BIOLOGICAL MOLECULES

Water EXAM Q&A

Q1.

(a) Explain the arrangement of phospholipids in a cell-surface membrane.

(2)

(b) Describe how an ester bond is formed in a phospholipid molecule.

(2)

(c) State and explain the property of water that helps to prevent temperature increase in a cell.

Property _____

Explanation _____

(2)

(Total 6 marks)

Q2.

(a) Explain **five** properties that make water important for organisms.

(5)

(b) Describe the biochemical tests you would use to confirm the presence of lipid, non-reducing sugar and amylase in a sample.

(5)

(c) Describe the chemical reactions involved in the conversion of polymers to monomers and monomers to polymers.

Give **two** named examples of polymers and their associated monomers to illustrate your answer.

(5)

(Total 15 marks)

Q3.

(a) State **and** explain the property of water that can help to buffer changes in temperature.

(2)

(b) Water is used to hydrolyse ATP.

Name the **two** products of ATP hydrolysis.

1. _____

2. _____

(1)

Hydrolysis of ATP is catalysed by the enzyme ATP hydrolase.

A student investigated the effect of ATP concentration on the activity of ATP hydrolase. She used shortening of strips of muscle tissue caused by contraction as evidence that ATP was being hydrolysed.

- She took four slides **A**, **B**, **C** and **D**, and added strips of muscle tissue of the same length to each slide.
- She then added the same volume of ATP solutions of different concentrations to the four slides and left each slide for five minutes.
- She then recorded the final length of each strip of muscle tissue.

Her results can be seen in the table.

Slide	Concentration of ATP solution added to slide / $\times 10^{-6}$ mol dm^{-3}	Final length of muscle tissue after 5 minutes / mm
A	2	36
B	4	31
C	6	29
D	8	26

(c) Other than those given, name two variables the student should have controlled.

1. _____

_____

2. _____

_____

(2)

(d) Describe and explain the pattern shown by the data in the table.

Description

_____

_____

_____

_____

_____

Explanation _____

_____

_____

_____

_____

(2)

(e) The hydrolysis of 1 dm^3 of a 1 mol dm^{-3} solution of ATP releases 30 500 J of energy.

60% of the energy released during the hydrolysis of 1 mol dm^{-3} of ATP is released as heat; the rest is used for muscle contraction.

The student added 0.05 cm^3 of ATP solution to slide **D**.

Calculate the energy available from ATP for contraction of the muscle on this slide.

Answer = _____ J

(3)

(Total 10 marks)

Q4.

Write an essay on the importance of diffusion in organisms.

(Total 25 marks)

Q5.

Water and inorganic ions have important biological functions within cells.

(a) Give **two** properties of water that are important in the cytoplasm of cells.
For each property of water, explain its importance in the cytoplasm.

Property 1_____

Biological importance within cells_____

_____

_____

Property 2_____

Biological importance within cells_____

_____

_____

(4)

(b) Other than sodium, name **one** inorganic ion and give **one** example of its biological importance in a cell.

Name of inorganic ion_____

Biological importance_____

_____

_____

(2)

(c) Compare and contrast the processes by which water and inorganic ions enter cells.

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

Q6.

The UK government pays farmers to leave grassy strips around the edges of fields of crops. These grassy strips contain a variety of plant species. Leaving the strips is an attempt to encourage biodiversity of animals.

(a) Give **two** reasons why the grassy strips increase the biodiversity of animals.

1. _____

2. _____

(2)

A group of scientists investigated the effect of grassy strips on the biodiversity of soil animals.

- They divided a field into plots measuring 25 m × 5 m, with a 5-metre-wide grassy strip of land between each plot.
- Each year, they planted wheat in each of the plots.
- In the fifth year, they removed samples of soil from each plot where wheat was growing and from the grassy strips around them.
- They sorted each soil sample by hand for 40 minutes to collect the soil animals

within the sample.

(b) The scientists decided to collect animals from the soil samples for 40 minutes.

Suggest how the scientists decided that 40 minutes was an appropriate time.

_____

_____

_____

_____

_____

(2)

(c) The table below shows how the scientists published their results. They calculated mean values and two times the standard deviation (SD) of the mean.

Two standard deviations above and below the mean includes 95.4% of the data.

Group of animals	**Mean number of animals per m² (± 2 × SD)**		**Mean number of species per m² (± 2 × SD)**	
	Soil under wheat crop	**Soil under grassy strips**	**Soil under wheat crop**	**Soil under grassy strips**
Beetles	41.2 (± 6.4)	80.1 (± 10.1)	10.0 (± 1.6)	17.3 (± 1.0)
Centipedes	18.4 (± 3.6)	13.5 (± 1.0)	1.8 (± 0.3)	2.1 (± 0.2)
Earthworms	244.5 (± 27.1)	281.2 (± 39.4)	3.8 (± 0.3)	5.1 (± 0.2)
Millipedes	38.4 (± 12.2)	36.2 (± 2.9)	3.5 (± 0.3)	3.2 (± 0.2)
Woodlice	0.0	73.9 (± 8.5)	0.0	2.8 (± 0.2)

It would **not** be possible to calculate an index of diversity from the results in the table.

Explain why.

_____

_____

_____

(1)

A summary of this research was published in a farming magazine. The journalist concluded that creating grassy strips around fields had little effect on the diversity of soil animals.

Do you agree with this conclusion?

Use evidence from the table to justify your answer.

(4)

(Total 9 marks)

Q7.

Write an essay on the ways in which water and the regulation of water content are important to organisms.

(Total 25 marks)

Q8.

Write an essay on the importance of ions in biology.

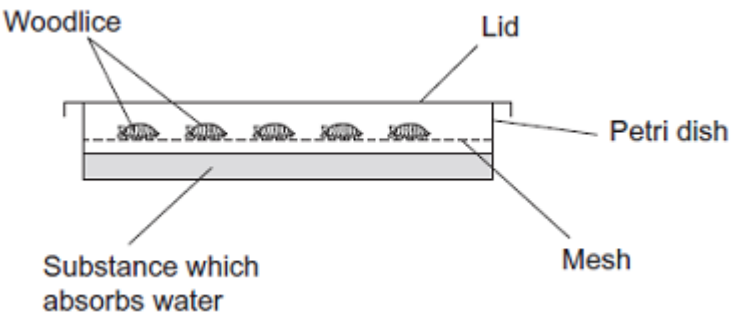
(Total 25 marks)

Q9.

Scientists investigated the effect of relative humidity on the activity of woodlice. They set up a Petri dish as shown in **Figure 1**.

In the bottom half they put a substance which absorbs water. Different concentrations of this substance produced different humidities in the air above the mesh.

Figure 1



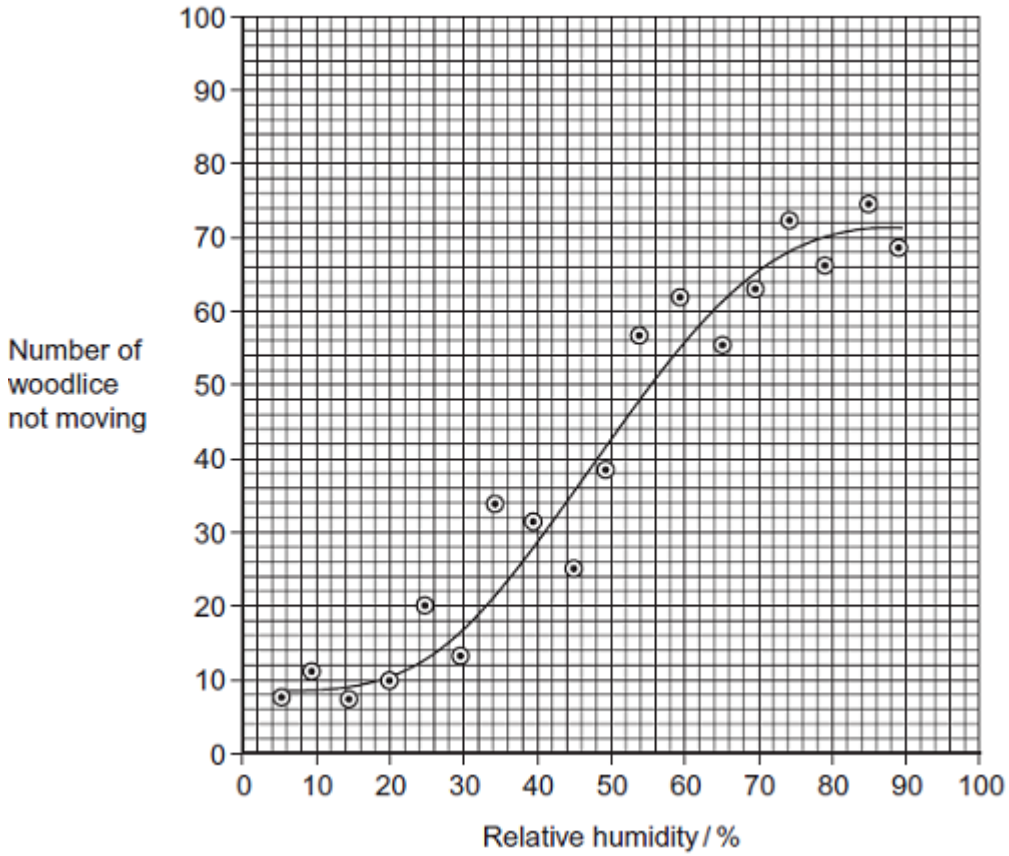
The scientists

- placed 10 woodlice in the top half of the dish

- replaced the lid and left the apparatus for 15 minutes in the laboratory
- recorded the number of woodlice **not** moving during the next 30 seconds
- repeated the experiment to obtain data for 100 woodlice
- repeated the experiment at different humidities.

The results are shown in **Figure 2**.

Figure 2



The movement of the woodlice in low relative humidity is an advantage to their survival. Explain how.

_____

_____

_____

_____

_____

(Total 2 marks)

Q10.

Read the following passage.

Straw consists of three main organic substances – cellulose, hemicellulose and lignin. Cellulose molecules form chains which pack together into fibres. Hemicellulose is a small molecule formed mainly from five-carbon (pentose) sugar monomers. It acts as a cement holding cellulose fibres together. Like hemicellulose, lignin is a polymer, but it is not a

5

carbohydrate. It covers the cellulose in the cell wall and supplies additional strength. In addition to these three substances, there are small amounts of other biologically important polymers present.

The other main component of straw is water. Water content is variable but may be determined by heating a known mass of straw at between 80 and 90°C until it reaches a constant mass. The loss in mass is the water content.

Since straw is plentiful, it is possible that it could be used for the production of a range of organic substances. The first step is the conversion of cellulose to glucose. It has been suggested that an enzyme could be used for this process. There is a difficulty here, however. The lignin which covers the cellulose protects the cellulose from enzyme attack.

Use information from the passage and your own knowledge to answer the following questions.

(a) (i) Give **one** way in which the structure of a hemicellulose molecule is similar to the structure of a cellulose molecule.

_____

_____

(1)

(ii) Complete the table to show **two** ways in which the structure of a hemicellulose molecule differs from the structure of a cellulose molecule.

Hemicellulose	Cellulose
_____ _____	_____ _____
_____ _____	_____ _____

(2)

(b) Name **one** biologically important polymer, other than those mentioned in the passage, which would be found in straw.

_____

(1)

(c) Explain why the following steps were necessary in finding the water content of straw:

(i) heating the straw *until it reaches constant mass* (line 9);

_____

_____

_____

(1)

(ii) not heating the straw above 90°C (line 9).

(2)

(d) A covering of lignin protects cellulose from enzyme attack (line 14). Use your knowledge of the way in which enzymes work to explain why cellulose-digesting enzymes do not digest lignin.

(2)

(e) Describe the structure of a cellulose molecule and explain how cellulose is adapted for its function in cells.

(6)

(Total 15 marks)

Q1.

(a) 1. Bilayer
OR
Water is present inside and outside a cell;

Accept annotated diagram for 'bilayer'

Accept cytoplasm/tissue fluid for water

Accept for two marks, annotated diagram of bilayer with water labelled on each side

2. Hydrophobic (fatty acid) tails point away/are repelled from water
OR

Hydrophilic (phosphate) heads point to/are in/are attracted to water;

2

Ignore hydrophilic/phosphate heads protect hydrophobic/fatty acid tails

(b) 1. Condensation (reaction)

OR

Loss of water;

2. Between of glycerol **and** fatty acid;

Accept labelled diagram

2

(c) 1. High (specific) heat capacity;

2. Buffers changes in temperature;

Accept ideas such as a lot of energy needed/gained to change temperature

2

[6]

Q2.

(a) 1. A <u>metabolite</u> **in** condensation/hydrolysis/ photosynthesis/respiration;

2. A solvent **so** (metabolic) reactions can occur
OR
A solvent **so** allowing transport of substances;

3. High heat capacity **so** buffers changes in temperature;

For 'buffer' accept 'resist'.

4. Large latent heat of vaporisation **so** provides a cooling effect (through evaporation);

5. Cohesion (between water molecules) **so** supports columns of water (in plants);

For 'columns of water' accept 'transpiration stream'.

Do not credit 'transpiration' alone but accept description of 'stream'.

For 'columns of water' accept 'cohesion-tension (theory)'.

For cohesion accept hydrogen bonding

6. Cohesion (between water molecules) **so** produces surface tension supporting (small) organisms;

For cohesion accept hydrogen bonding

Ignore reference to pH.

Allow other suitable properties but must have a valid explanation.

For example

- *ice floating **so** maintaining aquatic habitat beneath*
- *water transparent **so** allowing light penetration for photosynthesis*

5 max

(b)

4 max if marks gained from only 2 substance tests.

Lipid

1. Add ethanol/alcohol **then** add water **and** shake/mix
OR
Add ethanol/alcohol **and** shake/mix **then** pour into/add water;

Reject heating emulsion test.

Accept 'Add Sudan III and mix'.

2. White/milky emulsion
OR
emulsion test turns white/milky;

Ignore cloudy.

Reject precipitate.

Accept (for Sudan III) top (layer) red.

Non-reducing sugar

3. Do Benedict's test **and** stays blue/negative;

Ignore details of method for Benedict's test for this mp.

4. Boil with acid **then** neutralise with alkali;

Accept named examples of acids/alkalis.

5. Heat with Benedict's **and** becomes red/orange (precipitate);

Do not credit mp5 if no attempt at mp4.

For 'heat' ignore 'warm'/'heat gently'/'put in a water bath' but accept stated temperatures ≥ 60°C.

Heat must be stated again, do not accept using residual heat from mp4.

*Accept 'do the Benedict's test' **if** full correct method given elsewhere.*

Accept 'sodium carbonate, sodium citrate and copper sulfate solution' for Benedict's but must have all three if term 'Benedict's' not used.

Amylase

6. Add biuret (reagent) **and** becomes purple/violet/mauve/lilac;

Accept 'sodium or potassium hydroxide and copper sulfate solution' for 'biuret'.

Reject heating biuret test.

7. Add starch, (leave for a time), test for reducing sugar/absence of starch;

5 max

(c)

Ignore reference to dimers.

1. A condensation reaction joins monomers together **and** forms a (chemical) bond **and** releases water;

2. A hydrolysis reaction breaks a (chemical) bond between monomers **and** uses water;

3. A suitable example of polymers and the monomers from which they are made;

3. and 4. Polymers must contain many monomers.

3. and 4: suitable examples include

- *amino acid **and** polypeptide, protein, enzyme, antibody or specific example*
- *nucleotide **and** polynucleotide, DNA or RNA*
- *Alpha glucose **and** starch/glycogen*
- *Beta glucose **and** cellulose.*

If neither specific carbohydrate example is given, allow monosaccharide/glucose and polysaccharide.

3. and 4. Reject (once) reference to triglycerides.

4. A second suitable example of polymers and the monomers from which they are made;

5. Reference to a correct bond within a named polymer;

Reject reference to ester bond.

5

[15]

Q3.

(a) 1. (water has a relatively) high (specific) heat capacity;

Ignore numbers relating to heat capacity

2. Can gain / lose a lot of heat / energy without changing temperature;
OR
Takes a lot of heat / energy to change temperature;

Accept due to H bonding between water molecules

2

(b) Adenosine diphosphate and (inorganic) phosphate;

Accept ADP for adenosine diphosphate

Accept Pi / PO_4^{3-} / P in a circle for inorganic phosphate

Reject adenine diphosphate

Reject phosphorus / P for phosphate

1

(c) 1. Species / organism the muscle tissue came from;

OR

Thickness / type / source of the muscle tissue;

Ignore surface area of muscle tissue

2. Temperature of the muscle tissue / ATP solution / slides;

Need to be qualified

3. pH of the ATP solution;

Need to be qualified

Reject concentration / volume of ATP hydrolase

2 max

(d) Description

1. As concentration of ATP increases, length of muscle decreases;

Accept negative correlation

Explanation

2. More ATP (hydrolysed by ATP hydrolase), **so** more energy released, **so** more muscle contraction / shortening of muscle;

Accept more ATP available for correct/named aspect of muscle contraction

Idea of more is required once.

Reject energy produced

2

(e) 4.88×10^{-6} ;;;

If answer incorrect

EITHER

Allow 1 mark for 0.244

Allow 1 mark for 1.22×10^{-5}

OR

Allow 1mark for 12200 / 1.525

Allow 1 mark for 0.61

Accept 5×10^{-6}

Accept correct answer however expressed

Max 2 for incorrect final answer

3

[10]

Q4.

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

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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 (e.g. importance) at A-level standard.

Please note that to obtain full credit, students must use information to show **the importance of diffusion in organisms**.

Specification Reference	Topic Area
3.1.7 and 3.1.8	water and inorganic ions
3.2.3	transport across membranes
3.3.2	gas exchange
3.3.3	digestion and absorption
3.3.4.1	mass transport in animals
3.3.4.2	mass transport in plants
3.4.2	DNA and protein synthesis
3.5.1	photosynthesis
3.5.2	respiration
3.5.4	nutrient cycles
3.6.1.1	plant responses to stimuli
3.6.1.2	receptors
3.6.2.1	nerve impulses
3.6.2.2	synaptic transmission
3.6.3	muscle contraction
3.6.4.1 and 4.2	control of blood glucose concentration
3.6.4.3	control of blood water potential

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]

Q5.

(a) 1. Polar molecule;

2. Acts as a (universal) solvent;

OR

3. (Universal) solvent;

4. (Metabolic) reactions occur faster in solution;

OR

5. Reactive;

6. Takes place in hydrolysis / condensation / named reaction;

Polar molecule so acts as (universal) solvent so (metabolic reactions are faster = 3 marks

4

(b) Name of ion;

Correct function within cell;

Ions other than sodium in specification are H^+, Fe^{2+} and PO_4^{3-} but accept any correct ion (other than sodium) plus relevant function = 2.

Allow ion to be named in words but not as element, e.g, iron ion but not iron.

2

(c) 1. Comparison: both move down concentration gradient;

2. Comparison: both move through (protein) channels in membrane;

Accept aquaporins (for water) and ion channels

3. Contrast: ions can move against a concentration gradient by active transport

3

[9]

Q6.

(a) Any **two** valid reasons;

e.g.

1. Increase in plant diversity leads to more <u>types</u> of food for animals;

2. Increase in variety of animals leads to increase in predator species;

3. Increase in niche / habitat

2 max

(b) 1. Repeat soil sorting for different times and record number of species collected;

2. Find optimum time / time beyond which further sorting does not lead to increase in animal species found

2

(c) 1. No data on number of individuals in each

species / diversity index $= \frac{N(N-1)}{\sum n(n-1)}$

1

(d) Principle:

1. Overlap of 2 × SD shows probability of differences (in means) being due to chance is greater than 0.95;

Allow converse of MP1

Credit MP1 wherever it appears

Agree:

2. No difference in number of earthworms and millipedes (per m^2)

3. No difference in number of species of centipedes or millipedes.

Disagree:

4. More beetles and woodlice in grassy strips;

5. More species of beetles, earthworms, woodlice in grassy strips.

4 max

[9]

Q7.

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.

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The ways in which water and the regulation of water content are important to organisms.

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

Specification reference	**Topic area**
3.1.1	Monomers and polymers – carbohydrates – lipids –

	proteins
3.1.7	Water
3.2.3	Transport across membranes – osmosis – water potentials
3.3.2	Gas exchange – plants
3.3.2	Gas exchange – fish
3.3.2	Gas exchange – insects
3.3.4.1	Mass transport in animals - blood – circulation
3.3.4.1	Mass transport in animals – tissue fluid and formation
3.3.4.2	Mass transport in plants – transpiration stream
3.3.4.2	Mass transport in plants – translocation
3.5.1	Photosynthesis
3.5.4	Nutrient cycles – leaching and eutrophication
3.6.1	Growth responses in plants
3.6.4	Homeostasis
3.6.4.3	Control of blood and water potential

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]

Q8.

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		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.
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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 (e.g. importance) at A-level standard.

The importance of ions in biology.

Topics

P	3.1.3. and 3.2.2.	Phosphate in structure of phospholipids, structure of membranes, nucleotides, DNA and RNA
T	3.1.3	Water potentials and osmosis, chloride ions and cholera
	3.1.3	Co-transport involving sodium ions
H	3.2.4.	Haemoglobin and iron
Tr	3.2.7.	Passage of water through plants, symplast and root pressure
Tr	3.4.1.	ATP and ADP
	3.4.3.	Protons in photosynthesis, including reduced NADP and phosphorylated intermediates
R	3.4.4.	Protons in respiration, reduced NADS and FAD and phosphorylated intermediates
	3.4.4.	Glycolysis and lactate
F	3.4.5.	Use of (NPK) fertilisers
	3.4.6.	Nitrogen cycle
N	3.5.1.	Chemoreceptors, heart rate and Pacinian function
	3.5.2.	Nerve impulses and synapses
M	3.5.3.	Calcium ions and muscle contraction, and phosphate from ATP
G	3.5.8.	Genetic fingerprinting, electrophoresis

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]

Q9.

Low humidity results in more woodlice moving;

So increased movement increased chance of leaving dry / unfavourable environment so reduce water loss / reduce evaporation;

[2]

Q10.

(a) (i) both are polymers / polysaccharides / built up from many sugar units / both

contain glycosidic bonds / contain (C)arbon, (H)ydrogen and (O)xygen;

1

(ii) hemicellulose shorter / smaller than cellulose / fewer carbons;
hemicellulose from pentose / five-carbon sugars and cellulose from hexose / glucose / six-carbon sugars;

(only credit answers which compare like with like.)

2

(b) protein / nucleic acid / enzyme / RNA / DNA / starch / amylose / amylopectin polypeptide;

1

(c) (i) to make sure that all the water has been lost;

1

(ii) only water given off below 90 °C;
(above 90°C) other substances straw burnt / oxidised / broken down;
and lost as gas / produce loss in mass;

2

(d) enzymes are specific;
shape of lignin molecules will not fit active site (of enzyme);
OR
shape of active site (of enzyme);
will not fit molecule;

2 max

(e) 1. made from β-glucose;
2. joined by condensation / removing molecule of water / glycosidic bond;
3. 1 : 4 link specified or described;
4. “flipping over” of alternate molecules;
5. hydrogen bonds linking chains / long straight chains;
6. cellulose makes cell walls strong / cellulose fibres are strong;
7. can resist turgor pressure / osmotic pressure / pulling forces;
8. bond difficult to break;
9. resists digestion / action of microorganisms / enzymes;

(allow maximum of 4 marks for structural features)

6 max

[15]