Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Monday 10 June 2019

Morning (Time: 1 hour 30 minutes) | Paper Reference **WBI04/01**

Biology

Advanced

Unit 4: The Natural Environment and Species Survival

You must have:
Calculator, HB pencil, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 5 6 1 4 8 A 0 1 2 8

Pearson

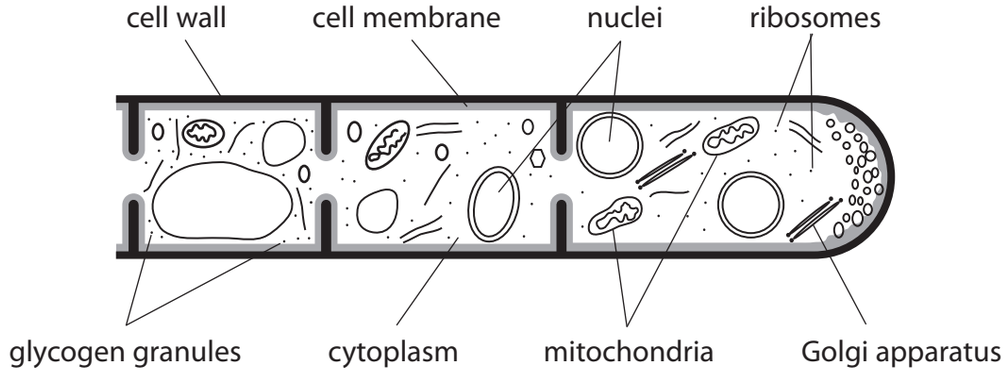
Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Bacteria and fungi are involved in the decomposition of organic matter and the recycling of carbon.

Fungi grow hyphae over the surface of organic matter.

The diagram below shows the structure of part of a hypha.



(a) Put a cross ☒ in the box next to the structure in the diagram that shows fungi belong to a different domain from bacteria.

(1)

☒ **A** cell membrane

☒ **B** cytoplasm

☒ **C** mitochondria

☒ **D** ribosomes

(b) Put a cross ☒ in the box next to the structure in the diagram that shows fungi are **not** plants.

(1)

☒ **A** cell membrane

☒ **B** cell wall

☒ **C** glycogen granules

☒ **D** Golgi apparatus

(c) Explain the role of the Golgi apparatus in the decomposition of organic matter.

(3)

(d) Explain the role of these mitochondria in the recycling of carbon.

(2)

(Total for Question 1 = 7 marks)

2 Sepsis is caused when bacteria get into the bloodstream.

As a result, an inflammatory response occurs that can destroy body organs and result in death.

(a) Explain how inflammation is a response of the body to infection.

(2)

(b) Sepsis is treated with antibiotics. However, scientists are developing alternative treatments.

(i) Explain the meaning of the term **antibiotic**.

(2)

(ii) Explain why scientists need to develop alternative treatments for bacterial infections.

(2)

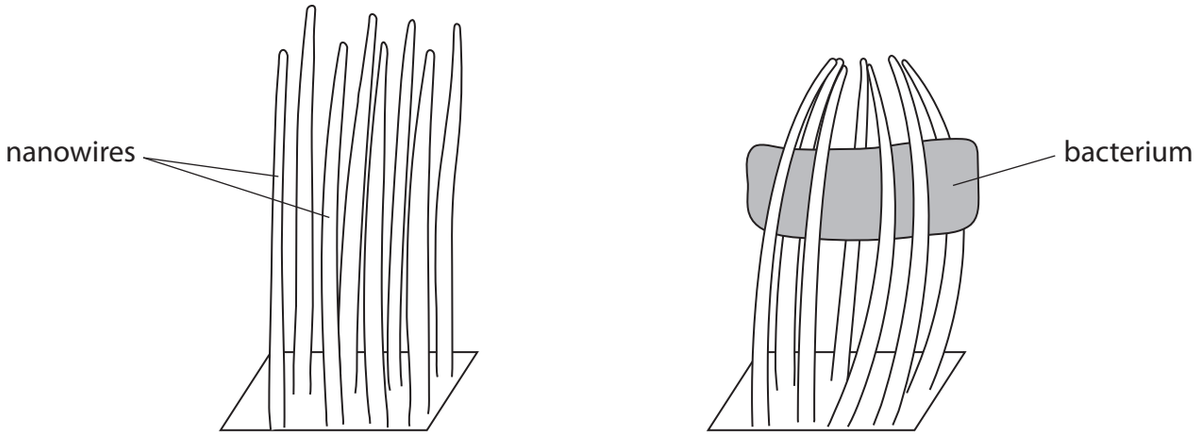
(c) One alternative treatment that is being developed uses nanowires.

Nanowires are small lengths of wire with a very narrow diameter.

Blood is passed through a filter of nanowires.

Nanowires bend around the bacteria as they pass through the filter, trapping the bacteria.

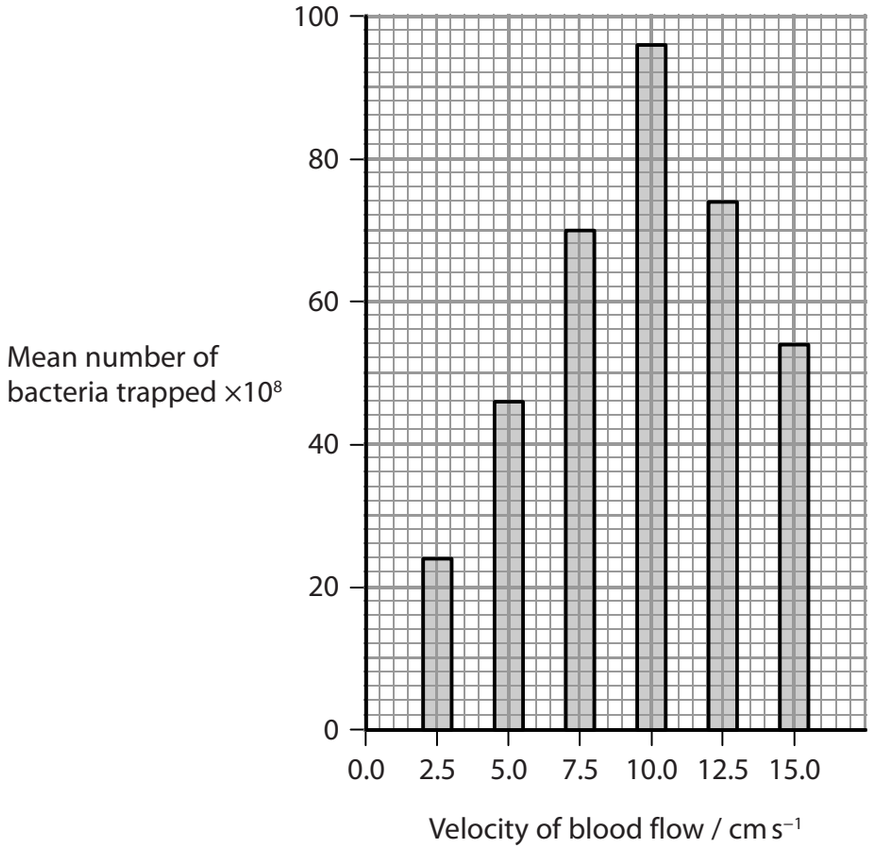
The diagram below shows part of a filter of nanowires and a bacterium trapped by the nanowires.



part of a filter of nanowires

bacterium trapped by the nanowires

The graph below shows the mean number of bacteria trapped as blood is passed through the filter of nanowires, at different velocities.



(i) Describe the relationship shown in the graph.

(2)

(ii) Suggest why the velocity of blood flow through the filter affects the mean number of bacteria trapped.

(2)

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(Total for Question 2 = 10 marks)

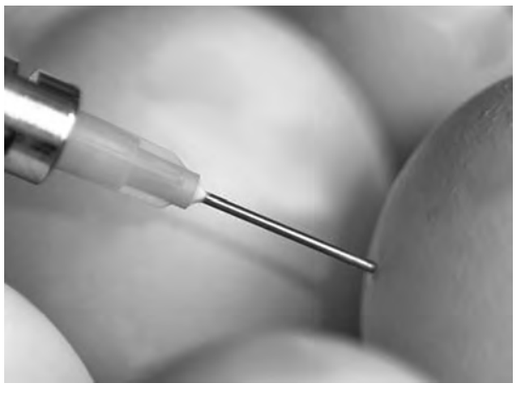
3 Cultures of bacteria and viruses can both be grown in a laboratory.

(a) Describe **one** way in which bacteria can be grown in a laboratory.

(3)

(b) One way to culture viruses in a laboratory is to inject them into chicken embryos in eggs.

The photograph below shows an egg being injected with viruses.



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Magnification ×2

(i) Name **two** structures found in all viruses.

(2)

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(ii) Explain why viruses have to be cultured in living cells.

(2)

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(iii) Put a cross ☒ in the box that names the host cell of Human Immunodeficiency Virus (HIV).

(1)

☒ **A** B memory cell

☒ **B** plasma cell

☒ **C** T helper cell

☒ **D** T killer cell

(iv) Suggest why different types of virus have to be injected into different parts of the chicken embryo.

(2)

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(Total for Question 3 = 10 marks)

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4 The photograph below shows a whale shark.

Magnification ×0.01

Whale sharks are an endangered species.

The number of individuals of this species and their distribution are not known.

(a) Give **two** reasons why this species is difficult to study.

(2)

(b) Environmental DNA (eDNA) is present in seawater at very low concentrations. This DNA is used to study whale sharks.

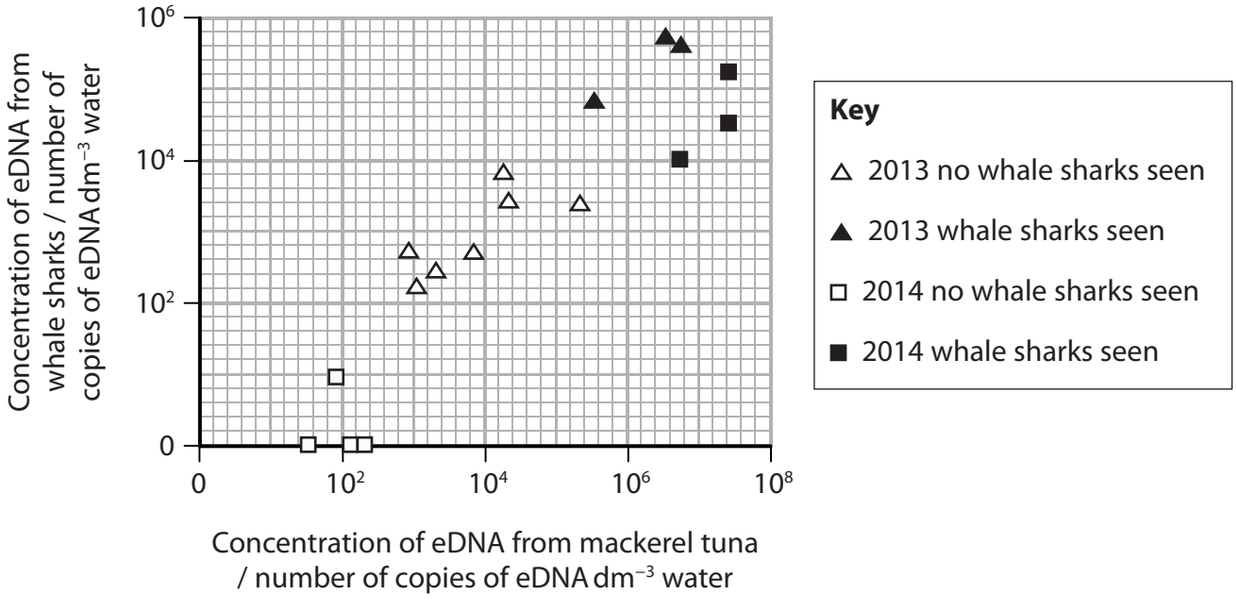
In one study in 2013, scientists determined the concentration of eDNA from whale sharks in the Arabian Gulf.

They also determined the concentration of eDNA from mackerel tuna, a species of fish, in the same area.

The scientists also recorded when they saw the whale shark.

The scientists repeated this study in 2014.

The graph below shows the results of both studies.



(i) Suggest **one** source of eDNA from whale sharks in the water.

(1)

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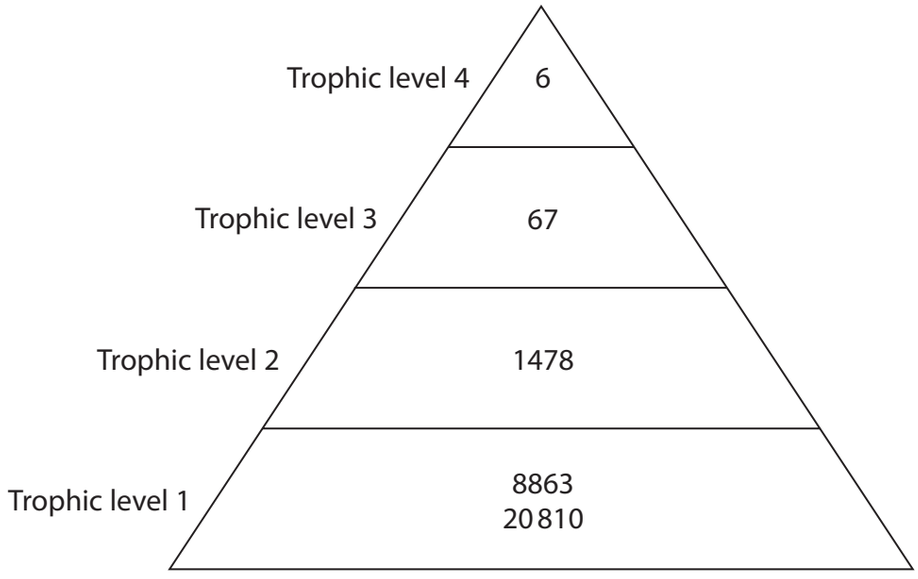
(ii) Using the information in the graph, describe conclusions that can be drawn from this study.
(3)

*(iii) Describe how the data shown in the graph could have been collected and analysed.
(6)

(Total for Question 4 = 12 marks)

5 (a) The diagram below shows the energy in four trophic levels in a food chain.



(i) Put a cross ☒ in the box next to the row in the table that shows the GPP, NPP and R of trophic level 1.

(1)

		GPP	NPP	R
☒	**A**	8863	11947	20810
☒	**B**	8863	20810	11947
☒	**C**	20810	8863	11947
☒	**D**	20810	11947	8863

(ii) Put a cross ☒ in the box next to the units for GPP.

(1)

☒ **A** $kJ\,m^{-1}\,yr^{-1}$

☒ **B** $kJ\,m^{-1}\,yr^{-2}$

☒ **C** $kJ\,m^{-2}\,yr^{-1}$

☒ **D** $kJ\,m^{-2}\,yr^{-2}$

(iii) Put a cross ☒ in the box next to the percentage efficiency of energy transfer between trophic levels 3 and 4.

(1)

☒ **A** 4.02

☒ **B** 8.95

☒ **C** 8.96

☒ **D** 11.17

(iv) Put a cross ☒ in the box to complete the following statement.

(1)

The energy content decreases from one trophic level to the next because

☒ **A** energy is made by respiration

☒ **B** energy is lost to the environment

☒ **C** the organisms are larger at each trophic level

☒ **D** there are fewer organisms in each trophic level

(v) Suggest why there are only four trophic levels in this food chain.

(2)

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(b) Plants use energy for the synthesis of starch and cellulose.

(i) Give **two** similarities and **two** differences between the structure of starch and the structure of a cellulose molecule.

(4)

(ii) Explain why seeds contain starch and cell walls contain cellulose.

(3)

(Total for Question 5 = 13 marks)

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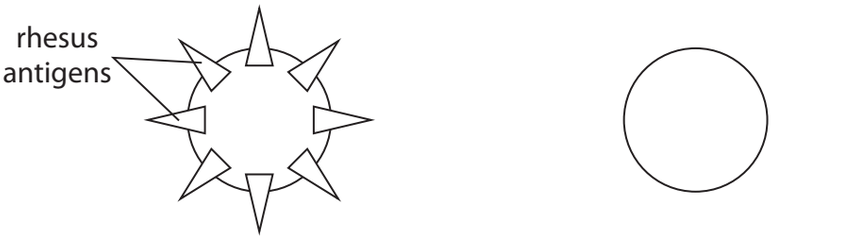
6 The membranes of red blood cells contain a number of different antigens. One of these antigens is the rhesus antigen.

People whose red blood cells have the rhesus antigen are rhesus positive (Rh positive).
People whose red blood cells do not have the rhesus antigen are rhesus negative (Rh negative).

The diagram below shows a red blood cell from a Rh positive person and one from a Rh negative person.

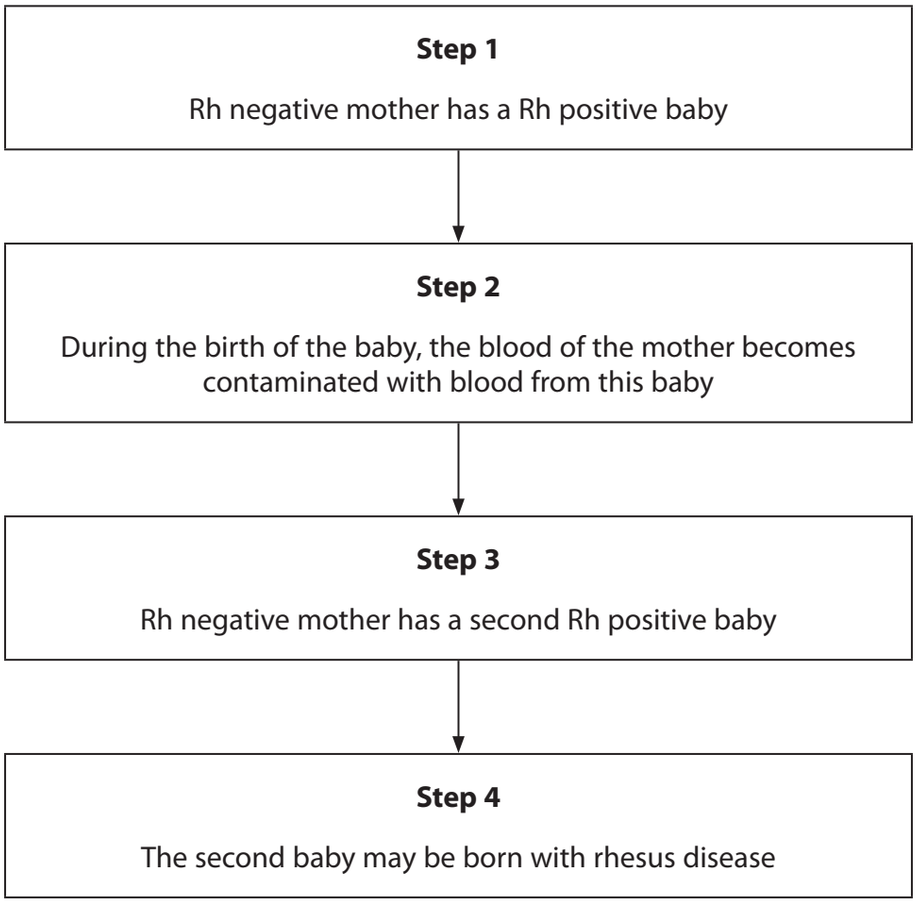


red blood cell from a Rh positive person

red blood cell from a Rh negative person

Rhesus disease is a condition where antibodies in the blood of a pregnant woman destroy the red blood cells of her developing baby.

The diagram below shows the sequence of events that lead to rhesus disease.



(a) The rhesus antigen is coded for by the dominant allele of the RHD gene.

(i) Explain how a Rh negative mother can have a Rh positive baby, in **Step 1**.

(2)

(ii) Explain the probabilities of this mother having another Rh positive baby.

(2)

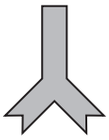
(b) (i) Put a cross ☒ in the box next to the diagram of an antibody for the rhesus antigen.

(1)

☒ **A**

☒ **B**

☒ **C**



☒ **D**

*(ii) Explain why the mother will produce antibodies to the rhesus antigen, in **Step 2**.

(6)

(c) Suggest why a baby born with rhesus disease can be treated by replacing all their blood with blood from a healthy person.

(2)

(Total for Question 6 = 13 marks)

7 Photosynthesis consists of the light-dependent and light-independent reactions. Photosynthesis produces GALP. A molecule of GALP contains hydrogen.

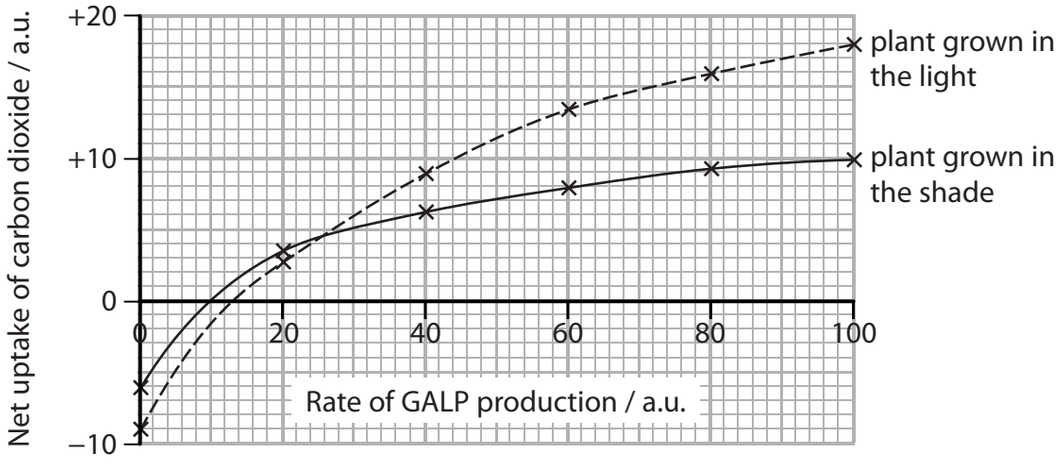
(a) Explain how the light-dependent reactions enable hydrogen to be incorporated into GALP.

(4)

(b) Explain why an increase in temperature increases the rate of production of GALP.

(3)

(c) The graph below shows how the rate of GALP production affects the net uptake of carbon dioxide by two plants, one grown in the light and one grown in the shade.



(i) Explain why the plant grown in the light had a greater net uptake of carbon dioxide than the plant grown in the shade, when the rate of GALP production was above 26 a.u.

(3)

(ii) Suggest why the net uptake of carbon dioxide was negative when the rate of GALP production was very low.

(2)

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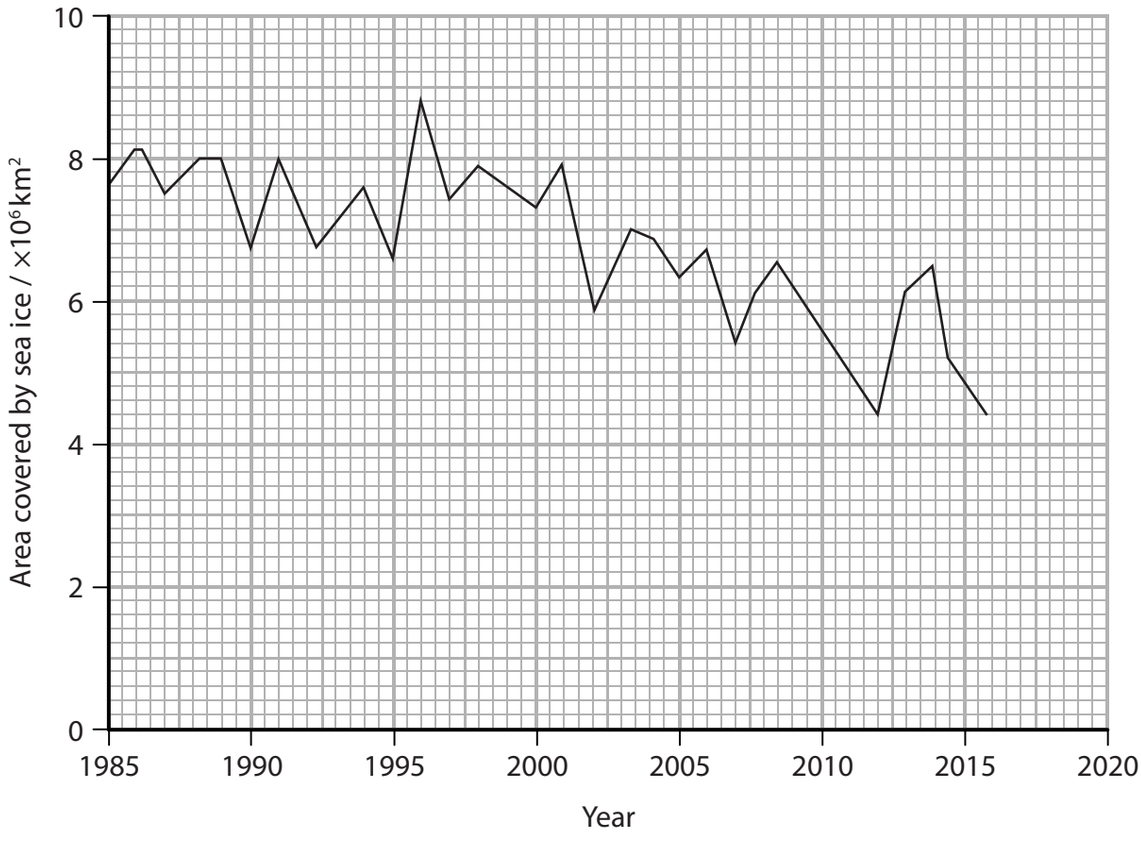
(Total for Question 7 = 12 marks)

8 Global warming is thought to be responsible for the decrease in area covered by sea ice.

(a) The graph below shows the changes in the area covered by sea ice in the Arctic between 1985 and 2016.



(i) Explain why global warming is thought to be responsible for this decrease.

(3)

(ii) Describe how this graph could be used to estimate the area covered by sea ice in 2020.

(2)

(iii) Explain why a prediction of the area covered by sea ice in 2020, using the data in this graph, could be wrong.

(3)

(b) The reduction in area covered by sea ice is affecting the behaviour of polar bears.

Some polar bears are staying on the ice-free areas, feeding on goose eggs, berries and, occasionally, caribou. Previously, these polar bears fed on seal blubber.

The table below gives some information about these food sources.

Food source	Mean mass / kg	Fat content / g kg^{-1}	Energy content / J kg^{-1}
one seal	160.000	862	32 424
one goose egg	0.144	139	5397
one berry	0.003	3	1344
one caribou	140.000	34	5334

(i) Calculate how many berries have the same mass as one seal.

(1)

Answer .....

(ii) Using the information in the table, explain why scientists are concerned that this change in behaviour could result in a decrease in the number of polar bears.

(4)

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(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 90 MARKS