

Questions

Q1.

Anthropogenic climate change is linked to an increase in carbon dioxide in the atmosphere.

The World Meteorological Association recorded carbon dioxide levels of 405 ppm in 2017.

This is an increase of 46% since 1817.

Calculate the level of carbon dioxide in 1817.

(2)

..... ppm

(Total for question = 2 marks)

Q2.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Climate change has been linked to the release of carbon dioxide from some power stations.

The main reason that carbon dioxide acts as a greenhouse gas is because it

(1)

- A** absorbs infrared radiation reflected by the surface of the Earth
- B** absorbs ultraviolet radiation reflected by the surface of the Earth
- C** reflects infrared radiation absorbed by the surface of the Earth
- D** reflects ultraviolet radiation absorbed by the Earth's atmosphere

(Total for question = 1 mark)

Q3.

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

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)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q4.

Answer the questions with a cross in the boxes you think are correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

The golden snub-nosed monkey (*Rhinopithecus roxellana*) is endemic to high mountainous regions of China.

This endangered species of monkey feeds on seeds.

The population size of this species has decreased due to changes in its habitat. Climate change is one of the factors affecting the habitat of this species.

(i) Which of the following causes global warming?

(1)

- A** a decrease in carbon dioxide and methane in the atmosphere that trap infrared radiation
- B** a decrease in carbon dioxide and methane in the atmosphere that trap ultraviolet radiation
- C** an increase in carbon dioxide and methane in the atmosphere that trap infrared radiation
- D** an increase in carbon dioxide and methane in the atmosphere that trap ultraviolet radiation

(ii) Which of the following could provide evidence for climate change?

(1)

- A** dendrochronology, peat bog pollen analysis and ice cores
- B** ice cores, classification and peat bog pollen analysis
- C** niche, dendrochronology and classification
- D** niche, dendrochronology and ice cores

(Total for question = 2 marks)

Q5.

Climate change can also affect the life cycle of organisms.

The effect of temperature on the lifespan of fruit flies (*Drosophila melanogaster*) was investigated.

The results are shown in the table.

Temperature / °C	Lifespan / days
15	130.3
21	86.3
27	41.6
30	20.4

Determine the relationship between the increase in temperature and the change in lifespan.

(2)

.....

.....

.....

.....

.....

.....

(Total for question = 2 marks)

Q6.

An experiment was carried out to determine the effect of temperature on the activity of the enzyme catalase in yeast cells.

The substrate was hydrogen peroxide. A suspension of yeast cells was added to hydrogen peroxide.

The volume of oxygen produced during the initial two minutes was recorded. This was repeated at a range of temperatures.

The results are shown in the table.

Temperature / °C	Mean volume of oxygen / mm ³
20	80
30	240
40	540
50	320
60	120

(i) Calculate the temperature coefficient (Q_{10}) for this reaction between 20 °C and 30 °C.

(1)

Answer

(ii) Explain the effects of a temperature increase from 20 °C to 30 °C on the initial rate of activity of catalase in the yeast cells.

(3)

.....

.....

.....

.....

.....

.....

.....

(iii) Explain what happens to the Q_{10} value between 40 °C and 50 °C.

(2)

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q7.

Leaf rust is a disease caused by a species of fungus. Leaf rust affects cereal crops such as wheat.

Leaf rust yeast spreads through cereal crops when the humidity is high.

Discuss the possible impact of climate change on the effects of leaf rust on the yield of wheat crops.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

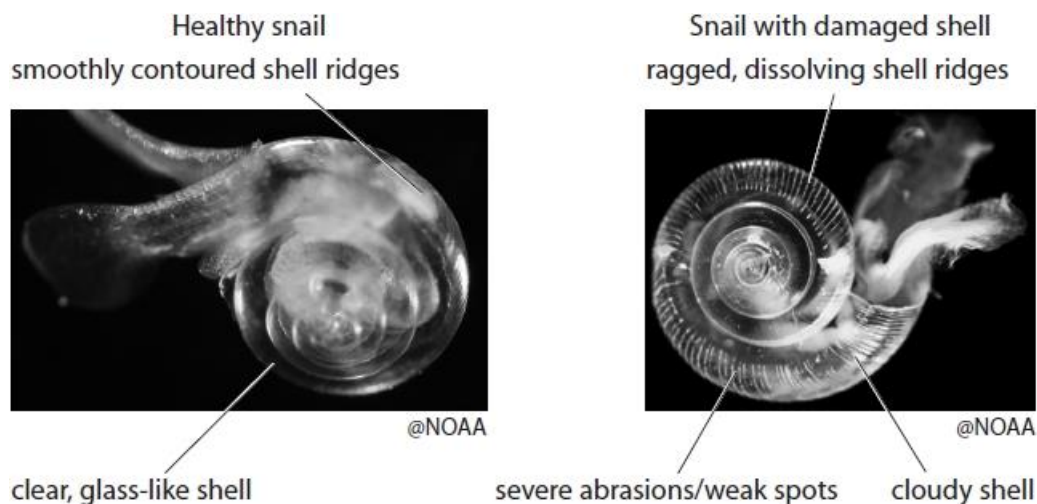
(Total for question = 4 marks)

Q8.

*Pteropods are small free-swimming snails found in oceans throughout the world. They are a food source for a variety of fish including salmon, mackerel and herring.

In 2011, the health of these snails was studied in the ocean around Hawaii. A sample of these snails showed that 53% of them had damaged shells.

The photographs show a healthy snail and a snail with a damaged shell found in the ocean around Hawaii.



The pH of sea water affects shell formation in these snails. The changes in carbon dioxide concentration and pH have been recorded in oceans surrounding several islands.

These records are shown in the graphs.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q9.

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)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q10.

Global warming can affect abiotic factors that determine the distribution of organisms.

The presence of sodium chloride in soil is an abiotic factor that affects the germination of seeds.

The effects of sodium chloride solution and gibberellin on the germination of rice seeds have been investigated.

Gibberellin regulates developmental processes in plants.

Fifty seeds were placed in each of three Petri dishes containing different solutions.

The seeds were incubated for 96 hours and the number that germinated in each Petri dish was counted.

Treatment	Solution	Number of seeds germinating
Control	Distilled water	48
Sodium chloride	120 mmol dm ⁻³ of sodium chloride	33
Sodium chloride and gibberellin	120 mmol dm ⁻³ sodium chloride and 50 μmol dm ⁻³ gibberellin	45

(i) Give a null hypothesis for this experiment.

(1)

.....

(ii) Calculate the chi-squared (χ^2) value for these results, using the formula provided.

(3)

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Answer

(iii) In a second experiment, using the same three treatments, the chi-squared (X^2) value was found to be 6.635.

The table gives the critical values for the chi-squared (X^2) test at different probability levels.

Degrees of freedom	Probability level		
	0.05	0.01	0.001
1	3.841	6.635	10.83
2	5.991	9.210	13.82
3	7.815	11.34	16.27
4	9.488	13.28	18.47

Deduce the statistical significance of the results of the second experiment.

(2)

.....

.....

.....

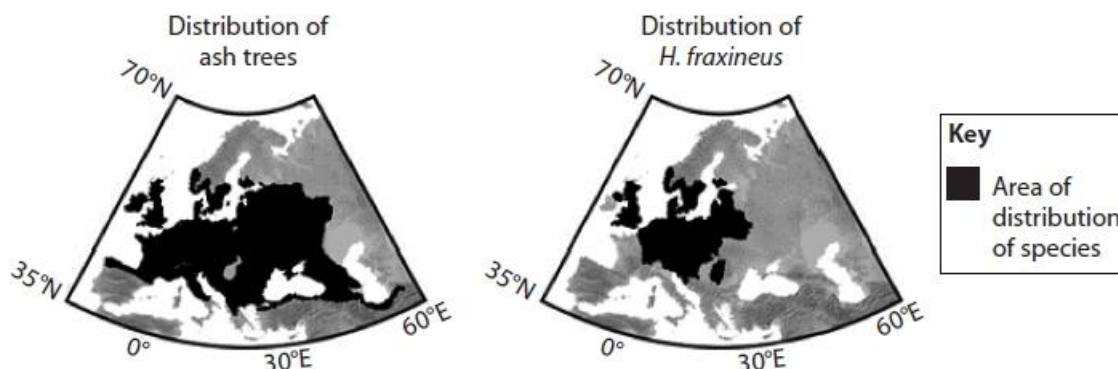
.....

(Total for question = 6 marks)

Q11.

Hymenoscyphus fraxineus (*H. fraxineus*) is the fungus that causes ash dieback. This disease usually kills all the ash trees that it infects.

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 <i>H. fraxineus</i>	Predicted distribution of ash trees
430			
1080			

(i) Which of the following is an abiotic factor that should be considered in the model?

(1)

- A ash tree resistance to *H. fraxineus*
- B *H. fraxineus* pathogens
- C humidity
- D ocean pH

(ii) Which of the following could be caused by an increase in atmospheric carbon dioxide from 398 ppm to 1080 ppm?

(1)

- A decreased photosynthesis
- B global warming
- C increased plant respiration
- D ozone depletion

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

(5)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 7 marks)

Q12.

The golden snub-nosed monkey (*Rhinopithecus roxellana*) is endemic to high mountainous regions of China.

This endangered species of monkey feeds on seeds.

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)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

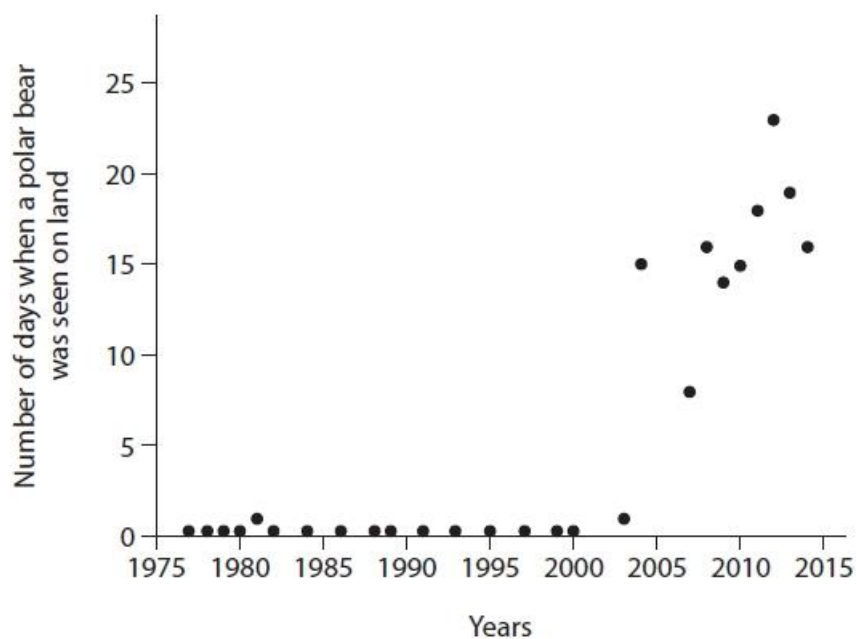
(Total for question = 4 marks)

Q13.

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

The scientists also recorded data from west Spitsbergen on polar bear behaviour.

The graph shows the number of days polar bears were seen on land.



Sketch a trend line onto this graph.

(1)

(Total for question = 1 mark)

Q14.

Lipoprotein lipase is an enzyme found in different tissues including the brain.

Lipoprotein lipase can be extracted from brain tissue to investigate the effect of temperature on the rate of reaction of this enzyme.

(i) State what is meant by the term Q_{10} temperature coefficient.

(1)

.....

.....

.....

(ii) Devise an investigation to determine Q_{10} for an extract of lipoprotein lipase enzyme.

(5)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q15.

Lipoprotein lipase is an enzyme found in different tissues including the brain.

The enzyme lipoprotein lipase is involved in the metabolism of lipids in the brain.

The effect of temperature on lipid metabolism in the brain tissue of a species of fish was investigated.

The results of this investigation are shown in the table.

Temperature /°C	Lipoprotein lipase mRNA / a.u.	Triglyceride concentration / mmol mg ⁻¹	Fatty acid concentration / μmol mg ⁻¹	Lipoprotein lipase activity per milligram of tissue / a.u.
5	4.50	0.58	0.84	1.70
17	1.00	0.60	0.69	1.55
30	1.10	0.70	0.64	0.99

Comment on the effect of temperature on lipid metabolism in this species of fish.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

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

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q17.

Photosynthesis contributes to the productivity of ecosystems.

(i) State what is meant by the term ecosystem.

(1)

.....

.....

.....

.....

(ii) The table shows information about two types of ecosystem.

Ecosystem	Gross productivity / g m ⁻² day ⁻¹	Net productivity / g m ⁻² day ⁻¹	Percentage of gross productivity used in respiration (%)	Total surface area of Earth occupied / km ²
Tropical rainforest	16.7	5.5	67.1	510 x 10 ⁶
Salt marsh	10.5		34.3	5.5 x 10 ⁴

Calculate the net productivity of the salt marsh ecosystem.

(2)

..... g m⁻² day⁻¹

(iii) Comment on the impact of these different types of ecosystem on global warming.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Mark Scheme

Q1.

Question Number	Answer	Additional guidance	Mark
	An answer that makes reference to <ul style="list-style-type: none">• correct method for calculation the change in value (1)• correct answer (1)	<u>Example of calculation</u> $405 \div 1.46$ 277.4 (ppm) ALLOW 277 Correct answer without working gains full marks	(2)

Q2.

Question Number	Answer	Mark
	<p>The only correct answer is A absorbs infrared radiation reflected by the surface of the Earth</p> <p><i>B is incorrect because it does not absorb ultraviolet</i></p> <p><i>C is incorrect because it does not reflect infrared</i></p> <p><i>D is incorrect because it does not reflect ultraviolet</i></p>	(1)

Q3.

Question Number	Answer	Additional Guidance	Mark
	<p>An explanation that makes reference to four of the following:</p> <ul style="list-style-type: none"> • 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) 	<p>ALLOW conditions / temperature in place of climate</p> <p>ALLOW carbon-14 dating</p> <p>ALLOW pollen quantity or type</p>	4

Q4.

Question Number	Answer	Mark
(i)	<p>The only correct answer is C - an increase in carbon dioxide and methane in the atmosphere that trap infrared radiation</p> <p><i>A is incorrect because carbon dioxide and methane are increasing</i></p> <p><i>B is incorrect because carbon dioxide and methane are increasing and they do not trap ultraviolet radiation</i></p> <p><i>D is incorrect because carbon dioxide and methane do not trap ultraviolet radiation</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
(ii)	<p>The only correct answer is A - dendrochronology, peat bog pollen and ice cores</p> <p><i>B is incorrect because classification does not provide evidence</i> <i>C is incorrect because niche and classification do not provide evidence</i> <i>D is incorrect because niche does not provide evidence</i></p>		(1)

Q5.

Question Number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> • an inverse relationship described (1) • quantification of the relationship (1) 	<p>e.g. as temperature increases the lifespan decreases ALLOW negative correlation</p> <p>e.g. from 15 to 30°C decrease of 84% / 109.9 days or a decrease of 7.3 days per degree increase in temperature $(130.3 - 20.4) \div 15 = 7.3$</p>	(2)

Q6.

Question Number	Answer	Additional guidance	Mark
(i)	<ul style="list-style-type: none"> correct calculation of Q_{10} value 	<p><u>Example of calculation</u></p> <p>$(240 \div 80 =) 3$</p>	(1)

Question Number	Answer	Additional guidance	Mark
(ii)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none"> (between 20 °C and 30 °C) there is more kinetic energy available (1) therefore there will be more frequent collisions (between enzyme and substrate) (1) more enzyme-substrate complexes formed (1) (the Q_{10} value indicates) the activity triples with the 10 °C temperature rise (1) 	<p>ALLOW more frequent collisions between catalase and hydrogen peroxide</p>	(3)

Question Number	Answer	Additional guidance	Mark
(iii)	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none"> Q_{10} value is less than 1.0 (1) because the enzyme is denatured (1) therefore no increase in formation of enzyme-substrate complexes / substrate no longer fits active site (1) 	<p>ALLOW Q_{10} value of 0.59</p> <p>ALLOW fewer enzyme-substrate complexes formed</p>	(2)

Q7.

Question Number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to four of the following:</p> <ul style="list-style-type: none"> • climate change could result in { increased temperature / increased humidity / change in rainfall patterns / drought } (1) • increase in temperature could increase the growth of the leaf rust (1) • { increased rainfall / increased humidity } could increase the spread of the leaf rust (1) • a period of drought could reduce the spread of leaf rust (1) • relevant observation about the impact on crop yield (1) 	<p>ALLOW increased reproduction of leaf rust (yeast)</p> <p>e.g. decrease in yield of wheat if leaf rust {spread/growth} is increased and vice versa</p>	(4)

Q8.

Question Number	Answer
	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p><u>Indicative content</u></p> <ul style="list-style-type: none"> • Human activity increasing carbon dioxide levels e.g. burning fossil fuels such as oil, coal, gas • Therefore human activity is increasing the level of carbon dioxide in the atmosphere, which then dissolves in the oceans • Graphs show that as carbon dioxide levels increase, pH of the oceans decreases • Reduction in pH increases the percentage of snails with damaged shells • These will not survive therefore less food available for fish / impact on food chains and food webs in the oceans • There may be an initial increase in fish population due to snails becoming more vulnerable to predation • Therefore reduction in fish populations

Level	Mark	Descriptor	Additional Guidance
Level 0	Marks	No awardable content	
Level 1	1-2	<p>An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information.</p> <p>The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.</p>	<p>One study focussed on</p> <p>Increase in CO₂ / pH in oceans becoming lower or effect of lower pH on snail shells</p>
Level 2	3-4	<p>An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information.</p> <p>The explanation shows some linkages and lines of scientific reasoning with some structure.</p>	<p>Reference to effect of pH on shells of snails linked to CO₂ and changes in pH in oceans</p> <p>Links made to effects on food chains due to fewer snails</p>
Level 3	5-6	<p>An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information.</p> <p>The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.</p>	<p>Analysis of both studies linked to human activity and change in pH of oceans. Explanation of the effect on fish populations.</p> <p>Snails with damaged shells do not survive</p>

Q9.

Question Number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none"> • 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) 	<p>e.g. burning fossil fuels / landfill / cattle ranching / deforestation</p> <p>e.g. carbon dioxide / methane</p> <p>ALLOW more heat trapped in the atmosphere</p>	(3)

Q10.

Question number	Answer	Additional guidance	Mark
(i)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> • treatment of seeds with sodium chloride or sodium chloride and gibberellin has no effect on the number of seeds that germinate (1) 		(1)

Question number	Answer	Additional guidance	Mark																																																				
(ii)	Choose an item. <ul style="list-style-type: none"> correct expected value calculated (1) $(O - E)^2$ values calculated (1) Sum of $(O - E)^2$ values divided by expected value (1) 	Example of calculation: $= 42$ 36, 81 and 9 $126 \div 42 = 3$ ALLOW calculations based on E value of 48 or 50 <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Obs</th> <th>Exp</th> <th>$(O - E)^2$</th> <th>$(O - E)^2/E$</th> </tr> </thead> <tbody> <tr> <td>48</td> <td>42</td> <td>36</td> <td>0.857143</td> </tr> <tr> <td>33</td> <td>42</td> <td>81</td> <td>1.928571</td> </tr> <tr> <td>45</td> <td>42</td> <td>9</td> <td>0.214286</td> </tr> <tr> <td></td> <td></td> <td></td> <td>3</td> </tr> <tr> <td>48</td> <td>50</td> <td>4</td> <td>0.08</td> </tr> <tr> <td>33</td> <td>50</td> <td>289</td> <td>5.78</td> </tr> <tr> <td>45</td> <td>50</td> <td>25</td> <td>0.5</td> </tr> <tr> <td></td> <td></td> <td></td> <td>6.36</td> </tr> <tr> <td>48</td> <td>48</td> <td>0</td> <td>0</td> </tr> <tr> <td>33</td> <td>48</td> <td>225</td> <td>4.6875</td> </tr> <tr> <td>45</td> <td>48</td> <td>9</td> <td>0.1875</td> </tr> <tr> <td></td> <td></td> <td></td> <td>4.875</td> </tr> </tbody> </table>	Obs	Exp	$(O - E)^2$	$(O - E)^2/E$	48	42	36	0.857143	33	42	81	1.928571	45	42	9	0.214286				3	48	50	4	0.08	33	50	289	5.78	45	50	25	0.5				6.36	48	48	0	0	33	48	225	4.6875	45	48	9	0.1875				4.875	
Obs	Exp	$(O - E)^2$	$(O - E)^2/E$																																																				
48	42	36	0.857143																																																				
33	42	81	1.928571																																																				
45	42	9	0.214286																																																				
			3																																																				
48	50	4	0.08																																																				
33	50	289	5.78																																																				
45	50	25	0.5																																																				
			6.36																																																				
48	48	0	0																																																				
33	48	225	4.6875																																																				
45	48	9	0.1875																																																				
			4.875																																																				
		Correct answer with no working gains full marks	(3)																																																				

Question number	Answer	Additional guidance	Mark
(iii)	An answer that makes reference to the following: <ul style="list-style-type: none"> calculated value is significant at $p = 0.05$ (1) at 2 degrees of freedom (1) 		(2)

Q11.

Question Number	Answer	Mark
(i)	<p>C – humidity</p> <p><i>The only correct answer is C</i></p> <p>A is not correct because resistance to infection is a biotic factor</p> <p>B is not correct because pathogens are biotic factors</p> <p>D is not correct because ocean pH is an abiotic factor but not one relevant to plants and their pathogens</p>	(1)

Question Number	Answer	Mark
(ii)	<p>B – global warming</p> <p><i>The only correct answer is B</i></p> <p>A is not correct because increase CO₂ to 1080 ppm does not decrease photosynthesis</p> <p>C is not correct because increased CO₂ to 1080 ppm does not increase plant respiration</p> <p>D is not correct because increased CO₂ to 1080 ppm does not cause ozone depletion</p>	(1)

Question Number	Answer	Additional Guidance	Mark
(iii)	<p>An explanation that makes reference to the following</p> <ul style="list-style-type: none"> • carbon dioxide (is a greenhouse gas and) causes global warming • a relevant description of a change in the distribution of ash trees (with increasing CO₂ concentrations) • (because increased CO₂) would result in a change in the range for <i>H. fraxineus</i> (1) • and ash trees will be found in regions without <i>H. fraxineus</i> • change in range of { <i>H. fraxineus</i> / ash trees } linked to a relevant aspect of climate change 	<p>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</p> <p>e.g. temperature increase, change in humidity, change in rainfall patterns</p>	(5)

Q12.

Question Number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to four of the following</p> <ul style="list-style-type: none"> • 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) 	<p>ALLOW lipids needed for insulation/less respiration to generate heat</p>	(4)

Q13.

Question Number	Answer	Additional Guidance	Mark
	<ul style="list-style-type: none"> • correct trend line drawn (1) 	<p>Examples:</p> <p>The figure contains two scatter plots. Both plots have 'Years' on the x-axis (1975 to 2015) and 'Number of days when a polar bear was seen on land' on the y-axis (0 to 25). The data points in both plots are nearly identical, showing zero sightings until approximately 2000, followed by a rapid increase to about 23 sightings by 2015. The top plot features a smooth, upward-curving trend line. The bottom plot features a straight line of best fit.</p>	(1)

Q14.

Question number	Answer	Additional guidance	Mark
(i)	An answer that makes reference to the following: <ul style="list-style-type: none"> the ratio of the rate of an enzyme reaction taking place at temperatures differing by 10 °C or K). 	ALLOW description ALLOW equation	Choose an item. (1)

Question number	Answer	Additional guidance	Mark
(ii)	An answer that makes reference to five of the following: <ul style="list-style-type: none"> description of how two suitable temperatures will be controlled (1) provide excess triglyceride (1) control concentration of lipoprotein lipase (1) measure concentration of {triglyceride / fatty acids } at stated time intervals (1) find initial rates (1) description of how Q10 can be determined (1) 	e.g use two water baths with a 10 degree temperature difference / use water baths at 5 and 15 °C ALLOW more than two if they include a 10 °C difference ALLOW use lipoprotein lipase at a limiting concentration ALLOW enzyme in place of lipoprotein lipase ALLOW determine pH at set time intervals ALLOW colorimeter to measure cloudiness of milk / lipid solution ALLOW draw tangent to curve to find rate e.g. rate at T+10 ÷ rate at T	Choose an item. (5)

Q15.

Question number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to three of the following:</p> <ul style="list-style-type: none">• as temperature increase less lipoprotein lipase mRNA is produced (1)• resulting in reduced lipoprotein lipase activity (1)• (as temperature increases) triglyceride concentrations increase and fatty acid concentrations decrease (1)• (because) triglycerides are not being broken down into fatty acids (1)	ALLOW converse arguments	(3)

Q16.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> 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) 	<p>ALLOW description of (sea) ice being present for less time per year</p> <p>ALLOW use of data to illustrate a reduction in days with sea ice over time</p> <p>IGNORE greenhouse effect for global warming IGNORE climate change</p>	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation that makes reference to four of the following:</p> <ul style="list-style-type: none"> 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) 	<p>ALLOW extrapolation may not be accurate</p> <p>ALLOW data does not go back far enough</p> <p>ALLOW appropriate comment on range of fluctuations e.g. 0 days to 210 days in 2/3 years</p>	(4)

Q17.

Question number	Answer	Additional guidance	Mark
(i)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> organisms and {non-living components / abiotic factors} (1) 		(1)

Question number	Answer	Additional guidance	Mark
(ii)	<p>Choose an item.</p> <ul style="list-style-type: none"> • correct value for respiration (1) • respiration value calculated subtracted from gross productivity value (1) 	<p>Example of calculation</p> $10.5 \times (34.3 \div 100) = 3.6$ $10.5 - 3.6 = 6.9 \text{ (g m}^{-2} \text{ day}^{-1}\text{)}$ <p>Correct answer with no working gains full marks</p>	(2)

Question number	Answer	Additional guidance	Mark
(iii)	<p>An answer that makes reference to three of the following:</p> <ul style="list-style-type: none"> • tropical rain forests use a greater percentage (of gross productivity) in respiration (1) • tropical rain forests occupy a larger surface area (1) • therefore (tropical rain forests) release more carbon dioxide (1) • which is a greenhouse gas / making a greater contribution to global warming (1) 	<p>ALLOW converse arguments for salt marsh for mps 1, 2 and 3</p>	(3)