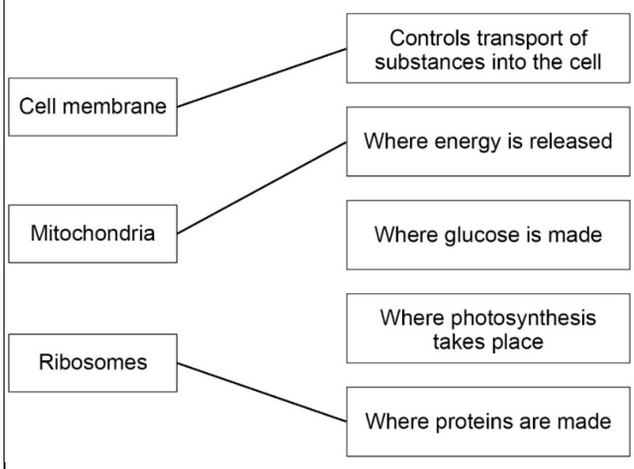
You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

### 4.1.2.3 Stem cells





| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.1** | bacterium | | 1 | AO2<br>4.1.1.1 |
| **01.2** | to strengthen the cell | | 1 | AO1<br>4.1.1.1<br>4.1.1.2 |
| **01.3** | chloroplast | | 1 | AO2<br>4.1.1.2<br>4.2.3.1 |
| **01.4** | **Structure** — **Function**<br><br><br>additional line from a box on the left negates the mark for that box | | 3 | AO1<br>4.1.1.2<br>4.1.3.1 |
| **01.5** | adjust the focus knob | | 1 | AO3<br>4.1.1.2<br>RPA1 |
| **01.6** | (A =) 15 (mm)<br>(B =) 60 (mm) | allow a tolerance of ± 1mm | 1<br>1 | AO2<br>4.1.1.2<br>RPA 1 |
| **01.7** | $\frac{60}{15} = 4(.0)$ | allow ecf from question **01.6** | 1 | AO2<br>4.1.1.2<br>RPA 1 |

### 4.1.2.3 Stem cells





| | | | | |
|---|---|---|---|---|
| **01.8** | $\frac{40}{0.1}$<br><br>400 | <br><br>do **not** accept if a unit is given | 1<br><br>1 | AO2<br>4.1.1.5<br>RPA 1 |
| **Total** | | | **12** | |

### 4.1.2.3 Stem cells





| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.1** | mitosis | | 1 | AO1<br>4.1.2.2 |
| **02.2** | all lines correct = **2** marks<br>1 or 2 lines correct = **1** mark<br>**Stage of cell cycle** / **What happens during that stage**<br>Stage 1 → The cell grows and the chromosomes replicate<br>Stage 2 → One set of chromosomes is pulled to each end of the cell<br>Stage 3 → The cytoplasm and cell membrane divide to form two new cells<br>additional line from a box on the left negates the credit for that box | | 2 | AO1<br>4.1.2.2 |
| **02.3** | $\frac{7}{10} \times 100$<br><br>70(%) | allow $\frac{252}{300} \times 100$<br><br>allow answer calculated from angle in range 250° to 254°<br><br>if no other mark awarded, allow 0.7 for **1** mark | 1<br><br>1 | AO2<br>4.1.2.2 |
| **02.4** | 3 | | 1 | AO2<br>4.1.2.2 |
| **02.5** | DNA | allow deoxyribonucleic acid | 1 | AO1<br>4.1.2.1<br>4.1.2.2 |
| **02.6** | a gene | | 1 | AO1<br>4.1.2.1 |

### 4.1.2.3 Stem cells





| | | | | |
|---|---|---|---|---|
| **02.7** | (bone marrow) cells differentiate into many / other types of (named) cell<br><br>(so) will cure diseases where new cells are needed<br>**or** will cure diseases where cells are damaged | allow (bone marrow) cells can become many / other types of (named) cell<br><br>allow (so) will cure anaemia / leukaemia **or** blood cancer **or** blood disorders<br>allow (so) will cure paralysis / diabetes | 1<br><br>1 | AO1<br><br>AO2<br><br>4.1.2.3 |
| **Total** | | | **10** | |

### 4.1.2.3 Stem cells





| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.1** | any **one** from:<br>• bacteria<br>• fungi<br>• protists | allow singular<br>allow names of pathogens e.g. Salmonella<br>ignore virus / germ | 1 | AO1<br>4.3.1.1<br>4.3.1.3<br>4.3.1.5 |
| **03.2** | hydrochloric acid is produced by the stomach<br><br>the skin is a barrier covering the whole body | | 1<br><br>1 | AO1<br>4.2.2.1<br>4.3.1.6 |
| **03.3** | white blood cells engulf the microorganisms. | | 1 | AO1<br>4.2.2.3<br>4.3.1.6 |
| **03.4** | weakened<br><br>fast | in this order only | 1<br><br>1 | AO1<br>4.3.1.7 |
| **03.5** | by coughs / sneezes | allow 'by droplets in the air'<br>do **not** accept other means of transmission e.g. touch | 1 | AO1<br>4.3.1.1<br>4.3.1.2 |
| **03.6** | (from day) 10 (to day) 18 | allow (from day) 18 (to day) 10 | 1 | AO2<br>4.3.1.2 |
| **03.7** | 14 (days) | allow in the range 13 to 15 (days) | 1 | AO3<br>4.3.1.2 |
| **03.8** | any **one** from:<br>• they had been vaccinated<br>• they already had antibodies<br>• they were immune<br>• they had had it before<br>• they did not get any / enough virus from infected child<br>• they did not play (much) with the infected child | <br><br><br>ignore they were resistant<br><br>ignore they wore a mask<br>unqualified | 1 | AO3<br>4.3.1.2<br>4.3.1.7 |

### 4.1.2.3 Stem cells





| | | | | |
|---|---|---|---|---|
| **03.9** | antibiotics do not kill viruses | allow antibiotics do not work on viruses<br>allow antibiotics only kill bacteria | 1 | AO3<br>4.3.1.8 |
| **Total** | | | **11** | |

### 4.1.2.3 Stem cells





| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.1** | increased (at first)<br><br>until 4 minutes **or** 50 breaths per minute<br><br>(then) stayed constant (from 4 minutes **or** at 50 breaths per minute) | | 1<br><br>1<br><br>1 | AO2<br>4.4.2.2 |
| **04.2** | 175 (beats per minute) | | 1 | AO2<br>4.4.2.2 |
| **04.3** | 140 (beats per minute) | | 1 | AO2<br>4.4.2.2 |
| **04.4** | because his rate is lower than the maximum safe rate | allow ecf for incorrect values in question **04.2** and question **04.3** | 1 | AO3<br>4.2.2.2<br>4.4.2.2 |

| | | | |
|---|---|---|---|
| **04.5** | **Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account. | 5–6 | AO3 |
| | **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 | AO2 |
| | **No relevant content** | 0 | |
| | **Indicative content**<br><br>• heart rate increased<br>○ to increase blood flowing to muscles / lungs<br>○ to provide more oxygen (to muscles)<br>○ to provide more glucose (to muscles)<br>○ to remove carbon dioxide more quickly (from the muscles / blood)<br>○ to remove lactic acid more quickly (from the muscles)<br><br>• breathing rate increased<br>○ supplies more oxygen / air to lungs<br>○ so more oxygen to blood<br>○ more carbon dioxide removed<br><br>• more oxygen to muscles<br>○ needed for (increased) respiration<br>○ to release / provide energy<br>○ for muscle contraction<br><br>• anaerobic respiration occurs<br>○ due to lack of oxygen<br>○ which causes a build-up of lactic acid<br>○ oxygen debt<br>○ muscle fatigue / pain<br><br>To reach **Level 3**, there must be reference to heart rate, breathing rate and respiration | | 4.2.2.2<br>4.2.2.3<br>4.4.2.1<br>4.4.2.3<br>4.4.2.2 |

| | | | |
|---|---|---|---|
| **Total** | | | **12** |

### 4.1.2.3 Stem cells



MARK SCHEME – GCSE BIOLOGY – 8461/1F – JUNE 2020

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | will stop animals / herbivores eating it | allow it will not be eaten | 1 | AO3<br>4.3.3.2 |
| **05.2** | chemical | | 1 | AO1<br>4.3.3.2 |
| **05.3** | thorns / spikes / spines / prickles (to stop animals / herbivores eating it) | | 1 | AO3<br>4.3.3.2 |
| **05.4** | for respiration<br><br>to store as starch | | 1<br><br>1 | AO1<br>4.4.1.3<br>4.4.2.1 |
| **05.5** | add Benedict's (solution / reagent to the liquid)<br><br>boil / heat<br><br>(if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick)red | <br><br>allow any temperature of 65 °C or above | 1<br><br>1<br><br>1 | AO1<br>4.2.2.1<br>RPA 4 |
| **05.6** | (nitrate ions are needed) to make proteins / amino acids<br><br>which are needed for growth / enzymes / new cells | allow to make chlorophyll / DNA / ATP / nucleic acid<br><br>allow correct process for named molecule in mp1 | 1<br><br>1 | AO1<br><br>AO2<br><br>4.1.3.3<br>4.4.1.3<br>4.4.2.3 |
| **05.7** | in / on the (soil) water | allow through air (spaces) in the soil | 1 | AO3<br>4.3.1.1<br>4.3.1.4 |
| **05.8** | dosage<br><br>toxicity | | 1<br><br>1 | AO1<br>4.3.1.9 |

### 4.1.2.3 Stem cells



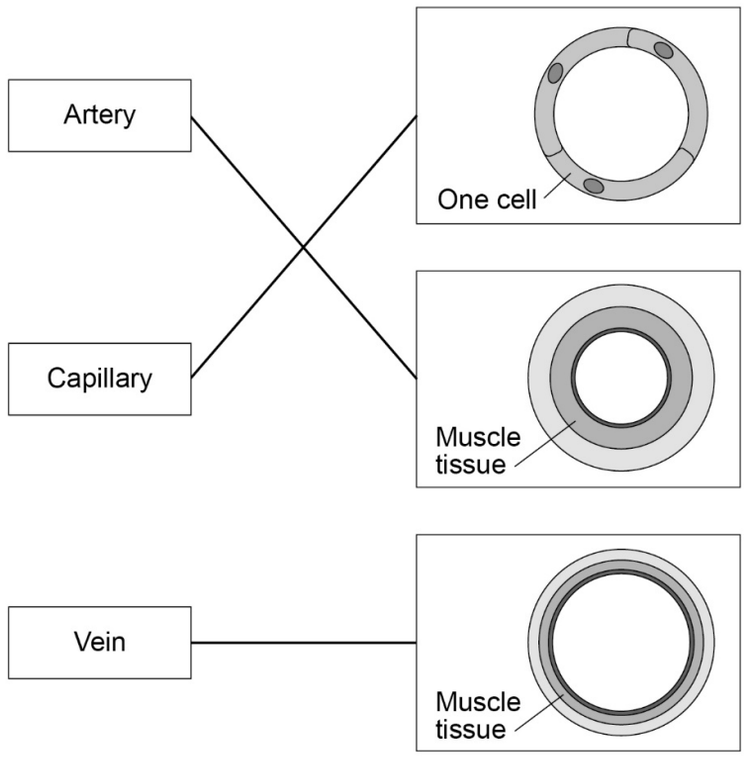


| | | | | |
|---|---|---|---|---|
| **05.9** | placebos | | 1 | AO1<br>4.3.1.9 |
| **Total** | | | **14** | |

### 4.1.2.3 Stem cells





| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.1 | all lines correct = **2** marks<br>1 **or** 2 lines correct = **1** mark<br>**Type of blood vessel** / **Structure of blood vessel**<br><br><br>additional line from a box on the left negates the credit for that box | | 2 | AO2<br>4.2.2.2 |

### 4.1.2.3 Stem cells





| | | | | |
|---|---|---|---|---|
| **06.2** | any **one** from:<br><br>• thick(er) (muscle) walls / tissue (1)<br><br>to push blood (all) around the body (1)<br><br>**or**<br><br>• thick(er) elastic walls / tissue (1)<br><br>to maintain / withstand high (blood) pressure<br>**or** to retain / regain shape (1)<br><br>**or**<br><br>• narrow lumen (1)<br><br>to maintain high (blood) pressure (1) | allow to withstand high (blood) pressure<br>do **not** accept to pump blood (all) around the body | 2 | AO1<br>4.2.2.2 |
| **06.3** | (A) – white (blood) cell(s)<br><br>(B) – platelet(s) | allow any named white (blood) cell(s) | 1<br><br>1 | AO2<br>4.2.2.3 |
| **06.4** | (no nucleus) more space for haemoglobin / oxygen<br><br>(has haemoglobin) to bind / carry oxygen | allow to carry more oxygen<br><br>ignore carries carbon dioxide | 1<br><br>1 | AO3<br>4.1.1.2<br>4.1.1.3<br>4.2.2.3 |
| **06.5** | plasma | | 1 | AO1<br>4.2.2.3 |
| **06.6** | platelets | | 1 | AO3<br>4.2.2.3 |

### 4.1.2.3 Stem cells





| | | | | |
|---|---|---|---|---|
| **06.7** | any **one** from:<br>• (continued) bleeding<br>• (more) bruising | allow described<br>allow blood does not clot (at cuts)<br>allow ecf from answer to question **06.6** | 1 | AO3<br>4.2.2.3 |
| **Total** | | | **11** | |

### 4.1.2.3 Stem cells





| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **07.1** | | allow correct chemical symbols<br>ignore any attempt at balancing equation<br>ignore light / chlorophyll | | AO1<br>4.4.1.1 |
| | *before arrow*<br>carbon dioxide **and** water | either order | 1 | |
| | *after arrow*<br>glucose | ignore sugar / carbohydrate<br>do **not** accept starch | 1 | |
| **07.2** | | ignore description of subsequent parts of the photosynthesis reaction | | AO1<br>4.1.1.2<br>4.4.1.1 |
| | <u>light</u> | allow sun<u>light</u><br>ignore sun | 1 | |
| | (light) is captured / trapped / absorbed by chlorophyll / chloroplasts | allow (light) is used by chlorophyll / chloroplasts | 1 | |
| **07.3** | $\frac{(18.5 + 19.3 + 19.5)}{3}$<br>**or**<br>$\frac{57.3}{3}$ | | 1 | AO2<br>4.4.1.2<br>RPA 6 |
| | 19.1 ($cm^3$/hour) | allow an answer correctly calculated using only two correct values | 1 | |
| **07.4** | a ring around 14.2 | allow clear indication of correct result | 1 | AO3<br>4.4.1.2<br>RPA 6 |

### 4.1.2.3 Stem cells





| | | | | |
|---|---|---|---|---|
| **07.5** | any **one** from:<br>• scale / value was misread<br>• there was air / oxygen in the syringe / measuring cylinder / apparatus<br>• the lamp / light was moved<br>• temperature changed<br>• had different mass / length of pondweed<br>• pondweed had not acclimatised | ignore human error<br>ignore references to counting bubbles or time<br>allow measurement error<br>allow light intensity changed<br>ignore different bulb / lamp unqualified | 1 | AO3<br>4.4.1.2<br>RPA 6 |
| **07.6** | did not use it in calculation (of mean) | | 1 | AO3<br>4.4.1.2<br>RPA 6 |
| **07.7** | any **one** from:<br>• light (intensity)<br>• carbon dioxide (concentration)<br>• pondweed size / amount<br>• pondweed species | do **not** accept temperature<br>ignore time<br>allow distance / power / colour of lamp / light<br>allow same (piece of) pondweed | 1 | AO3<br>4.4.1.2<br>RPA 6 |
| **07.8** | enzyme(s) lose the shape of the active site | allow enzyme(s) (start to) denature<br>allow enzyme(s) destroyed / damaged<br>do **not** accept enzyme(s) killed | 1 | AO2<br>4.2.2.1 |

### 4.1.2.3 Stem cells





| | | | | |
|---|---|---|---|---|
| **07.9** | y-axis labelled '(rate of) photosynthesis in $cm^3$/hour' | | 1 | AO2<br>4.4.1.2<br>RPA 6 |
| | suitable scale on y-axis | must take up half or more of grid provided | 1 | |
| | all points plotted to within ± ½ small square | allow 3 or 4 correct plots for **1** mark<br>ignore any attempt to plot a point at 20 °C | 2 | |
| | correct curved line of best fit | ignore line joined point to point with straight lines<br>ignore extrapolation | 1 | |
| **Total** | | | **16** | |

### 4.1.2.3 Stem cells





| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.1** | movement / spreading out of molecules / particles | allow movement / spreading out of (named) substances / chemicals / gases / liquids<br>ignore reference to membranes / cells | 1 | AO1<br>4.1.3.1 |
| | from (an area of) high(er) concentration to (an area of) low(er) concentration | allow down / with the concentration gradient<br>ignore along / across the concentration gradient<br>do **not** accept movement from / to a concentration gradient | 1 | |
| **08.2** | increased carbon dioxide concentration in the air | | 1 | AO2<br>4.1.3.1<br>4.2.3.2 |
| | increased number of stomata that are open | | 1 | |

### 4.1.2.3 Stem cells





| | | | |
|---|---|---|---|
| **08.3** | **Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account. | 5–6 | AO1<br>4.1.3.1<br>4.2.2.2<br>4.2.2.3 |
| | **Level 2:** Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear. | 3–4 | |
| | **Level 1:** Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking. | 1–2 | |
| | **No relevant content** | 0 | |
| | **Indicative content**<br>• (many) alveoli<br>  • provide a large(r) surface area (**:** volume)<br><br>• capillaries are thin<br>  **or** alveoli / capillary walls are thin **or** one cell thick<br>  **or** capillaries are close to the alveoli<br>  • which provides short diffusion path (for oxygen / carbon dioxide)<br><br>• breathing (mechanism) moves air in and out<br>**or** lungs are ventilated<br>  • to bring in (fresh) oxygen<br>  • to remove carbon dioxide<br>  • to maintain a concentration / diffusion gradient`<br><br>• large capillary network (around alveoli)<br>**or** good blood supply<br>  • to remove oxygen(ated blood) quickly<br>  • to bring carbon dioxide to the lungs quickly<br>  • to maintain a concentration / diffusion gradient | | |

### 4.1.2.3 Stem cells





| | | | | |
|---|---|---|---|---|
| **08.4** | Osmosis | allow diffusion | 1 | AO1<br>4.1.3.1<br>4.2.3.2<br>4.1.3.2 |
| **08.5** | active transport<br><br>(because) energy is needed<br><br>(to move nitrate ions) from a low(er) concentration (in the soil) to a high(er) concentration (in the root / cell) | <br><br><br><br>allow (to move nitrate ions) against / up the concentration gradient<br><br>allow (because) there is a lower concentration (of nitrate ions) in the soil **or** (because) there is a higher concentration (of nitrate ions) in the root / cell<br><br>ignore reference to amount / number of nitrate ions<br><br>ignore along / across the concentration gradient<br><br>do **not** accept if reference to molecules / atoms moving | 1<br><br>1<br><br>1 | AO3<br><br>AO2<br><br>AO2<br><br>4.1.1.3<br>4.2.3.2<br>4.1.3.3 |
| **Total** | | | **14** | |

4.1.2.3 Stem cells

Answer 05 · Examiner comments — November 2020 | 8461/1F | Original Q2

**Question 2 (low & standard demand)**

In **02.3**, whilst there is no expectation for students to use a protractor to measure angles, this was occasionally seen. **02.7** was not answered well due to weak use of language, with 4% of students gaining both marks, and 23% gaining one mark. Many students talked generally about new cells replacing the old ones, and some new cells actually 'fixing' or repairing the damaged cells. The idea of stem cells 'adapting' was a common occurrence, as was a repeat of the stem of the question, in relation to stem cells becoming specialised. A few students thought that stem cells were made of plastic or metal (confusing them with replacement heart valves). There was confusion from some students regarding the bone marrow itself being damaged.

Answer 06 · Examiner comments — June 2022 | 8461/1F | Original Q2

**Question 2 (Low demand)**

**02.1** It was clear that many students had not previously had experience of viewing cells in different stages of division under a microscope, with just over a quarter of students gaining the mark in this question.

**02.2** Students' understanding of mitosis maintaining the chromosome number was poor, with less than 40% of students gaining the mark in this question. The most common incorrect answer was 5, perhaps because students were confusing the process with meiosis, where the chromosome number is halved.

**02.3** Many students struggled to select the correct terms to describe the cell cycle in this question, often confusing the word 'contracts' with 'divides'.

**02.4** Nearly all students were able to determine the longest part of the cell cycle from **Figure 2**.

**02.5** Over three quarters of students were able to calculate that stage **A** in **Figure 2** represented 10%, with the most common incorrect answer being 15%.

**02.6** Over 75% of students were able to correctly identify the heart as being part of the circulatory system, with the most common incorrect answer being the respiratory system.

4.1.2.3 Stem cells

**Answer 06 · Examiner comments** June 2022 | 8461/1F | Original Q2

**02.7** Less than half of students were awarded a mark in this question. Common incorrect answers did not relate to the heart, such as diabetes, and students are reminded of the need to read all questions carefully, to avoid such errors. In addition, some students named parts of the heart rather than medical conditions, perhaps indicating that they had not read the question properly. 'Chronical' heart disease was more commonly seen than anticipated and cancer was often given, which was not creditworthy.

**02.8** Over 55% of students gained credit in this question, with the most common answers relating to religious or personal beliefs. Occasionally, risk of infection was seen but rejection was a rarity. This is the type of question where many students had the right idea, but articulated themselves poorly and so did not get the mark. Vague descriptions such as 'they don't agree with it' were not given credit.

**Answer 07 · Examiner comments** June 2023 | 8461/1F | Original Q6

**Question 6 (Standard demand)**

**06.1** Whilst most students could describe a tissue as being 'a group of cells', with many of these going on to state that these cells were 'working together'; this was insufficient for credit. Further qualification in respect of the cells being 'similar' or of the cells 'having a particular function' was required to gain this mark. Thus, relatively few students were rewarded. It was evident that some students struggled, as ideas such as tissues being 'parts of organs' were not uncommon. Almost 79% of students failed to gain the mark.

**06.2** Many answers referred to parts of the plant, such as xylem or root hairs. Knowledge of 'meristem' as being the tissue in plants where stem cells are found was by no means widespread. Some students had not read the question carefully enough and suggested animal tissues, most commonly 'bone marrow'. Just over 10% of students knew that meristem tissue contains stem cells and gained the mark.

**06.3** A wide variety of plants were suggested, along with some suggestions of plant tissues and even fictitious plants such as 'the aspirin tree', perhaps as students struggled to recall the answer and had been trained to write down something, rather than nothing – that said, 17% of students did not attempt a response at all. Of the plants given in responses, 'willow' was

Answer 07 · Examiner comments

June 2023 | 8461/1F | Original Q6

by far the most common and gained the mark for over 18% of students. Others such as 'foxglove' were mentioned, indicating a recollection of plants named in the specification.

**06.4** Many answers simply repeated information given in the table, such as 'berries have the least mass of the chemical', but this was not sufficient as it does not explain why the berries are picked in preference to leaves or roots. Vague answers such as there being 'more berries' were also insufficient to gain credit. Around a quarter of students gain the mark, with common correct answers referring to the idea that picking berries would not harm the plant, that berries would be 'easier to collect' or that 'the chemical would be easier to extract'.

**06.5** Relatively few students managed to complete the calculation correctly, with only 4% gaining all 4 marks. The most common error was by students who did not know the conversion factor for grams to milligrams. Fortunately, this usually only cost students 1 of the 4 marks, as answers which had used the incorrect conversion factor (whether this involved multiplying or dividing by an incorrect multiple of 10) were still able to gain the final mark. Students often got only part way through the calculation, stopping at 0.72 or 2.4, for 1 mark only; however, the 3$^{rd}$ and 4$^{th}$ marking points could still be gained if correctly addressed. Some students divided values, rather than multiplying, as was needed, whilst others arrived at somewhat unlikely answers equivalent to many hundreds of grams, far exceeding the 200 g mass of plant tissue it was extracted from. Nearly half of all responses gained no credit – either because it was not attempted – or completely incorrect.

**06.6** Around 30% of students gained the mark in this question. A lack 'of magnesium' or 'of chlorophyll' was quite well known and many students gained this mark. Answers often implied a degree of speculation by students, but those who did attempt an answer may have been rewarded for this, as, for example, a lack 'of light' or of water' were both credited. A description of 'an infection' along with naming any plant disease also gained credit, as students are not expected to know, for example, that the tobacco mosaic virus does not infect nightshade plants. A not infrequent suggestion was that having chlorosis would 'put animals off from eating them', as students interpreted the question as asking for an advantage of having chlorosis, rather than what had caused the condition.

**06.7** There were many good answers to this question, with frequent references to toxicity, dosage and efficacy. Some students, though, offered two ideas relating to toxicity, with descriptions regarding safety and side effects: thus, gaining only the one mark. However, over 90% of students gained some marks in this question, which was pleasing.

**06.8** Many responses referred to writers of the report, or companies who might want the public to use or avoid the drug, however relatively few references to one party or another making financial loss or gain were made and as such only around 10% of students were awarded the mark. Other insufficient responses referred to ethics of using plants or the possibility that habitats might be destroyed by large nightshade plantations. Students only needed to refer to people 'buying' or someone 'selling' the product, to gain the mark or alternatively the idea that the writer of the biased report might have been 'paid' for their work.

**06.9** Nearly 64% of students correctly indicated that scientists should 'have the claims peer reviewed' to be sure claims are valid.