Climate Change and Evolution (Topic 5): Edexcel SNAB A Level Biology Exam Questions by Topic

20 questions · 61 marks · about 73 minutes. Answer in the spaces, then check the mark schemes at the end.

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Question 1 · A level Paper 1 · June 2017 · Q5(a) · 4 marks

5 Climate change has been correlated with changing atmospheric carbon dioxide levels.

(a) Scientists studying climate change have examined peat bogs to observe pollen grains such as those shown in the photograph.



Explain how studying pollen grains in peat bogs can provide evidence of climate change.

(4)

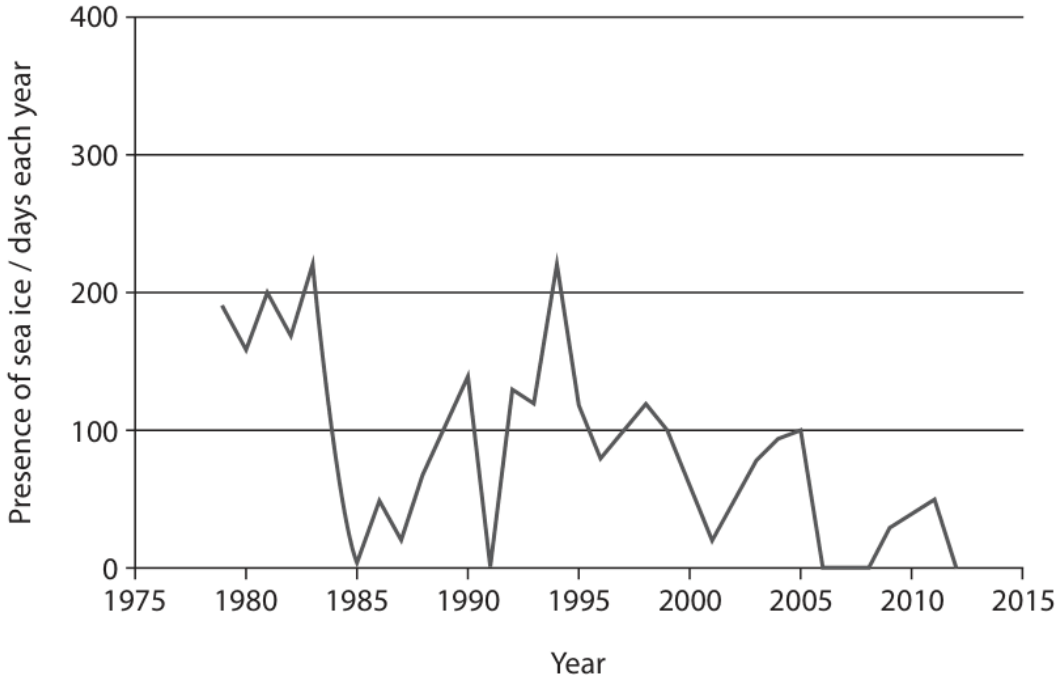
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Question 2 · A level Paper 3 · June 2018 · Q2(a)(i) · 2 marks

2 Scientists are concerned that climate change may be affecting the Arctic environment and the polar bears that live there.

(a) In a study, scientists recorded the length of time ice was present each year in the sea around the west coast of Spitsbergen, an island in the Arctic.

The graph shows the number of days each year when sea ice was present.



(i) Explain how the data could support a conclusion that climate change is occurring in the Arctic.

(2)

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Question 3 · A level Paper 1 · June 2019 · Q10(a) · 3 marks

10 The Intergovernmental Panel on Climate Change (IPCC) has issued the following statement:

"Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems."

(a) Explain why anthropogenic emissions of greenhouse gases are affecting the climate.

(3)

Question 4 · A level Paper 1 · June 2023 · Q8(c)(i) · 3 marks

(c) Seagrass cannot survive if the water becomes warmer or more acidic.

Seagrass in the Mediterranean Sea has declined by 34% in the last 50 years.

(i) Explain why the increase in greenhouse gases is leading to a decrease in the growth of seagrass.

(3)

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Question 5 · A level Paper 3 · November 2021 · Q5(b)(ii) · 4 marks

(ii) Explain the impact of cutting down trees on climate change.

(4)

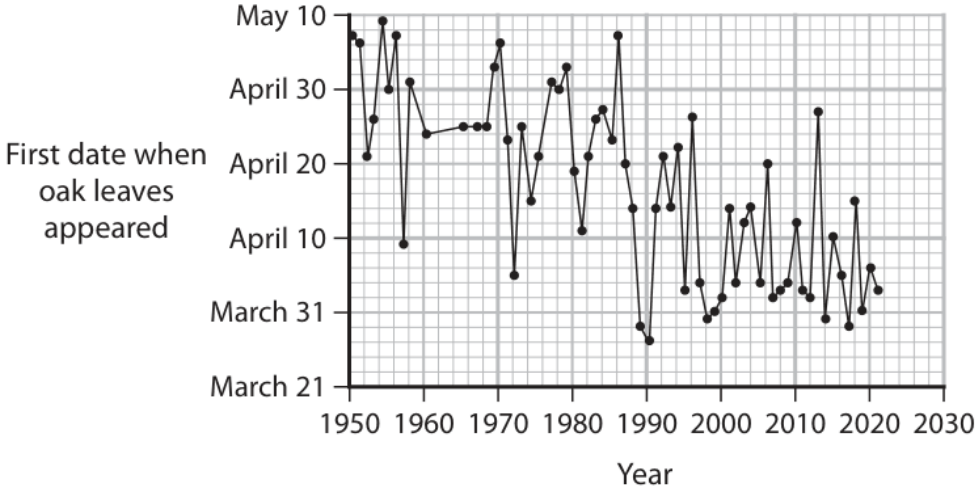
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10 The average spring temperature in the UK has increased by 0.5 °C from 1995 to 2014. This is due to climate change.

This has affected plants and the insects that feed on them.

(a) Many butterfly species depend on oak trees.
The larvae feed on the young leaves in spring.

The graph shows the date when oak leaves first appeared on one tree between the years 1950 and 2021.



Draw a trend line to predict when oak leaves will first appear in the year 2030.

(2)

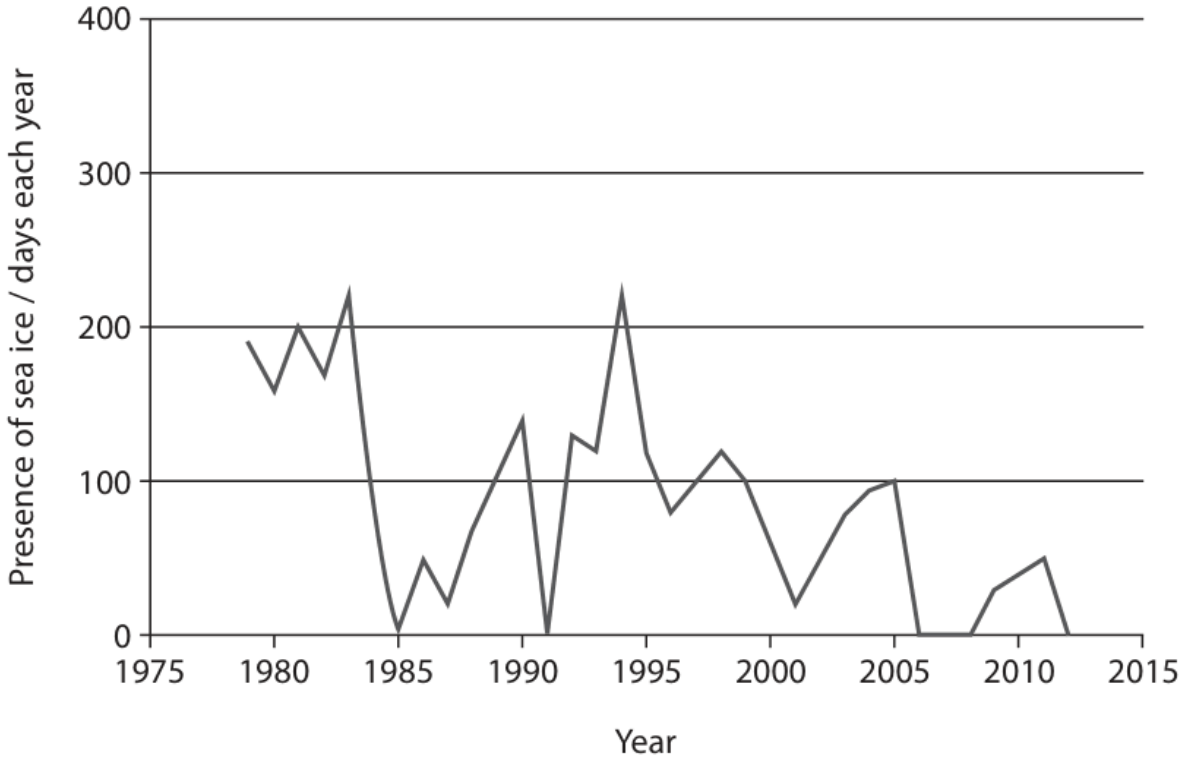
Date .....

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2 Scientists are concerned that climate change may be affecting the Arctic environment and the polar bears that live there.

(a) In a study, scientists recorded the length of time ice was present each year in the sea around the west coast of Spitsbergen, an island in the Arctic.

The graph shows the number of days each year when sea ice was present.



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Question 7 · A level Paper 3 · June 2018 · Q2(a)(ii) · 4 marks

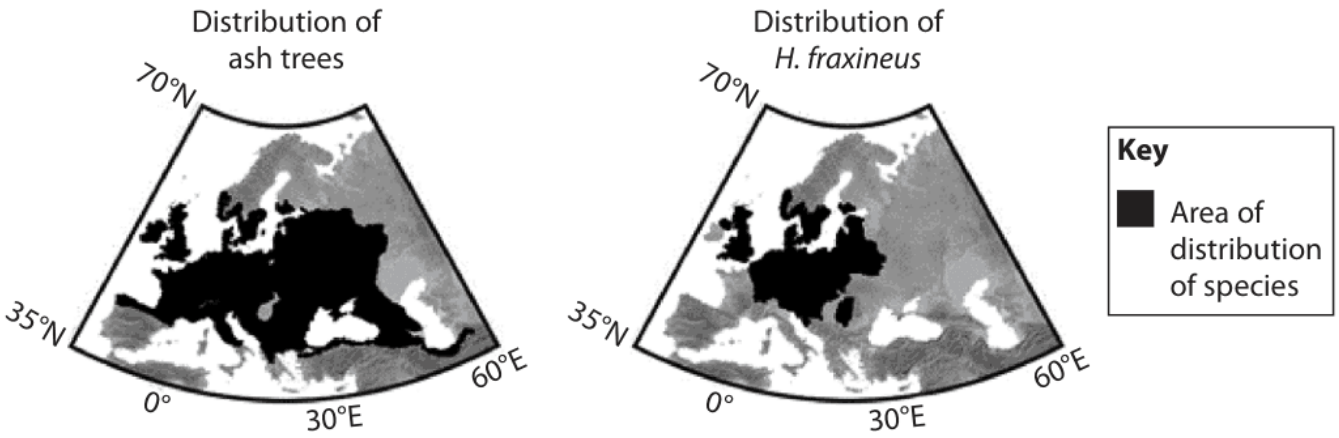
(ii) Explain why the data may not be useful for predicting future climate change.

(4)

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Question 8 · information from earlier in the question

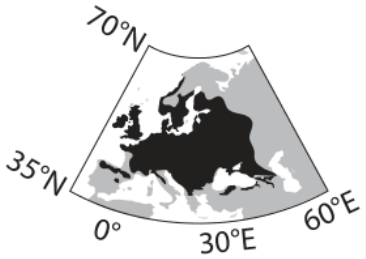
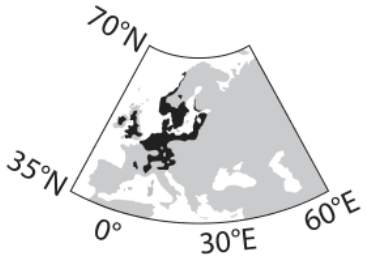
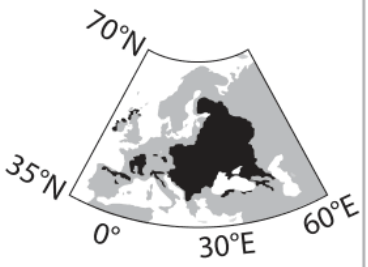
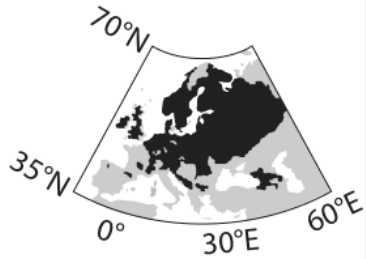
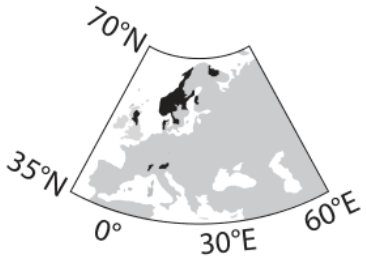
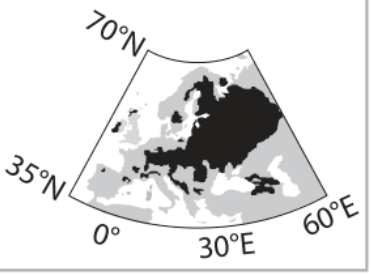
(b) The diagrams show the distribution of ash trees and *H. fraxineus* in 2007.



In 2007 the mean atmospheric carbon dioxide concentration was 398 ppm.

Models have been used to predict the effect of increasing atmospheric carbon dioxide concentration on the distribution of ash trees and *H. fraxineus*.

The table shows these predictions.

Concentration CO_2 / ppm	Predicted region suitable for ash trees	Predicted region suitable for *H. fraxineus*	Predicted distribution of ash trees
430			
1080			

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Question 8 · A level Paper 1 · June 2018 · Q7(b)(iii) · 5 marks

(iii) Analyse the data to explain the predicted effect of climate change on the distribution of ash trees.

(5)

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Question 9 · A level Paper 1 · October 2020 · Q2(c) · 4 marks

(c) Golden snub-nosed monkeys live in areas with very cold winters.

The seeds in their diet contain lipids and carbohydrates.

Climate change is reducing seed production by plants in their habitat.

Discuss the impact of climate change on the monkey population.

(4)

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Question 10 · A level Paper 1 · June 2024 · Q6(b)(ii) · 2 marks

(ii) Global warming can result in climate change.

Describe how climate change could affect the distribution of plants in woodlands in North America.

(2)

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Question 11 · A level Paper 1 · June 2023 · Q10(c)(i) · 2 marks

(c) The effect of the rise in spring temperature on the life cycle of butterflies was studied.

These insects have a typical life cycle of four stages:

egg, larva, pupa and adult.

The photograph shows a butterfly larva (caterpillar) feeding on a leaf.



(Source: © dossyl/Shutterstock)

(i) Explain why an increase in environmental temperature may lead to a shorter life cycle.

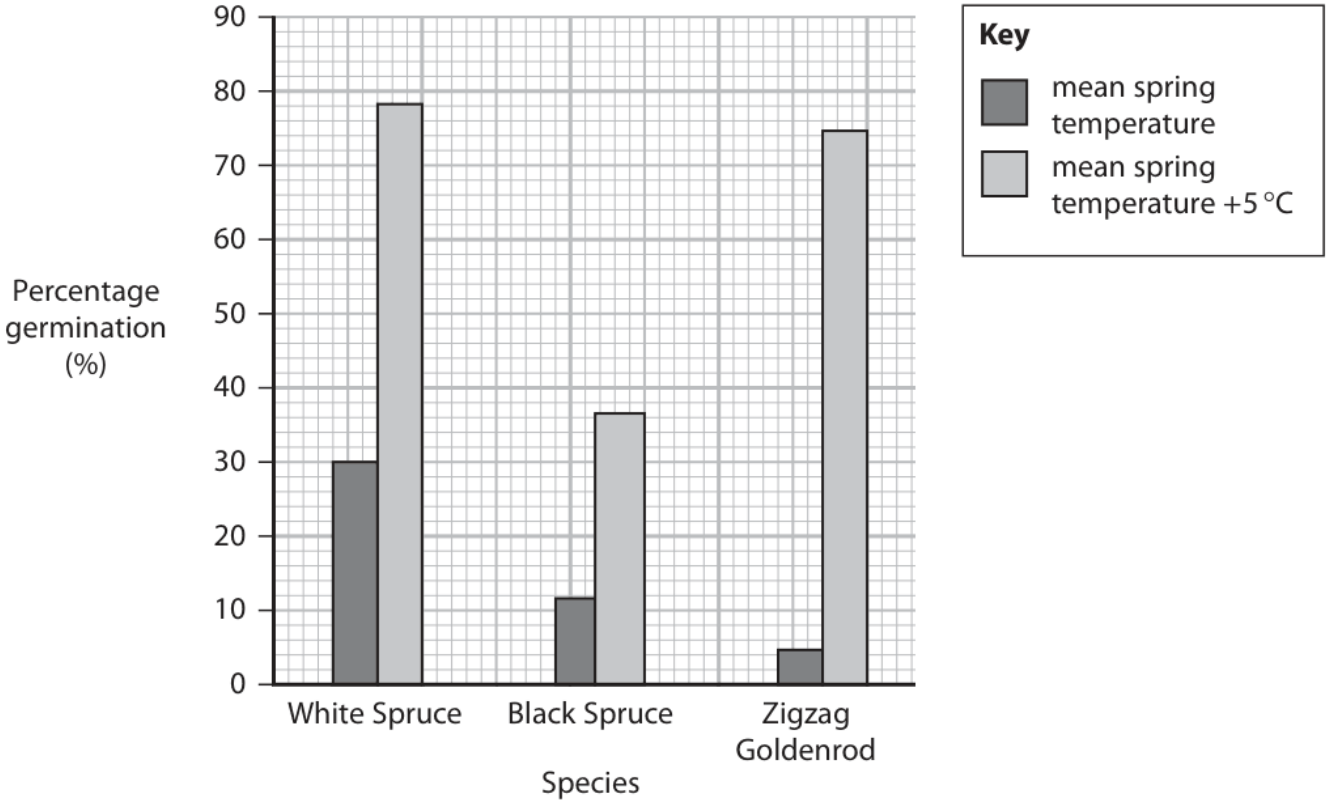
(2)

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(b) The starch in seeds is broken down by enzymes during germination.

An investigation into the effect of temperature on germination was carried out using seeds from three species of North American woodland plants.

The percentage germination of these seeds at the mean spring temperature for these woodlands was compared with an increase of 5 °C.



(i) Explain the effect of an increase in temperature on germination of these seeds.

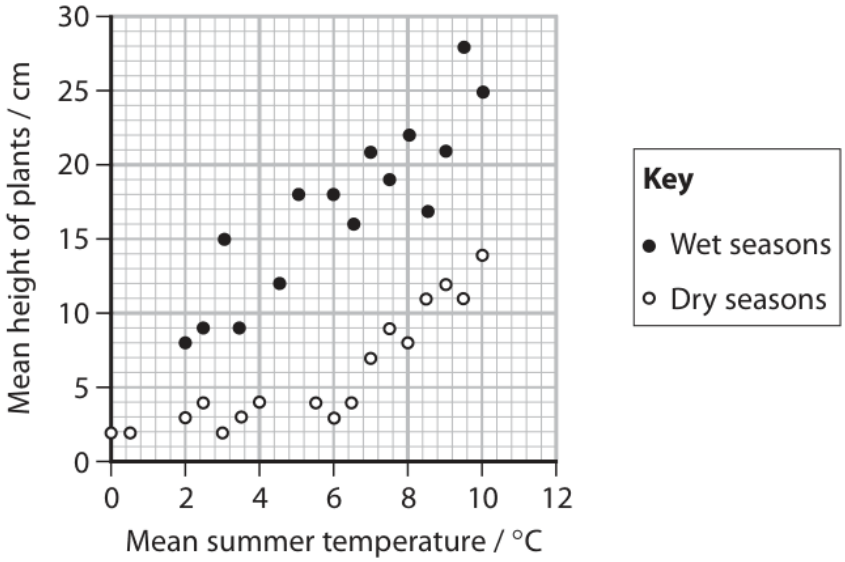
(3)

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(b) A study has investigated the effect of temperature changes on plants growing in the Arctic. This is an area with cold and short growing seasons.

Warming in the Arctic is leading to a change in the community of plants. The mean height of plants in the area was studied in both dry and wet growing seasons over a 30-year period. The summer temperatures over this period were recorded.

The results are shown in the graph.



Explain the effect of these environmental factors on the mean height of the plants.

(2)

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(b) In most mammals, the production of lactase enzyme decreases when the offspring stop feeding on milk.

In Europe, a single mutation resulted in the continued production of lactase enzyme by children and adults.

The study recorded changes in the frequency of this mutation over the past 4000 years.

Time, years ago	Frequency of mutation allowing lactase production into adulthood	
	UK	Central Europe
4000	0.096	0.079
3000	0.280	0.093
2000	0.680	0.250
1000	0.770	0.590
0 (Present)	0.740	0.440

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Question 14 · A level Paper 1 · June 2024 · Q8(b)(ii) · 4 marks

(ii) During the last 4000 years, changes in farming led to a greater increase in the consumption of milk and dairy products in the UK compared with Central Europe.

Many children and adults in Europe have a mutation that allows continued production of lactase enzyme.

Comment on the effect of consuming milk and dairy products on the change in the frequency of this mutation.

(4)

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Question 15 · A level Paper 1 · June 2025 · Q7(b)(ii) · 4 marks

(ii) A mutation causing females to mature rapidly allows stoats to reproduce in their first year.

Explain how the frequency of an allele leading to early maturity may change over time.

(4)

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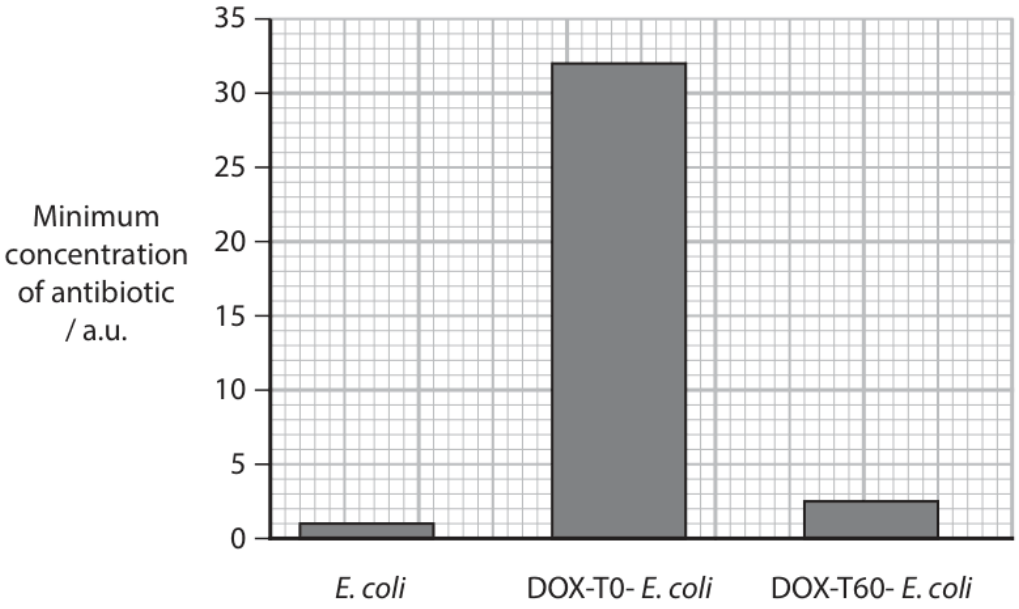
(b) Antibiotic resistance to DOX was investigated.

A culture of *E. coli* was treated with DOX and a resistant strain of *E. coli* called DOX-T0- *E. coli* was produced.

The DOX-T0- *E. coli* were then placed in antibiotic free conditions.

After 60 cycles of cell division, they became a different strain called DOX-T60- *E. coli*.

The graph shows the minimum concentration of DOX required to have a bacteriostatic effect on the bacteria.



(i) Explain the effect of 60 cycles of cell division on DOX resistant *E. coli* (DOX-T0- *E. coli*).

(2)

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Question 17 · A level Paper 1 · June 2017 · Q10(b)(ii) · 3 marks

(ii) Explain how two species of African elephant could evolve from a common ancestor.

(3)

Question 18 · A level Paper 1 · June 2018 · Q9(b) · 3 marks

(b) Explain how reforestation of tropical rainforests can be used to minimise climate change.

(3)

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Question 19 · A level Paper 1 · June 2022 · Q2(b)(ii) · 3 marks

(ii) Beef cattle are traditionally reared by grazing on natural pastures (grassland).

In recent years, large areas of rainforest have been cleared to produce beef.

Explain why the farming of beef cattle on deforested land produces more greenhouse gas emissions than from those reared on natural pastures.

(3)

Question 20 · A level Paper 3 · November 2021 · Q5(b)(i) · 2 marks

(b) Many forests are exploited by humans.

(i) Describe how forests can be managed as a sustainable resource.

(2)

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Mark schemes

Question 1 · A level Paper 1 · June 2017 · Q5(a) · 4 marks

Question Number	Answer
5(a)	An explanation that makes reference to four of the following: • pollen preserved in peat bogs (1) • a plant species can be identified from its pollen (1) • climate affects the type of plants growing (1) • depth of peat correlates with period of time since pollen was produced (1) • changes in pollen over time indicate changes in climate (1)

Additional Guidance	Mark
ALLOW conditions / temperature in place of climate ALLOW carbon-14 dating ALLOW pollen quantity or type	4

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Question 2 · A level Paper 3 · June 2018 · Q2(a)(i) · 2 marks

Question Number	Answer
2(a)(i)	An explanation that makes reference to the following: • trend shows a reduction in number of days per year when (sea) ice is present (1) • (sea) ice { melting / absent / not forming } due to { global warming / rise in (surface) temperature } (1)

Additional Guidance	Mark
ALLOW description of (sea) ice being present for less time per year ALLOW use of data to illustrate a reduction in days with sea ice over time IGNORE greenhouse effect for global warming IGNORE climate change	(2)

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Question 3 · A level Paper 1 · June 2019 · Q10(a) · 3 marks

Question Number	Answer
10(a)	An explanation that makes reference to three of the following: • relevant example of human activity (1) • increasing a named greenhouse gas (1) • therefore more {heat energy / infrared radiation} is trapped in the atmosphere (1) • causing a mean increase in the {surface / atmospheric} temperature (1)

Additional guidance	Mark
e.g. burning fossil fuels / landfill / cattle ranching / deforestation e.g. carbon dioxide / methane ALLOW more heat trapped in the atmosphere	**(3)**

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Question 4 · A level Paper 1 · June 2023 · Q8(c)(i) · 3 marks

Question Number	Answer
8(c)(i)	An explanation that makes reference to three of the following • carbon dioxide dissolves in the (sea) water (1) • this increases the acidity of the water (1) • increased global warming could increase the water temperature (1) • therefore change in {temperature / pH} will denature the enzymes (so less seagrass survives) (1)

Additional guidance	Mark
ALLOW formation of carbonic acid ALLOW lowers pH ALLOW description of global warming ALLOW { temperature /pH} no longer optimum for the enzymes of the seagrass	(3)

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Question 5 · A level Paper 3 · November 2021 · Q5(b)(ii) · 4 marks

Question number	Answer
5(b)(ii)	An explanation that makes reference to four the following: • less photosynthesis (1) • less carbon dioxide will be fixed / more CO_2 remains in the atmosphere (1) • because CO_2 is a greenhouse gas (1) • more (heat) energy trapped in the atmosphere (1) • more energy in the atmosphere increases (atmospheric) temperature (1)

Additional guidance	Mark
Less can be implied from MP2 ALLOW more of the products of photosynthesis accumulate as new biomass than are released due to respiration IGNORE less carbon dioxide will be used IGNORE unqualified reference to greenhouse effect ALLOW increasing surface temperature of earth	Choose an item (4)

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Question 6 · A level Paper 1 · June 2023 · Q10(a) · 2 marks

Question Number	Answer
10(a)	• suitable trend line drawn on graph (1) • correct date from extrapolated trend line on graph (1)

Additional guidance	Mark
e.g. a smooth/straight line date correctly read from graph	(2)

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Question 7 · A level Paper 3 · June 2018 · Q2(a)(ii) · 4 marks

Question Number	Answer
2(a)(ii)	An explanation that makes reference to four of the following: • cannot assume a trend will continue (1) • not enough data collected (1) • data only from { one location / one island / part of one island } (1) • data fluctuates / no trend before 1994 (1) • ice { rarely present from 2006 / not present from 2012 } so cannot be used to judge future temperature rise (1)

Additional Guidance	Mark
ALLOW extrapolation may not be accurate ALLOW data does not go back far enough ALLOW appropriate comment on range of fluctuations e.g. 0 days to 210 days in 2/3 years	**(4)**

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Question 8 · A level Paper 1 · June 2018 · Q7(b)(iii) · 5 marks

Question Number	Answer
7(b)(iii)	An explanation that makes reference to the following • carbon dioxide (is a greenhouse gas and) causes global warming (1) • a relevant description of a change in the distribution of ash trees (with increasing CO_2 concentrations) (1) • (because increased CO_2) would result in a change in the range for *H. fraxineus* (1) • and ash trees will be found in regions without *H. fraxineus* (1) • change in range of { *H. fraxineus* / ash trees } linked to a relevant aspect of climate change (1)

Additional Guidance	Mark
e.g. an increase to 430 ppm leads to more ash trees in the east or an increase to 1080 ppm leads to more ash trees in the north e.g. temperature increase, change in humidity, change in rainfall patterns	**(5)**

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Question 9 · A level Paper 1 · October 2020 · Q2(c) · 4 marks

Question Number	Answer
2(c)	An answer that makes reference to four of the following • fewer seeds will lead to a decrease in the plant population(1) • fewer seeds means that there is less {food / energy} (1) • lipids and carbohydrates contain (large amounts) of stored energy(1) • the monkeys will not be able to generate enough heat to survive the cold winters (1) • the monkey population will decrease in size (1)

Additional guidance	Mark
ALLOW lipids needed for insulation/less respiration to generate heat	**(4)**

Question 10 · A level Paper 1 · June 2024 · Q6(b)(ii) · 2 marks

Question Number	**Answer**
6(b)(ii)	An explanation that makes reference to the following • increase in temperature may lead to { earlier germination / plants will grow further north } (1) • change in rainfall patterns may lead to { an increase in drought resistant plants /a change in the distribution of plants } (1)

Additional guidance	**Mark**
ALLOW increase in temperature may lead to {plants growing in different areas / more germination}	(2)

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Question 11 · A level Paper 1 · June 2023 · Q10(c)(i) · 2 marks

Question Number	Answer
10(c)(i)	An explanation that makes reference to two of the following • (life cycle) depends on metabolic reactions (1) • (increase in temperature) increases the kinetic energy of enzymes (1) • (therefore) there will be {more frequent collisions between enzyme and substrate / faster rate of formation of enzyme-substrate complexes} (1)

Additional guidance	Mark
ALLOW increases {metabolism / respiration / cell division / protein synthesis } IGNORE rate of these processes ALLOW increases rate of enzyme activity DO NOT ALLOW increase in enzyme activity without reference to rate	(2)

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Question 12 · A level Paper 1 · June 2024 · Q6(b)(i) · 3 marks

Question Number	Answer
6(b)(i)	An explanation that makes reference to three of the following • increase in (spring) temperature increased germination for all three species (1) • (because) there is more (kinetic) energy and more (frequent) collisions between substrate and enzyme (1) • (therefore) starch is { broken down / hydrolysed } faster (1) • greater supply of glucose increases the rate of respiration (1)

Additional guidance	Mark
ALLOW { lipids/proteins } broken down faster	(3)

Question 13 · A level Paper 1 · November 2021 · Q10(b) · 2 marks

Question Number	Answer
10 (b)	An explanation that makes reference to two of the following: • plants show increase in height as the temperature increases (from 3°C to 10°C) in this period (1) • the rate of photosynthesis will increase (in the Arctic plants) as the temperature increases, leading to an increase in growth (1) • the increase is greater in wet conditions because water is also needed for { photosynthesis / growth } (1)

Additional guidance	Mark
	(2)

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Question 14 · A level Paper 1 · June 2024 · Q8(b)(ii) · 4 marks

Question Number	Answer
8(b)(ii)	An answer that makes reference to the following • diet containing milk and dairy acted as a selection pressure (1) • individuals able to produce lactase { have an advantage / have better nutrition } (1) • more likely to { survive / live longer } and reproduce (1) • (therefore) over time the frequency of the allele increases (1)

Additional guidance	Mark
ALLOW (lactase) allele is advantageous ALLOW reference to passing down or producing offspring for reproduce	(4)

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Question 15 · A level Paper 1 · June 2025 · Q7(b)(ii) · 4 marks

Question Number	Answer
7(b)(ii)	An explanation that makes reference to four of the following: • due to genetic variation some (females) have the mutation / mutation (in some females) leads to genetic variation (1) • females with the mutation will reproduce at a younger age (1) • (advantage of breeding early being that) more offspring can be produced (1) • (because they mate earlier) more of the {offspring / population} will inherit the allele (1) • leading to an increase in frequency of the allele (1)

Additional guidance	Mark
ALLOW it will pass on the allele to more offspring	(4)

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Question 16 · A level Paper 3 · June 2025 · Q5(b)(i) · 2 marks

Question number	Answer
5(b)(i)	An explanation that makes reference to the following: • (antibiotic) resistance decreases (1) • DOX resistant bacteria no longer had an advantage (1) • (presence of) antibiotic is a selection pressure (1)

Additional guidance	Mark
ALLOW {allele/gene} for antibiotic resistance becomes less frequent ALLOW resistance no longer of use ALLOW absence of selection pressure (during 60 days with no antibiotic)	(3)

Question 17 · A level Paper 1 · June 2017 · Q10(b)(ii) · 3 marks

Question Number	Answer
10(b)(ii)	An explanation that makes reference to three of the following: • two populations are geographically isolated from each other (1) • therefore reduced gene flow between the two populations (1) • which leads to allopatric speciation (1) • different selection pressures leading to natural selection (1)

Additional Guidance	Mar
ALLOW description of populations separated by a geographical feature ALLOW description of natural selection in context of selection pressures	**3**

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Question 18 · A level Paper 1 · June 2018 · Q9(b) · 3 marks

Question Number	Answer
9(b)	An explanation that makes reference to three of the following • {new / young / growing} trees (1) • resulting in net uptake of carbon dioxide / more carbon dioxide taken in by photosynthesis than released by respiration (1) • therefore reducing carbon dioxide in the atmosphere (1) • which slows the rate of global warming (1)

Additional Guidance	Mark
ALLOW plant more trees ALLOW trees acting as a carbon sink/store ALLOW reduces greenhouse effect	**(3)**

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Question 19 · A level Paper 1 · June 2022 · Q2(b)(ii) · 3 marks

Question Number	Answer
2(b)(ii)	An explanation that makes reference to the following • (deforestation cuts down) trees which are carbon sinks (1) • {burning / decomposition} of these trees releases carbon dioxide into the atmosphere (1) • without trees there is {less/no} photosynthesis to remove carbon dioxide (from the atmosphere) (1)

Additional guidance	Mark
ALLOW trees are stores of carbon	(3)

Question 20 · A level Paper 3 · November 2021 · Q5(b)(i) · 2 marks

Question number	Answer
5(b)(i)	A description that makes reference to two of the following: • replacing trees that have been cut down (1) • {remove / cut down} older trees (1) • replace with {seedlings / young / rapidly growing} trees (1)

Additional guidance	Mark
ALLOW coppicing IGNORE allow trees to fully grow	Choose an item (2)

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