The Energy of Life (June 2017 Paper 3 Scientific Article): Edexcel SNAB A Level Biology Exam Questions

11 questions · 30 marks · about 36 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 3 · June 2017 · Q7(a) · 3 marks

7 The scientific article you have studied is adapted from an article from '*The Scientist*'.

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

(a) Explain why the 'anaerobic oxidation of methane' could be a 'key climate regulator' (paragraph 2).

(3)

Question 2 · A level Paper 3 · June 2017 · Q7(b) · 2 marks

(b) Give reasons why 'humble microbes', such as bacteria, are considered less complex than eukaryotes (paragraph 4).

(2)

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Question 3 · A level Paper 3 · June 2017 · Q7(c) · 2 marks

(c) State what is meant by the phrase 'fix carbon into biomass' (paragraph 4).

(2)

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Question 4 · A level Paper 3 · June 2017 · Q7(d) · 4 marks

(d) Humans have a 'requirement for oxygen' (paragraph 5).

Explain the role of oxygen in human respiration.

(4)

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Question 5 · A level Paper 3 · June 2017 · Q7(e) · 3 marks

(e) Explain how the unfolding of the enzymes in *E. coli* makes them 'become ineffective at 60 °C' (paragraph 12).

(3)

Question 6 · A level Paper 3 · June 2017 · Q7(f) · 1 mark

(f) State what is meant by the genome of a thermophile (paragraph 14).

(1)

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Question 7 · A level Paper 3 · June 2017 · Q7(g) · 5 marks

(g) Explain how cyanobacteria evolved to 'handle high temperatures' (paragraphs 14 and 15).

(5)

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Question 8 · A level Paper 3 · June 2017 · Q7(h) · 2 marks

(h) Describe the structure of the 'protein-synthesis machinery' in bacteria (paragraph 20).

(2)

Question 9 · A level Paper 3 · June 2017 · Q7(i) · 3 marks

(i) Explain how the production of antibiotics by *Streptomyces* species can reduce interspecific competition (paragraph 20).

(3)

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Question 10 · A level Paper 3 · June 2017 · Q7(j) · 1 mark

(j) Pyruvate is one of the products of glycolysis (paragraph 20).

State one difference between the structure of pyruvate and the structure of the acetyl group in acetyl CoA.

(1)

Question 11 · A level Paper 3 · June 2017 · Q7(k) · 4 marks

(k) *Bacillus subtilis* 'initiate a hibernation protocol' (paragraph 25).

Mycobacterium tuberculosis can also become dormant for long periods of time.

Compare and contrast the dormancy of these two species of bacteria.

(4)

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Mark schemes

Question 1 · A level Paper 3 · June 2017 · Q7(a) · 3 marks

Question Number	Answer
7(a)	An explanation that makes reference to three of the following: • methane is a greenhouse gas **(1)** • greenhouse gases {absorb / trap} {heat / infra red / long wave} energy **(1)** • (anaerobic oxidation of methane results in) less methane in the atmosphere **(1)** • (the breakdown of methane) could {reduce the greenhouse effect / result in less heat being trapped / reduce global warming} **(1)**

Additional Guidance	Mark
	(3)

Question 2 · A level Paper 3 · June 2017 · Q7(b) · 2 marks

Question Number	Answer
7(b)	An answer that makes reference to two of the following: • only one cell as opposed to potentially many **(1)** • no nucleus present **(1)** • no membrane-bound organelles present / absence of named membrane-bound organelle other than nucleus **(1)**

Additional Guidance	Mark
ALLOW DNA not associated with histones ALLOW example e.g. no mitochondrion	**(2)**

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Question 3 · A level Paper 3 · June 2017 · Q7(c) · 2 marks

Question Number	Answer
7(c)	An answer that makes reference to the following: • transfer carbon from an {inorganic source / CO_2} into organic compound **(1)** • that becomes part of the mass of that organism **(1)**

Additional Guidance	Mark
ALLOW correct named organic compound e.g. cellulose / protein ALLOW description of light independent reactions of photosynthesis ALLOW part of biomass	**(2)**

Question 4 · A level Paper 3 · June 2017 · Q7(d) · 4 marks

Question Number	Answer
7(d)	An explanation that makes reference to four of the following: • final acceptor of electrons (and H^+) (in the electron transport chain) **(1)** • {to allow / in} oxidative phosphorylation **(1)** • ATP is synthesised **(1)** • (presence of oxygen) allows oxidation of (reduced) NAD **(1)**

Additional Guidance	Mark
ALLOW coenzyme / FAD ALLOW converse	**(4)**

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Question 5 · A level Paper 3 · June 2017 · Q7(e) · 3 marks

Question Number	Answer
7(e)	An explanation that makes reference to three of the following: • unfolding due to breaking of bonds **(1)** • change in {tertiary structure / 3D shape} / enzyme denatured **(1)** • leading to a change in the shape of the active site **(1)** • substrate no longer able to bind to {enzyme / active site} **(1)**

Additional Guidance	Mark
ALLOW breaking of hydrogen or ionic bonds ALLOW not complementary / not fitting / enzyme substrate complex not formed	**(3)**

Question 6 · A level Paper 3 · June 2017 · Q7(f) · 1 mark

Question Number	Answer	Additional Guidance	Mark
7(f)	An answer that makes reference to the following: • all the {DNA / exons and introns} **(1)**	DO NOT ALLOW 'all the genes in the DNA' / 'all the DNA in the genes'	**(1)**

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Question 7 · A level Paper 3 · June 2017 · Q7(g) · 5 marks

Question Number	Answer
7(g)	An explanation that makes reference to five of the following: • as a result of a mutation **(1)** • (cyanobacteria) produce proteins containing the amino acid cysteine **(1)** • (cysteine rich proteins) produce {heat stable enzymes / proteins resistant to unfolding} **(1)** • other adaptations such as {enzymes with large hydrophobic cores / simpler protein folds / amino acids that do not bond to metal ions } **(1)** • high temperatures act as a selection pressure **(1)** • allowing them to {survive / replicate} and pass advantageous allele to next generation **(1)**

Additional Guidance	Mark
ALLOW 'pass alleles for heat tolerance to next generation'	**(5)**

Question 8 · A level Paper 3 · June 2017 · Q7(h) · 2 marks

Question Number	Answer
7(h)	A description that makes reference to two of the following: • (70S) ribosome **(1)** • larger and smaller subunits **(1)** • containing protein and rRNA **(1)**

Additional Guidance	Mark
	(2)

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Question 9 · A level Paper 3 · June 2017 · Q7(i) · 3 marks

Question Number	Answer
7(i)	An explanation that makes reference to three of the following: • antibiotics reduce the number of other (species of) bacteria **(1)** • antibiotics that attack cell walls {cause lysis / are bactericidal } **(1)** • antibiotics that attack protein synthesis (machinery) {prevent growth / are bacteriostatic} **(1)** • this reduces interspecific competition from other bacteria for limited resources **(1)**

Additional Guidance	Mark
ALLOW attack ribosomes	**(3)**

Question 10 · A level Paper 3 · June 2017 · Q7(j) · 1 mark

Question Number	Answer	Additional Guidance	Mark
7(j)	An answer that makes reference to the following: • pyruvate has 3 carbons compared to 2 carbons in acetyl **(1)**		**(1)**

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Question 11 · A level Paper 3 · June 2017 · Q7(k) · 4 marks

Question Number	Answer
7(k)	An answer that makes reference to four of the following: Similarities • to avoid adverse environmental conditions **(1)** • formation of resistant {outer coating / capsule} **(1)** • reduce metabolic activity **(1)** Differences • sporulation and no sporulation **(1)** • different reasons for entering dormancy **(1)** • (only) genetic material is in a protective capsule in Bacillus **(1)**

Additional Guidance	Mark
e.g. mycobacterium enters dormancy to avoid immune response and Bacillus to survive lack of resources	**(4)**

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