Mark schemes

Q1.

(a) Correct answer of 12 = **2 marks**

OR

Correct answer of 11.95 = **2 marks**;;

Incorrect answer but shows 1195 (ignoring orders of magnitude) = **1 mark**

OR

Incorrect answer but shows 1.05 (Tg) or 13 (Tg) = **1 mark**;

*Accept any numerical representation of the correct answer for **two** marks.*

Do not allow 1.05 or 13 to the incorrect order of magnitude e.g. x 10^1.

2

(b) 1. No significant difference (in production between untreated and treated) with **no** water shortage

OR

No significant difference (in production) between **R** and **S**;

1, 2, 3, 4 Accept descriptions of production e.g., more tomatoes and descriptions of treated and untreated seedlings / plants / seeds e.g., with / without mycorrhizae / Glomus / fungus.

*1, 2, 3, 4 Reject 'results are significant' or 'results are not significant' **once**, but **only** where there is no indication that these results are 'different', 'greater', 'reduced' etc.*

1, 2, 3, 4 Accept 'not due to chance' for significant and converse for not significant.

2. Significantly greater/different (production in treated than untreated) with water shortage

OR

Significantly greater/different (production) in **Q** than **P**;

3. Significant decrease/difference (in production) of treated with water shortage

OR

Significant increase/difference (in production) of treated with **no** water shortage

OR

Significantly greater/different (production) in **S** than **Q**;

4. Overlap in SDs indicate no significant difference
OR

No overlap in SDs indicate a significant difference;

Accept '(error) bars' for SDs.

5. Only one (mycorrhizae) species studied;

Accept 'only Glomus studied'.

6. Only shows (results for) tomato(es);

Accept only shows 'one crop' or one 'species or type of plant'.

7. Large sample size increases validity/reliability;

8. (Investigation) done in sterile soil;

9. (Investigation) done in green/glasshouse
OR

Not done in field;

Max 3 marks from points 5 to 9

Do not credit idea of variation between green/glasshouses.

5 max

(c) 1. Kill/remove/no (other) mycorrhizae/fungi;

1 to 6 Accept in context of organisms being present if soil not sterilised.

2. Kill/remove/no nitrogen-fixing /nitrifying/denitrifying/saprobiotic bacteria;

Accept saprophytes and saprobionts.

3. Kill/remove/no pathogens;

Accept removes disease-causing bacteria/viruses /microorganisms.

Removes 'harmful bacteria' is not enough.

4. Kill/remove/no pests;

Accept named pests.

5. Kill/remove/no competitors;

6. Kill/remove/no seeds/spores;

Accept weeds or (other) plants.

7. Is a (controlled) variable;

2 max

(d) 1. So mycorrhizae/water is the only variable

OR

(So fertiliser) is **not** a variable

OR

So fertiliser is a controlled variable;

'For comparison' on its own is not enough.

Accept same amount of fertiliser.

2. Affects (crop) production/growth/mass;

Accept benefits or limiting factor of named nutrient/ion.

3. (Concentration of fertiliser) would affect water potential of soil;

4. Does not affect pH (of soil);

5. To provide (usual) soil/farming conditions;

Ignore leaching and eutrophication.

2 max

[11]

Q2.

(a) 1. Volume of (stock) bacteria (culture);

If not credited accept number/mass of bacteria for 1 mark.

Ignore volume/concentration of liquid culture.

Ignore amount.

2. Concentration of (stock) bacteria (culture);

If not credited accept number/mass of bacteria for 1 mark.

Ignore volume/concentration of liquid culture.

Ignore amount.

3. Concentration of glucose

OR

Concentration of (respiratory) substrate;

Accept concentration of ion/named ion but ignore ammonium chloride.

Ignore 'same bacteria/species/type'.

Ignore 'sugar'.

Ignore amount.

Ignore nutrients.

4. Volume of ammonium chloride;

Ignore amount.

Ignore nutrients.

5. Time (bacteria/culture left to divide);

6. Concentration/volume of oxygen;

Ignore amount.

Ignore availability/access/exposure.

7. Concentration/volume of nitrogen;

Ignore amount.

Ignore availability/access/exposure.

Accept vol. for volume and conc. for concentration.

2 max

(b) **(For)**

1. Nitrogenase activity decreases with increase in ammonium chloride (concentration);

Accept ammonia for ammonium chloride.

Accept negative correlation between nitrogenase activity and ammonium chloride (concentration).

2. Nitrogenase activity zero with high (concentration of) ammonium chloride
OR
Ammonium chloride remains (in medium) when nitrogenase activity zero;

Accept ammonia for ammonium chloride.

Accept nitrogenase activity zero at 80/100/120/above 60 (μg cm^3 of ammonium chloride).

Accept 'stops' for zero.

(Against)

3. Only used one species;

Accept only Azotobacter/A. chroococcum/ chroococcum/one nitrogen-fixing bacterium/one type/strain used.

4. (Inhibition/results) may be due to chloride (ions)
OR
(Investigation) uses ammonium chloride not ammonia;

Reject 'chlorine'.

Ignore reference to statistical tests.

3 max

(c) 1. Less/no ATP/energy required/used
OR
More ATP/energy available;

2. ATP/energy can be used for growth/synthesis/replication
OR
Lower (rate of) respiration required
OR
ATP for phosphorylation;

Accept ATP can be used for 'other reactions', 'movement', 'active transport' or correctly named reaction.

Ignore 'aerobic', 'anaerobic' in context of respiration.

Reject ATP/energy used for/in respiration.

Reject mitosis.

2

[7]

Q3.

21-25	Extended Abstract Generalised beyond specific context	Response shows holistic approach to the question with a fully integrated answer which makes clear links between several different topics and the theme of the question. Biology is detailed and comprehensive A-level content, uses appropriate terminology, and is very well written and always clearly explained. No significant errors or irrelevant material. For top marks in the band, the answer shows evidence of reading beyond specification requirements.
16-20	Relational Integrated into a whole	Response links several topics to the main theme of the question, to form a series of interrelated points which are clearly explained. Biology is fundamentally correct A-level content and contains some points which are detailed, though there may be some which are less well developed, with appropriate use of terminology. Perhaps one significant error and, or, one irrelevant topic which detracts from the overall quality of the answer.
11-15	Multistructural Several aspects covered but they are unrelated	Response mostly deals with suitable topics but they are not interrelated and links are not made to the theme of the question. Biology is usually correct A-level content, though it lacks detail. It is usually clearly explained and generally uses appropriate terminology. Some significant errors and, or, more than one irrelevant topic.
6-10	Unistructural Only one or few aspects covered	Response predominantly deals with only one or two topics that relate to the question. Biology presented shows some superficial A-level content that may be poorly explained, lacking in detail, or show limited use of appropriate terminology. May contain a number of significant errors and, or, irrelevant topics.
1-5	Unfocused	Response only indirectly addresses the theme of the question and merely presents a series of biological facts which are usually descriptive in nature or poorly explained and at times may be factually incorrect. Content and terminology is generally below A-level. May contain a large number of errors and, or, irrelevant topics.
0		Nothing of relevance or no response.

Commentary on terms and statements in the levels mark scheme

The levels mark scheme for the essay contains a number of words and statements that are open to different interpretations. This commentary defines the meanings of these words and statements in the context of marking the essay. Many words and statements are used in the descriptions of more than one level of response. The definitions of these remain the same throughout.

Levels mark scheme word/statement	Definition
Holistic	Synoptic, drawing from different topics (usually sections of the specification)
A fully integrated answer which makes clear links between several different topics and the theme of the question.	All topics relate to the title and theme of the essay; for example, explaining the biological importance of a process. When considering, for example, the importance of a process, the explanation must be at A-level standard. 'Several' here is defined as at least four topic areas from the specification covered. This means some sentences, not just a word or two. It does not mean using many examples from one topic area.
Biology is detailed and comprehensive A-level content, uses appropriate terminology, and is very well written and always clearly explained.	Detailed and comprehensive A-level content is the specification content. Terminology is that used in the specification. Well written and clearly explained refers mainly to biological content and use of terminology. Prose, handwriting and spelling are secondary considerations. Phonetic spelling is accepted, unless examiners are instructed not to do so for particular words; for example, glucagon, glucose and glycogen.
No significant errors or irrelevant material.	A significant error is one which significantly detracts from the biological accuracy or correctness of a described example. This will usually involve more than one word. Irrelevant material is several lines (or more) that clearly fails to address the title, or the theme of the title.
For top marks in the band, the answer shows evidence of reading beyond specification requirements.	An example that is relevant to the title and is not required in the specification content. The example must be used at A-level standard.
Response mostly deals with suitable topics but they are not interrelated and links are not made to the theme of the question.	Not addressing the biological theme of the essay (eg importance) at A-level standard.

The importance of cycles in biology

- 3.1.1 Monomers and polymers
- 3.1.4.2 Many proteins are enzymes
- 3.1.5.2 DNA replication
- 3.1.6 ATP
- 3.2.2 All cells arise from other cells
- 3.3.2 Gas exchange – mechanism of breathing
- 3.3.4.1 Cardiac cycle and blood circulation and 3.6.1.3 Control of heart rate
- 3.4.3 Meiosis
- 3.5.1 Photosynthesis – light independent reaction
- 3.5.2 Respiration – Krebs cycle and electron transport chain
- 3.5.4 Nutrient cycles
- 3.6.2.1 Nerve impulses
- 3.6.2.2 Synaptic transmission
- 3.6.3 Muscle contraction
- 3.6.4.1 Negative feedback
- 3.6.4.2 Control of blood glucose concentration
- 3.6.4.3 Control of blood water potential
- 3.7.4 Populations in ecosystems – predation
- 3.8.4.1 Recombinant DNA technology – PCR

In order to fully address the question and reach the highest mark bands students must also include at least four topics in their answer, to demonstrate a synoptic approach to the essay.

Students may be able to show the relevance of other topics from the specification.

Note, other topics from beyond the specification can be used, providing they relate to the title and contain factually correct material of at least an A-level standard. Credit should not be given for topics beyond the specification which are below A-level standard.

[25]