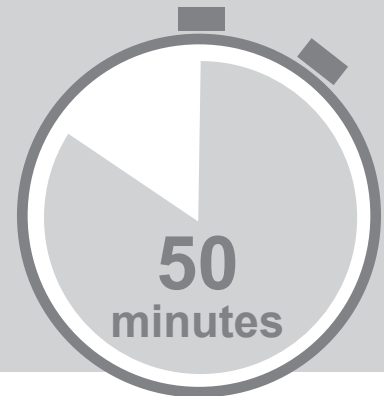




# Integrated Science

## General course

### Externally set task 2017



Write your name in this box.

Student number: In figures

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In words

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#### Before starting this task **check** that you have:

- black or blue pen, 2B pencils
- sharpener
- eraser
- highlighters
- correction fluid/tape
- ruler
- a calculator of the type used in class assessments.



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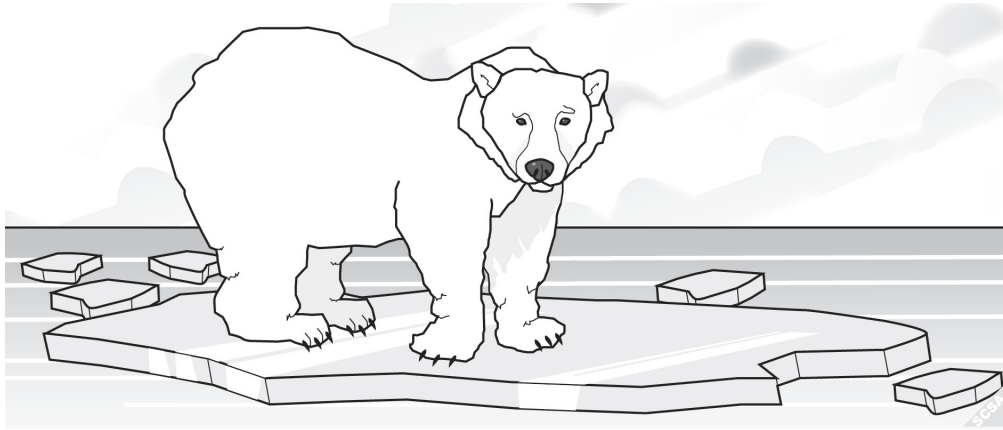
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Total time for the task: 50 minutes  
Total marks: 38 marks  
Weighting: 15% of the school mark

Question 1

(18 marks)



The Arctic region consists of large areas of pack ice with some large land masses that border the ice. The pack ice provides important habitats for a wide variety of creatures, but global warming (gradual heating of the Earth's surface, oceans and atmosphere) has seen the areas of pack ice reduced.

One animal that has been affected greatly is the polar bear, *Ursus maritimus*, one of the largest carnivores of the Arctic region. The reduction in the areas of pack ice has meant polar bears are confined to land more often, and their access to food is being cut off. Their ecological position is now classified as 'endangered'.

To stop their decline researchers investigated the idea of substituting their food supply. A food preparation containing seaweed (flavoured with fat to taste and smell like seal meat) was developed. Seaweed is known to provide a lot of protein. The preparation would be fed to bears when global warming cuts off access to sea ice.

To investigate the alternative food source, researchers monitored 100 polar bears in Northern Canada. The bears were enclosed in a large compound of five square kilometres. This was divided into two equal areas with 25 male bears and 25 female bears in each area.

One group of polar bears was fed seal meat and the other group was fed the seaweed food preparation. For two years, a team of researchers took three-monthly weight records of the polar bears to assess the impact of the two diets.

- (a) (i) Name the independent variable and the dependent variable in this investigation. (2 marks)

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

See next page

**Question 1(a)** (continued)

- (ii) Write an hypothesis for this investigation. (2 marks)

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The investigation results are shown in the table below.

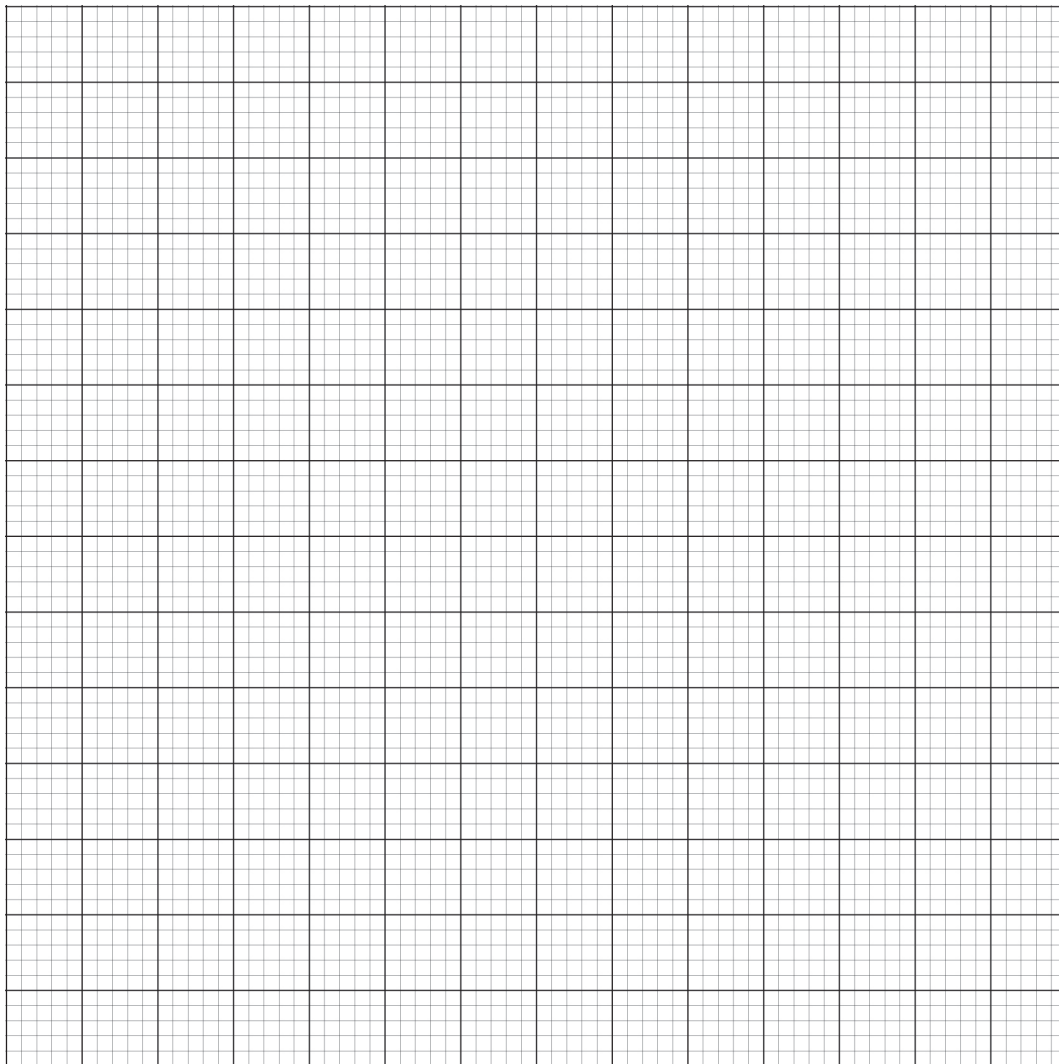
**Average weight (kg) of polar bears over two years for different food sources**

	Year 1				Year 2			
	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec
Seal meat	830	836	836	832	842	839	829	836
Seaweed preparation	835	841	841	835	832	827	823	819

- (b) Using the data from the table, construct a column graph comparing the average weight of polar bears and the type of food they consumed. (5 marks)

A spare grid is provided at the end of the booklet. If you need to use it, cross out this attempt.

Title: \_\_\_\_\_



- (c) Using the table or your graph, outline the results of the investigation. (3 marks)

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**Question 1** (continued)

Some of the researchers suggested that two years was not long enough to trial the seaweed preparation, while others stated that they had obtained all the data they needed and that further investigation might prove harmful to the bears.

- (d) What change would you suggest to the investigation to enable it to be extended? Outline a reason for the suggestion. (3 marks)

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The researchers would have needed to apply for approval from a research ethics committee before conducting this research.

- (e) Name a factor in this investigation for which the researchers would have needed to seek approval. Explain the reason for the factor. (3 marks)

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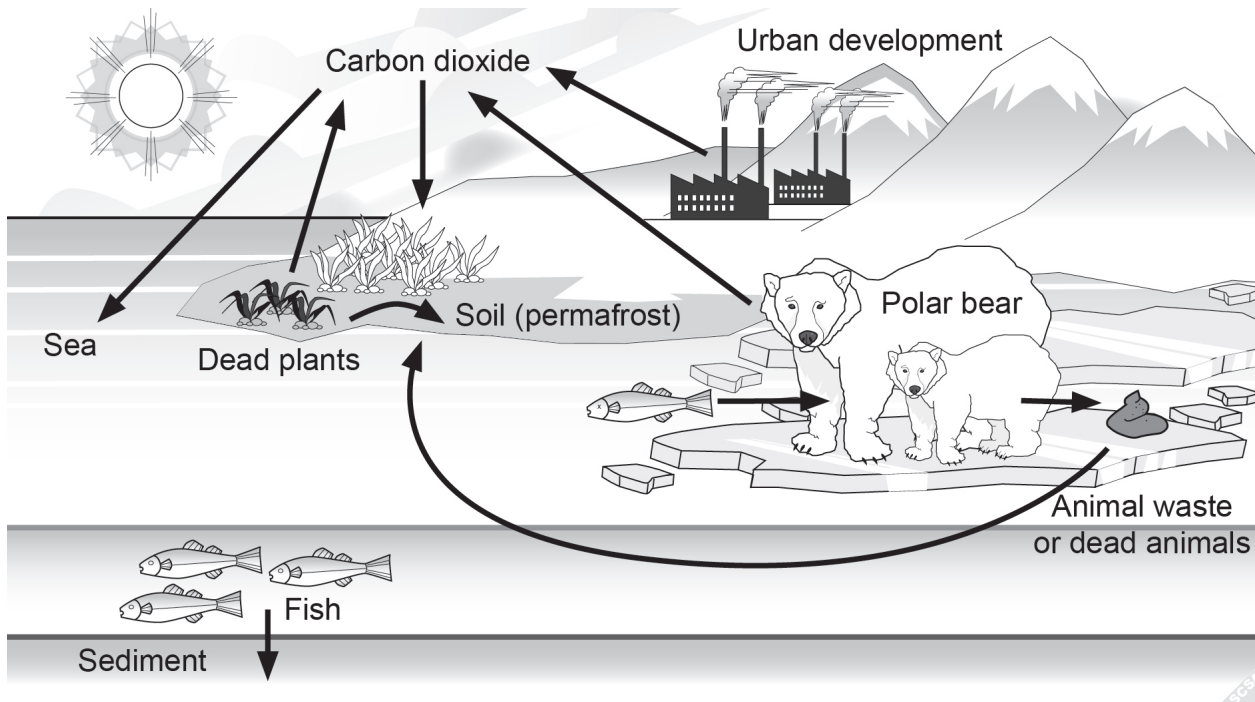
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Question 2

(20 marks)

Many biogeochemical cycles are currently being studied as climate change and human impacts are drastically changing the speed, intensity and balance of these cycles.

Look at the diagram below which represents the carbon cycle in the Arctic region.



- (a) Use the diagram to explain how the element carbon is recycled.

(4 marks)

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**Question 2** (continued)

- (b) Explain why the carbon cycle is considered a biogeochemical cycle. (3 marks)

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Rainforests occur mainly in tropical areas, a long way from the Arctic region, however the huge amount of plant material in them store vast amounts of the element, carbon. The plants in the rainforest can be described as a 'reservoir for carbon'.

- (c) What does a 'reservoir for carbon' mean and outline how this can be used to counteract climate change. (3 marks)

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- (d) With climate change Arctic sea ice has declined (melting into the ocean) and carbon dioxide levels have increased. Explain how the changes to these two abiotic factors affect the survival of coldwater fish that live in the Arctic region. (4 marks)

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The water cycle is another biogeochemical cycle. Human activities can alter the water cycle and impact on natural ecosystems.

- (e) Give **two** examples of how humans can alter the water cycle and for each example explain the impact on the natural ecosystems. (6 marks)

One: \_\_\_\_\_

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Two: \_\_\_\_\_

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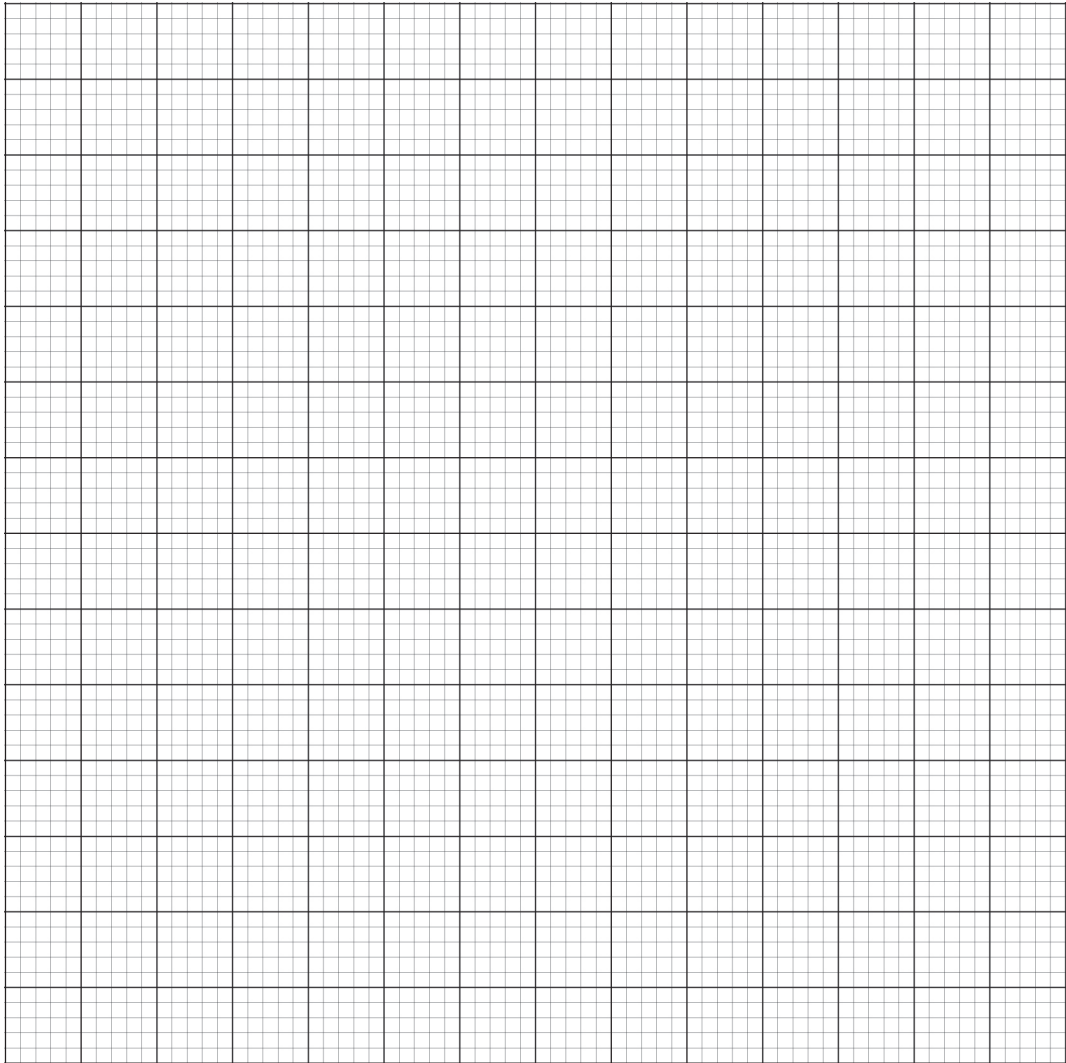
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Spare grid

Title: \_\_\_\_\_



DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF





# **Integrated Science**

## **General course**

**Externally set task 2017**  
**Marking key**

**Total marks for this task: 38**

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Question 1

(18 marks)

- (a) (i) Name the independent variable and the dependent variable in this investigation. (2 marks)

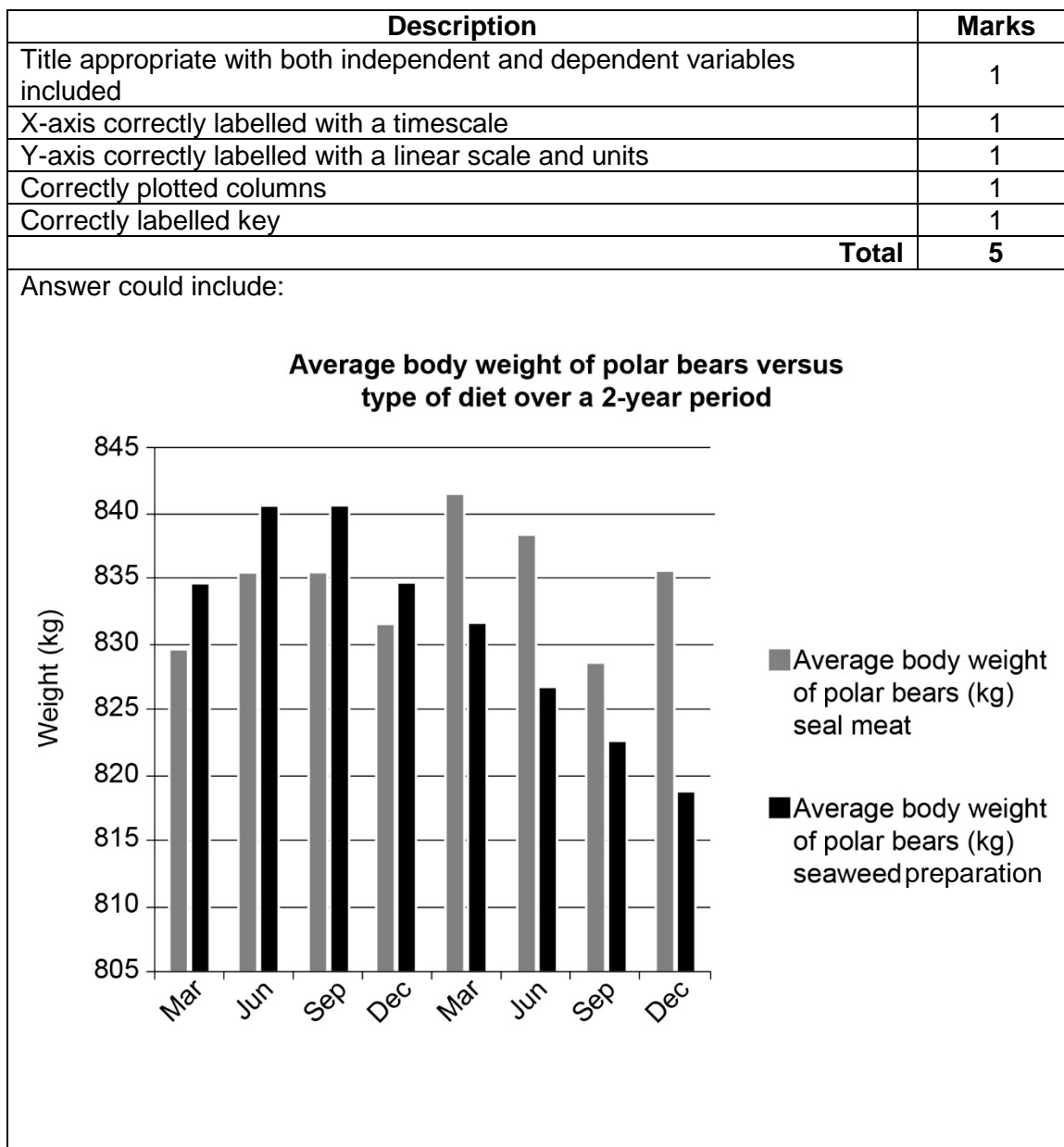
Description	Marks
Independent variable – diet the polar bears consumed (seal meat or seaweed preparation)	1
Dependent variable – The polar bears' body weight (in kg)	1
<b>Total</b>	<b>2</b>

- (ii) Write an hypothesis for this investigation. (2 marks)

Description	Marks
Hypothesis showing the relationship between independent and dependent variables	2
Statement made about polar bear diet and body weight (e.g. polar bear diet affects body weight)	1
<b>Total</b>	<b>2</b>
<p>Answer could include:</p> <ul style="list-style-type: none"> <li>polar bears fed seal meat gain more body weight than those fed the seaweed preparation</li> <li>polar bears fed a seaweed preparation lose more body weight than those fed seal meat</li> <li>polar bears fed seal meat lose more body weight than those fed seaweed preparation.</li> </ul> <p>Answer <b>must</b> include an item of diet and a reference to body weight gain or loss in comparison to the other item of diet.</p> <p>Accept other relevant answers.</p>	

Question 1 (continued)

- (b) Using the data from the table, construct a column graph comparing the average weight of polar bears and the type of food they consumed. (5 marks)





- (c) Using the table or your graph, outline the results of the investigation. (3 marks)

Description	Marks
Outline indicates:	
The seal meat group maintained the average weight throughout the investigation	1
The seaweed preparation group maintained the average weight for the first year	1
The seaweed preparation group did not maintain the average weight in the second year	1
<b>Total</b>	<b>3</b>
<p>Answer could include:</p> <p>The average weight of the polar bear that ate seal meat did range from measurement to measurement however did maintain a reasonably constant weight range. The average weight of the polar bear that ate seaweed preparation did increase in the first year, however in the second year the average body weight slowly declined indicating that the bears like for the preparation was declining.</p>	

- (d) What change would you suggest to the investigation to enable it to be extended? Outline a reason for the suggestion. (3 marks)

Description	Marks
States a valid change to the investigation	1
Outlines a valid reason for the change to the investigation	2
States some information for the change to the investigation	1
<b>Total</b>	<b>3</b>
<p>Answer could include:</p> <ul style="list-style-type: none"> <li>change the seaweed preparation: provide a variety of seaweed preparations with different dietary additives to see which provides the best result</li> <li>reduce the numbers of bears: seaweed preparation can be tested on smaller numbers with similar results; <b>or</b> smaller numbers can be monitored more closely; <b>or</b> the area is currently too large to monitor effectively.</li> </ul> <p>Accept other relevant answers.</p>	

**Question 1** (continued)

- (e) Name a factor in this investigation for which the researchers would have needed to seek approval. Explain the reason for the factor. (3 marks)

Description	Marks
Names a valid factor	1
Explains a reason for the factor	2
States some relevant information about the factor	1
<b>Total</b>	<b>3</b>
<p>Answer could include:</p> <ul style="list-style-type: none"> <li>• large numbers of bears: the size of the area in which they are enclosed maybe too confining</li> <li>• damage to the environment: environmental damage by polar bears on such a small area</li> <li>• change to polar bear diet: seaweed could cause harm to polar bears</li> <li>• potential harm to human beings: polar bears are wild animals, contact with humans in the past has often left people badly injured or dead</li> <li>• polar bears are endangered: the investigation may cause greater loss</li> <li>• nature of the enclosure: the enclosure may not be safe for bears and/or humans</li> <li>• initial condition of the bears: some of the female bears maybe pregnant and the welfare of the unborn bear cub could be at risk.</li> </ul> <p>Accept other relevant answers.</p>	

Question 2

(20 marks)

(a) Use the diagram to explain how the element carbon is recycled.

(4 marks)

Description	Marks
Explanation includes:	
Carbon enters the atmosphere as carbon dioxide from respiration and/or combustion (burning)	1
Carbon dioxide is absorbed by producers (plants) for photosynthesis	1
Animals feed on the plants and the carbon compounds move along the food chain	1
The dead organisms (animals and plants) are broken down decomposers in the ground. The carbon in these is released as carbon dioxide to the atmosphere	1
<b>Total</b>	<b>4</b>
<p>Answer could include:</p> <p>Carbon enters the atmosphere as carbon dioxide from respiration from the polar bears and burning materials in the urban development</p> <p>Carbon dioxide is absorbed by plants to make carbohydrates in photosynthesis. Fish and other animals feed on the plants. Polar bears eat the fish. Thus passing the carbon compounds along the food chain</p> <p>The dead organisms (dead animals and plants) and polar bear waste are broken down by decomposers in the soil permafrost. The carbon in these is returned to the atmosphere as carbon dioxide.</p>	

(b) Explain why the carbon cycle is considered a biogeochemical cycle.

(3 marks)

Description	Marks
Explains what a biogeochemical cycle is	3
Outlines what biogeochemical cycle is	2
States a fact about biogeochemical cycling	1
<b>Total</b>	<b>3</b>
<p>Answer could include:</p> <ul style="list-style-type: none"> <li>a biogeochemical cycle or cycling of substances is a pathway by which a chemical substance moves through both biotic and abiotic components of the Earth. Carbon is an element that cycles in this manner</li> <li>a cycle is a series of change which comes back to the starting point and which can be repeated. Elements such as carbon, chemical compounds, and other forms of matter are passed from one organism to another and from one part of the biosphere to another through biogeochemical cycles</li> <li>the term 'biogeochemical' tells us that biological, geological and chemical factors are all involved. The circulation of chemical nutrients like carbon, oxygen, nitrogen, phosphorus, calcium, and water etc. through the biological and physical world are known as biogeochemical cycles.</li> </ul>	

**Question 2 (continued)**

- (c) What does a 'reservoir for carbon' mean and outline how this can be used to counteract climate change. (3 marks)

Description	Marks
States that the element carbon is accumulated or held for a long period of time in the plant materials	1
Outlines how carbon stored in plant materials can be used to counteract climate change.	2
States that carbon dioxide is taken out of the atmosphere	1
<b>Total</b>	<b>3</b>
<p>Answer could include:</p> <p>The element, carbon is stored in the form of plant material and hence the amount of carbon in the atmosphere in the form of carbon dioxide is reduced. This means that the chance of increase warming of the atmosphere due to carbon dioxide levels is diminished to some extent.</p>	

- (d) With climate change Arctic sea ice has declined (melting into the ocean) and carbon dioxide levels have increased. Explain how the changes to these two abiotic factors affect the survival of coldwater fish that live in the Arctic region. (4 marks)

Description	Marks
Explanation includes:	
Melting ice increases water temperature	1
Carbon dioxide level will change the pH on the water	1
Outlines that coldwater fish will react to this change (e.g. move location, die)	2
States some valid information that coldwater fish survival will be impacted on	1
<b>Total</b>	<b>4</b>
<p>Answer could include:</p> <p>Climate change has caused the sea ice to melt. This water will be at a higher temperature than the ocean, hence water temperature will increase. The carbon dioxide from the atmosphere will dissolve into the water and lower the pH of the water.</p> <p>These changes will impact on the coldwater fish as their environment will change. The fish may move their location. Warmwater fish may now come into their environment and compete for food source. Change in pH levels may affect their reproduction. Any of these will impact on their survival.</p> <p>Accept other relevant answers.</p>	

- (e) Give **two** examples of how humans can alter the water cycle and for each example explain the impact on the natural ecosystems. (6 marks)

Description	Marks
Three marks for each example. Maximum six marks.	
Gives a valid example of how humans can alter the water cycle	1
Explains the impact on the natural ecosystems	2
States an impact on the natural ecosystems	1
<b>Total</b>	<b>6</b>
<p>Answer could include:</p> <ul style="list-style-type: none"> <li>• agriculture/use of water in dry areas/removal of groundwater from wells will cause changes in the water table, that may cause trees/plants to die out</li> <li>• industry if used to cool materials in the production of goods the heated waste water may be put into waterways, changing the temperature, hence the environment</li> <li>• construction of dams or water abstraction from rivers stops water from flowing downstream, hence impacts on plants and animals in this environment</li> <li>• deforestation removal of trees will reduce the amount of water in the soil and this will affect the plants and animals living in the area as well as cause soil erosion</li> <li>• urbanisation removal of natural waterways, hence change in the natural environment/habitat for native plants and animals.</li> </ul> <p>Accept other relevant answers.</p>	

## ACKNOWLEDGEMENTS

- Question 2(a)** Adapted from: BBC. (n.d.). *GCSE Bitesize: The carbon and nitrogen cycles*. Retrieved 2016, from [www.bbc.co.uk/schools/gcsebitesize/science/add\\_gateway\\_pre\\_2011/greenworld/recyclingrev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway_pre_2011/greenworld/recyclingrev1.shtml)
- Question 2(b)** Adapted from: Biogeochemical cycle. (n.d.). In *Wikipedia*. Retrieved 2016, from [https://en.wikipedia.org/wiki/Biogeochemical\\_cycle](https://en.wikipedia.org/wiki/Biogeochemical_cycle) Used under the Creative Commons Attribution-ShareAlike 3.0 Unported licence.