

Q1. (2018)

|   |  |     |   |     |  |
|---|--|-----|---|-----|--|
| 4 |  | C ✓ | 1 | 2.2 |  |
|---|--|-----|---|-----|--|

Q2. (2018)

|   |  |     |   |     |  |
|---|--|-----|---|-----|--|
| 9 |  | C ✓ | 1 | 2.2 |  |
|---|--|-----|---|-----|--|

Q3. (2018)

|    |  |     |   |     |  |
|----|--|-----|---|-----|--|
| 12 |  | D ✓ | 1 | 1.2 |  |
|----|--|-----|---|-----|--|

Q4. (2018)

|    |  |     |   |     |  |
|----|--|-----|---|-----|--|
| 14 |  | C ✓ | 1 | 1.1 |  |
|----|--|-----|---|-----|--|

Q5. (2018)

|    |  |     |   |     |  |
|----|--|-----|---|-----|--|
| 15 |  | A ✓ | 1 | 1.1 |  |
|----|--|-----|---|-----|--|

Q6. (2018)

A)

|    |     |     |              |   |     |                       |
|----|-----|-----|--------------|---|-----|-----------------------|
| 17 | (a) | (i) | guard cell ✓ | 1 | 1.1 | IGNORE stomatal cells |
|----|-----|-----|--------------|---|-----|-----------------------|

B)

|  |  |      |                                                                                                                          |   |         |                                                                                              |
|--|--|------|--------------------------------------------------------------------------------------------------------------------------|---|---------|----------------------------------------------------------------------------------------------|
|  |  | (ii) | allows gaseous exchange (of CO <sub>2</sub> and O <sub>2</sub> ) ✓<br>allows water evaporation (to help transpiration) ✓ | 2 | 2 x 1.1 | ALLOW to release/let water out of the leaf/plant<br>IGNORE to let water enter the leaf/plant |
|--|--|------|--------------------------------------------------------------------------------------------------------------------------|---|---------|----------------------------------------------------------------------------------------------|

Q7. (2018) – 17c

A)

|  |     |     |                                            |   |         |                                                                                                                              |
|--|-----|-----|--------------------------------------------|---|---------|------------------------------------------------------------------------------------------------------------------------------|
|  | (c) | (i) | 6H <sub>2</sub> O ✓      6O <sub>2</sub> ✓ | 2 | 2 x 1.1 | must be on correct side of equation<br>ALLOW unbalanced/incorrectly balanced H <sub>2</sub> O O <sub>2</sub><br>for one mark |
|--|-----|-----|--------------------------------------------|---|---------|------------------------------------------------------------------------------------------------------------------------------|

B)

|  |  |      |               |   |     |  |
|--|--|------|---------------|---|-----|--|
|  |  | (ii) | endothermic ✓ | 1 | 1.1 |  |
|--|--|------|---------------|---|-----|--|

Q8. (2018)

A)

|  |     |     |          |   |     |  |
|--|-----|-----|----------|---|-----|--|
|  | (d) | (i) | 30(°C) ✓ | 1 | 2.2 |  |
|--|-----|-----|----------|---|-----|--|

B)

|  |  |      |                                                                                          |   |          |                                                                                                                                                                        |
|--|--|------|------------------------------------------------------------------------------------------|---|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | (ii) | record at narrower temperature intervals ✓<br>narrower intervals around the 30°C value ✓ | 2 | 2 x 3.3b | ALLOW any temperature increment less than 5°C<br>ALLOW narrower intervals around the optimum<br>ALLOW narrower interval range between 25-35°C<br>but must include 30°C |
|--|--|------|------------------------------------------------------------------------------------------|---|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Q9. (2019)

|    |  |   |   |     |  |
|----|--|---|---|-----|--|
| 15 |  | B | 1 | 2.1 |  |
|----|--|---|---|-----|--|

Q10. (2019) – 19b

A)

|    |     |     |                                                                                                       |   |      |                                                                                                                                                                   |
|----|-----|-----|-------------------------------------------------------------------------------------------------------|---|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19 | (b) | (i) | plant B has grown in the direction of/towards the light source ✓<br><br>tropic response is positive ✓ | 2 | 3.1a | <b>ALLOW</b> in plant A it is still showing phototropism to the light source above<br><b>IGNORE</b> movement<br><br><b>ALLOW</b> positive phototropism is correct |
|----|-----|-----|-------------------------------------------------------------------------------------------------------|---|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|

B)

|    |     |      |         |   |     |                                     |
|----|-----|------|---------|---|-----|-------------------------------------|
| 19 | (b) | (ii) | auxin ✓ | 1 | 1.1 | <b>ALLOW</b> IAA/indole acetic acid |
|----|-----|------|---------|---|-----|-------------------------------------|

Q11. (2020)

A)

|    |     |  |                                 |   |     |                                                                                                 |
|----|-----|--|---------------------------------|---|-----|-------------------------------------------------------------------------------------------------|
| 18 | (a) |  | distance of lamp/light source ✓ | 1 | 2.2 | <b>ALLOW</b> light intensity<br><b>IGNORE</b> the lamp with no mention of distance or intensity |
|----|-----|--|---------------------------------|---|-----|-------------------------------------------------------------------------------------------------|

B)

|  |     |     |                                                                                                                                                                                                            |   |     |                                                                                                             |
|--|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|-------------------------------------------------------------------------------------------------------------|
|  | (b) | (i) | <b>Any two from:</b><br>bubbles are different sizes / has different volume of gas ✓<br><br>some bubbles may also be missed/miscounted ✓<br><br>so volume at each point may not be representative of rate ✓ | 2 | 2.2 | <b>ALLOW</b> amount of oxygen varies / bubbles burst<br><b>IGNORE</b> the pondweed could be different sizes |
|--|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|-------------------------------------------------------------------------------------------------------------|

C)

|  |  |      |                                                                                                                                                  |   |         |                                                                                                                              |
|--|--|------|--------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|------------------------------------------------------------------------------------------------------------------------------|
|  |  | (ii) | <b>Any two from:</b><br>measure volume (of gas released) ✓<br><br>names a suitable apparatus for measuring for volume ✓<br><br>use a heat sink ✓ | 2 | 2x 3.3a | <b>IGNORE</b> measure amount<br><br><b>ALLOW</b> e.g. measuring cylinder / gas syringe / Audus apparatus / graduated pipette |
|--|--|------|--------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|------------------------------------------------------------------------------------------------------------------------------|

D)

|  |     |     |                                                                                                                                     |   |         |                                                                                                                                                                                                                                                                                           |
|--|-----|-----|-------------------------------------------------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (c) | (i) | axes correctly labelled, including units ✓<br><br>all points correctly plotted ✓ ✓<br><br><br><br>suitable line of best fit drawn ✓ | 4 | 4 x 2.2 | <b>ALLOW</b> +/- half a square<br>all points correctly plotted<br>0 to 1 correct point plotted = 0 mark<br>2 to 4 correct points plotted = 1 mark<br>All 5 correct points plotted = 2 marks<br><br><b>ALLOW</b> line of best fit based on plotted points<br><b>IGNORE</b> dot to dot line |
|--|-----|-----|-------------------------------------------------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

E)

|  |  |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |      |                                                                                                                                                                                      |
|--|--|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | (ii) | further lamp is from the plant photosynthesis reduced / ORA ✓<br><br>example of a decrease from data e.g. at 10cm 30 bubbles given off and at 40cm only 2 bubbles ✓<br><br><b>OR</b><br><br>photosynthesis stops in very low light ✓<br><br>by 50 cm there are no bubbles ✓<br><br><b>OR</b><br><br>idea that rate of photosynthesis decrease is a non-linear relationship ✓<br><br>e.g. nearly double the number of bubbles at 10cm compared to 20cm but not double elsewhere ✓ | 2 | 3.2b | <b>IGNORE</b> type of gas mentioned in bubbles<br><b>ALLOW</b> description of decrease in bubbles e.g. further lamp the less bubbles<br><b>ALLOW</b> there is a negative correlation |
|--|--|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Q12. (2021)

|   |  |    |   |     |  |
|---|--|----|---|-----|--|
| 9 |  | B✓ | 1 | 1.2 |  |
|---|--|----|---|-----|--|

Q13. (2021)

A)

|  |      |                               |   |      |                                                     |
|--|------|-------------------------------|---|------|-----------------------------------------------------|
|  | (ii) | Oxygen stops being produced ✓ | 1 | 3.1a | <b>ALLOW</b> because photosynthesis produces oxygen |
|--|------|-------------------------------|---|------|-----------------------------------------------------|

B)

|     |     |                                                                                                                                  |   |          |                                             |
|-----|-----|----------------------------------------------------------------------------------------------------------------------------------|---|----------|---------------------------------------------|
| (b) | (i) | Light enables the moss ball plant to float/rise ✓<br>Idea of slight time lag between exposure to light and floating or sinking ✓ | 2 | 2 x 3.2a | <b>ALLOW</b> converse arguments in the dark |
|-----|-----|----------------------------------------------------------------------------------------------------------------------------------|---|----------|---------------------------------------------|

C)

|  |      |                                                                                                                                                                                                                                                                                                                       |   |         |                                                                                                                                                                                            |
|--|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (ii) | <b>Any two from:</b><br>Idea that exposure to light produces oxygen/allows photosynthesis, so ball floats ✓<br>Idea that (in experiment 1) dark conditions stop photosynthesis/oxygen production causing sinking ✓<br>Idea that the light is shone for a longer time in experiment 2, so the ball floats for longer ✓ | 2 | 2 x 2.1 | <b>DO NOT ALLOW</b> in the dark respiration starts<br><br>Answer needs to compare the length of time the light is shone and the length of time the ball floats to score this marking point |
|--|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

D)

|     |  |                                                                                                                                                                                                                                                                                                                                                                                                 |   |         |                                                                                                                                                                                      |
|-----|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (c) |  | <b>Any three from:</b><br>(Increased temperature) will increase photosynthesis/respiration /transpiration/water uptake OR ✓<br>Molecules move faster / increased kinetic energy ✓<br>Increased rate of collisions between enzymes and substrates/ increased rate of formation of ES complexes ✓<br>High temperature levels/above 37°C will stop/reduce the rate of photosynthesis/respiration ✓ | 3 | 3 x 1.1 | <b>ALLOW</b> increase evaporation<br><br><b>ALLOW</b> higher level responses to high temperature effects on enzymes e.g. enzymes/structural proteins in plants may start to denature |
|-----|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Q13. (2022)

|   |     |   |     |                 |
|---|-----|---|-----|-----------------|
| 7 | D ✓ | 1 | 2.2 | <b>ALLOW</b> 19 |
|---|-----|---|-----|-----------------|

Q14. (2022)

|    |     |   |     |  |
|----|-----|---|-----|--|
| 14 | C ✓ | 1 | 1.1 |  |
|----|-----|---|-----|--|

Q15. (2022)

A)

|    |     |  |   |         |                                                                                                                                                  |
|----|-----|--|---|---------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 18 | (a) |  | 4 | 4 x 1.1 | 6 correct lines = 4<br>5/4 correct lines = 3<br>3 correct lines = 2<br>2 correct lines = 1<br><b>DO NOT ALLOW</b> more than 1 line from each box |
|----|-----|--|---|---------|--------------------------------------------------------------------------------------------------------------------------------------------------|

B)

|  |     |                     |   |         |                                                                                       |
|--|-----|---------------------|---|---------|---------------------------------------------------------------------------------------|
|  | (b) | Water ✓<br>Oxygen ✓ | 2 | 2 x 1.1 | <b>ALLOW</b> alternatives H <sub>2</sub> O / O <sub>2</sub> but name takes precedence |
|--|-----|---------------------|---|---------|---------------------------------------------------------------------------------------|

Q16. (2023)

|    |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |   |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20 | (a) | <p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b><br/>         Provides a detailed description of how to change the light intensity <b>AND</b> describes variables that need to be controlled <b>AND</b> Describes in detail the measurements that should be taken.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b><br/>         Describes how to change the light intensity, states a variable that needs to be controlled and describes a measurement that should be taken.<br/> <b>OR</b><br/>         Provides a detailed description of how to change the light intensity and describes variables that need to be controlled.<br/> <b>OR</b><br/>         Provides a detailed description of how to change the light intensity and describes in detail the measurements that should be taken.<br/> <b>OR</b><br/>         Describes variables that need to be controlled and describes in detail the measurements that should be taken</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b><br/>         Describes how to change the light intensity <b>OR</b> describe variables that need to be controlled <b>OR</b> describes a measurement that should be taken.</p> | 6 | 4 x 2.2 | <p><b>AO2.2 Describes how to change the light intensity</b></p> <ul style="list-style-type: none"> <li>• suitable method used to describe how to change the light intensity.<br/>e.g. place the lamp at different distances from the pondweed/change light intensity</li> <li>• suggest how many light intensities / range of distances</li> </ul> <p><b>2x 3.3a AO3.3a Describes the variables that need to be kept constant to collect valid data</b></p> <ul style="list-style-type: none"> <li>• same species of plant</li> <li>• same piece/mass/amount of pondweed in each experiment</li> <li>• same volume/concentration of sodium hydrogen carbonate</li> <li>• same volume of water</li> <li>• eliminate all other light sources/only light source is the lamp</li> <li>• keep the temperature constant /use a thermostatically controlled water bath</li> <li>• same wavelength of light</li> <li>• pH</li> </ul> <p><b>AO2.2 Describes the measurements that should be taken</b></p> <ul style="list-style-type: none"> <li>• count the number of bubbles of oxygen given off in a set time</li> <li>• repeat the readings and/or calculate a mean</li> </ul> |
|    |     | <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b><br/>         No response or no response worthy of credit.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

Q17. (2024)

|   |   |   |     |  |
|---|---|---|-----|--|
| 4 | C | 1 | 1.1 |  |
|---|---|---|-----|--|

Q18. (2024)

|    |   |   |     |  |
|----|---|---|-----|--|
| 12 | C | 1 | 1.2 |  |
|----|---|---|-----|--|