



**General Certificate of Secondary Education  
2019–2020**

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**Double Award Science  
Biology**

**Unit B1**

**Higher Tier**

**[GDW12]**

**WEDNESDAY 6 NOVEMBER 2019, MORNING**

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**MARK  
SCHEME**

## General Marking Instructions

### **Introduction**

Mark schemes are intended to ensure that the GCSE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria which they should apply in allocating marks to candidates' responses.

### **Assessment objectives**

Below are the assessment objectives for GCSE Double Award Science.

Candidates must:

- |     |                                                                                                                                                                                                                                   |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AO1 | Demonstrate knowledge and understanding of: <ul style="list-style-type: none"><li>• scientific ideas; and</li><li>• scientific techniques and procedures;</li></ul>                                                               |
| AO2 | Apply knowledge and understanding of and develop skills in: <ul style="list-style-type: none"><li>• scientific ideas; and</li><li>• scientific enquiry, techniques and procedures; and</li></ul>                                  |
| AO3 | Analyse scientific information and ideas to: <ul style="list-style-type: none"><li>• interpret and evaluate;</li><li>• make judgements and draw conclusions; and</li><li>• develop and improve experimental procedures.</li></ul> |

### **Quality of candidates' responses**

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

### **Flexibility in marking**

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

### **Positive marking**

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. The exception to this for GCSE Double Award Science is when examiners are marking complex calculations when the Examiners are briefed to mark by error or omission. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

### **Awarding zero marks**

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

### **Marking Calculations**

In marking answers involving calculations, examiners should apply the 'carry error through' rule so that candidates are not penalised more than once for a computational error. To avoid a candidate being penalised, marks can be awarded where correct conclusions or inferences are made from their incorrect calculations.

### **Types of mark schemes**

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

### **Levels of response**

In deciding which level of response to award, examiners should look for the number of indicative content points in candidate responses to ensure that the answer has been written to coincide with the question. In deciding which mark within a particular level to award to any response, quality of communication will be assessed and examiners are expected to use their professional judgement.

The following guidance is provided to assist examiners.

- **Threshold performance:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- **High performance:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

### **Quality of written communication**

Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of bands of response. The description for each band of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within bands of response as follows:

Band A: Quality of written communication is excellent.

Band B: Quality of written communication is good.

Band C: Quality of written communication is basic.

Band D: Response not worthy of credit.

In interpreting these band descriptions, examiners should refer to the more detailed guidance provided below:

Band A (Excellent): Excellent reference to scientific terminology. The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

Band B (Good): Good reference to scientific terminology. The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

Band C (Basic): Basic reference to scientific terminology. The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <p>1 (a) (i) Habitat [1]</p> <p>(ii) Community [1]</p> <p>(b) (i) (Trophic level) 3/third/tertiary [1]</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <div>AVAILABLE MARKS</div> <div>6</div> |
| <p>(ii) <b>Description:</b> Increase/more owls alive/produce more owls/more offspring</p> <p>Any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>owls will have more food/prey/<b>more</b> rats (for owls to eat)/<b>more</b> beetles (for owls to eat)/<b>more</b> rabbits (for owls to eat);</li> <li><b>less</b> competition (for food)/foxes and owls eat the same food/there is one less predator/won't have to fight over animals</li> <li><b>less</b> food eaten by the fox/foxes eat less rabbit /beetles/rats/foxes eat less animals [3]</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                         |
| <p>2 (a) Any <b>two</b> sets from:</p> <p>A <b>Description</b><br/>thin walls/thin cells/ 2 layers of cells/2 cells/no gaps between air sacs and capillaries/air sac (alveolus) close to transport system;<br/><b>Explanation</b><br/>short or smaller <b>diffusion</b> pathway/better/easier <b>diffusion</b>/more O<sub>2</sub> <b>diffuses</b>/more CO<sub>2</sub> <b>diffuses</b>/short diffusion distance</p> <p>B <b>Description</b><br/>good blood supply/lots of capillaries/dense capillary network/rich blood supply<br/><b>Explanation</b><br/>maintain diffusion gradient/takes oxygen away <b>quickly</b>/faster/brings CO<sub>2</sub> <b>quickly</b>/faster</p> <p>C <b>Description</b><br/>Layer of moisture present/air sac has a layer of moisture; moist walls<br/><b>Explanation</b><br/>gases/oxygen or CO<sub>2</sub> <b>dissolve</b> in the moisture/water</p> <p>D <b>Description</b><br/>Large surface <b>area</b><br/><b>Explanation</b><br/><b>more</b> diffusion/<b>increased</b> diffusion/<b>max</b> diffusion/<b>more</b> O<sub>2</sub>/<b>more</b> CO<sub>2</sub> across or <b>more</b>/<b>increased</b>/<b>max</b> gas exchange<br/>allow more <b>room</b>/lots of <b>space</b>/for gas exchange</p> <p>E <b>Description</b><br/>Permeable<br/><b>Explanation</b><br/>to allow gases/allow oxygen/carbon dioxide <b>through/across/transfer</b> in or out/<b>easier</b> for gases to get in or out [4]</p> |                                         |

- (b) (i) Explanation any **two** from: (assume C)
- lowest breathing rate **at rest**/lower than A and B **at rest**;
  - lowest breathing rate **after exercise**/lower than A and B **after exercise**;
  - least time for breathing rate to **return to at rest value/normal** value/shortest **recovery** time
  - least increase in breathing rate (after exercise)
  - lowest breathing rate at **all times** = [1]

Or award if they give values shown below:

- Breathing rate at rest is 2 breaths less than student A and 3 breaths less than student B
- Breathing rate after exercise is 5 breaths less than student A and 8 breaths less than student B
- A increases by 21 and B increases by 23 or C **only** increases by 18
- Time taken to return to breathing rate at rest is 2 minutes faster than student A and 3 minutes faster than student B. [2]

- (ii) Any **two** from:
- **more** oxygen (taken in)/**more** carbon dioxide removed/oxygen taken in **faster**;
  - for **more** respiration/**increased** respiration/faster respiration;
  - for **more** energy/**increased** energy;
  - for **more** muscles contraction/muscles to work **more**/muscles more **efficient**/for muscles to work **better**; [2]

- (c) (i) No oxygen/lack of oxygen/not enough oxygen/anaerobic is without O<sub>2</sub>; not enough energy from aerobic respiration/gives you energy/you need energy/happens when we run out of energy and need more [2]

- (ii) Lactic acid/lactate [1]

AVAILABLE  
MARKS

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### 3 Indicative content:

1. (Leaves contain) chloroplasts/chlorophyll
2. Palisade mesophyll cells contain **many** chloroplasts
3. Palisade mesophyll cells tightly packed/near upper surface of the leaf/elongated/lengthways/90°
4. **Spongy** (mesophyll) cells contain chloroplasts/chlorophyll/contain some chloroplasts/less chloroplasts than palisade cells
5. Thin/transparent/clear cuticle
6. Epidermis lacks chloroplasts/thin/transparent/clear/one cell thick
7. Allows light to enter/not obstructed – **linked to 5. or 6.**
8. Large surface area (of leaf)
9. Short distance between upper and lower surfaces/leaf is thin

| Band | Response                                                                                                                                                                                                                      | Mark    |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| A    | Candidates use appropriate terms throughout to give <b>at least five</b> points from the indicative content. They use good spelling, punctuation and grammar skills. Form and style are of a high standard.                   | [5]–[6] |
| B    | Candidates use appropriate terms throughout to give <b>at least three or four</b> points from the indicative content. They use satisfactory spelling, punctuation and grammar. Form and style are of a satisfactory standard. | [3]–[4] |
| C    | Candidates use appropriate terms throughout to give <b>one or two</b> points from the indicative content. They use limited spelling, punctuation and grammar and have made little use of specialist terms.                    | [1]–[2] |
| D    | Response not worthy of credit.                                                                                                                                                                                                | [0]     |

[6]

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### 4 Mark description and explanation together

(a) **Description:** **Some** protein stain removed/large amount of protein remaining/10% removed/90% remaining/**little** stain removed/**most** stain remaining

**Explanation:** Any **three** from:

- Shape of active site changed
- Substrate cannot fit/not **complementary**/doesn't fit like lock and key
- no E–S complexes formed/less **successful** collisions
- pH is (too) acidic/pH far from optimum/pH is too low

[4]

(b) (pH) 9;

No stain remaining/all stain removed/100% stain removed/0% stain remaining/takes all stain

[2]

(c) (i) Molecule **B**

[1]

(ii) Lock and Key

[1]

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| 5 | Information                                                                                         | Biological molecule | AVAILABLE MARKS |
|---|-----------------------------------------------------------------------------------------------------|---------------------|-----------------|
|   | complex carbohydrate found in plant cell walls                                                      | glycogen            | 5               |
|   | complex carbohydrate used as a storage molecule in animal cells                                     | glycerol            |                 |
|   |                                                                                                     | cellulose           |                 |
|   | simple carbohydrate used by cells during respiration                                                | lactose             |                 |
|   | complex carbohydrate used as a storage molecule in plant cells                                      | starch              |                 |
|   |                                                                                                     | amino acid          | 6               |
|   | simple carbohydrate found in milk                                                                   | glucose             |                 |
|   | [1] each correct answer                                                                             | [5]                 |                 |
| 6 | (a) A                                                                                               | [1]                 |                 |
|   | (b) (i) Phototropism                                                                                | [1]                 |                 |
|   | (ii) Auxin                                                                                          | [1]                 |                 |
|   | (iii) Description: shoot grows straight up/straight/upright/upwards/vertically<br>Explanation:      |                     |                 |
|   | • Same amount of auxin/hormone on both sides/even auxin on both sides/even distribution of hormone; |                     |                 |
|   | • Same cell elongation on both sides/even cell elongation                                           | [3]                 |                 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | AVAILABLE MARKS |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <p>7 (a) (i) Stimulus: Object (near eye)/light<br/>Effector: Muscle/eye muscle<br/>Response: Eyelid closes/blink/blinking/eye closing rapidly [3]</p> <p>(ii) Motor [1]</p> <p>(b) Nervous system faster/hormone slower<br/>or nervous system uses neurones<br/>and hormone involves blood<br/>or hormone involves blood and nervous system does not<br/>(need a comparison)<br/>or nervous carried by (electrical) impulse and hormone chemical message<br/>or nervous short lived and hormone response longer lasting [1]</p> <p>(c) (i) Anti-diuretic hormone/ADH [1]</p> <p>(ii) Mark description and explanation together<br/>Description: smaller volume/more concentrated urine/less dilute urine/<br/>decreased/slower urine production/less urine;<br/>Explanation: <b>More</b> water (re)absorbed (by kidneys)/body retains more<br/>water/keeps more water [2]</p>                                                                                                                                                                                                                                                                                                                                     | 8               |
| <p>8 (a) Root hair cell(s) [1]</p> <p>(b) (i) Any <b>three</b> from:</p> <ul style="list-style-type: none"> <li>• Increase (in plant mass)/mass increased initially/mass increased overall;</li> <li>• From 8.5 g to 24.3 g/increase of 15.8 g/up to/max of 24.3 g/increased overall by 1.4g/up to 10;</li> <li>• Decrease in plant mass/less increase in plant mass (after 10/24.3 g);</li> <li>• from 24.3 to 9.9 g/decrease of 14.4 g/decreased to 9.9 g [3]</li> </ul> <p>(ii) <math>24.3 - 8.5 = 15.8</math>;<br/><math>15.8 \div 8.5 \times 100</math>;<br/><math>= 185.9\%</math> [3]</p> <p>(c) Know which nitrate concentration is the optimum/best/use 10 units/not use more than 10;<br/>(to obtain) <b>maximum</b> mass of the spinach produced/<b>largest</b> increase in mass/<b>largest</b> profit/produce spinach <b>fastest</b>/<b>highest</b> yield/<b>best</b> price/grow as much as possible [2]</p> <p>(d) Nitrogen fixing (bacteria);<br/>Nitrogen (gas) in the air/atmosphere/in the soil;<br/>Nitrifying (bacteria);<br/>Ammonia from dead/decaying matter/described/from urine/decomposing material/plants or animals remains<br/>(bacteria needs to match substance and source) [4]</p> | 13              |

- 9 (a) Any **two** from:
- (More) light/(more) sun/sunlight/light intensity increase;
  - More photosynthesis than respiration;
  - More CO<sub>2</sub> used than produced/more CO<sub>2</sub> taken in than given out [2]
- (b) (i) 6 **am** and 8 **pm** (need both)/06:00 and 20:00 [1]
- (ii) Red [1]
- (c) Yellow;
- Any **two** from:
- no photosynthesis but there is respiration/respiration **only**;
  - **More** CO<sub>2</sub> produced (than used)/**more** CO<sub>2</sub> (given out)/CO<sub>2</sub> **higher** than atmospheric/excess CO<sub>2</sub>/high/higher CO<sub>2</sub> [3]

**Total**

**AVAILABLE  
MARKS**

7

**70**