Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 2H

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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0 1 This question is about the cycling of water and carbon in ecosystems.

0 1 . 1 Which reaction produces water?

[1 mark]

Tick (✓) **one** box.

Aerobic respiration ☑

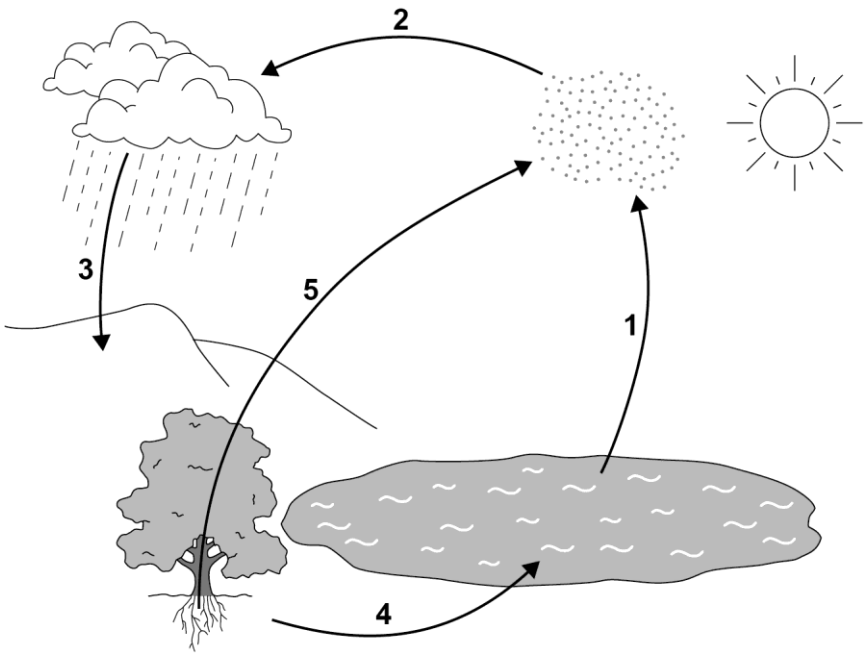
Anaerobic respiration ☐

Photosynthesis ☐

The water cycle provides water for plants and animals on land before the water goes into lakes and seas.

Figure 1 represents the water cycle.

Figure 1



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0 1 . 2 Name the processes **1** to **5** shown on **Figure 1**.

[5 marks]

1 Evaporation

2 condensation

3 Precipitation

4 draining

5 Transpiration

0 1 . 3 In 2007 the population of the world was 6 000 000 000

A study found that 4.5% of the population had severe water shortage.

Calculate how many people had severe water shortage.

Give your answer in standard form.

[3 marks]

$= 6000000000 \times \frac{4.5}{100}$

$= 270000000$

Number of people (in standard form) = 2.7×10^8

Question 1 continues on the next page

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0 1 . 4 Why do more people have severe water shortage now than in 2007?

[2 marks]

Tick (✓) **two** boxes.

Climate change has increased the area of deserts. ☑

Each person drinks less water. ☐

More water is used to grow crops. ☑

Sea levels have risen because the ice caps are melting. ☐

Some countries have built de-salting factories for seawater. ☐

Leaves on a tree contain carbon compounds.

In autumn the leaves fall to the ground.

0 1 . 5 Microorganisms in the soil recycle carbon from the leaves so that the carbon is used for new plant growth.

Explain how.

[4 marks]

decay / decomposition of leaves
respiration (by microorganisms / decomposers)
respiration releases carbon dioxide
or
microorganisms release carbon dioxide
carbon dioxide is used in photosynthesis (for new plant growth)

Do not write outside the box

0 1 . 6 What is **one** benefit of fallen leaves for living plants?

[1 mark]

Tick (✓) **one** box.

Energy is released for living plants. ☐

Insect pests in the soil are killed. ☐

Nitrates are released into the soil. ☑

Oxygen is supplied to root cells. ☐

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Turn over for the next question

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0 2 Water pollution is a problem for humans and wildlife.

Explain how human activities are polluting rivers, lakes and seas.

[6 marks]

Increase in world population
• sewage (released into rivers / lakes / seas)
o causes algae to grow
o algae block light
o causing plants to die and decompose
o leading to lack of oxygen in the water
o (sewage) could contain pathogens
Need to produce more food for world's population
• fertilisers (used on farms to increase crop yield, leach into rivers / lakes / seas)
o causes algae to grow
o leading to lack of oxygen in the water
• herbicides / pesticides (used on farms to increase crop yield, run into rivers / lakes / seas)
o build-up in food chains
Increasing demand for products / energy
• toxic chemicals or named toxic chemicals (run into rivers / lakes / seas)
o from factories / industry or power stations
o build-up in food chains
o chemicals may cause mutations or chemicals may act as hormones
o radiation leaks from nuclear (power stations)
o (oil) spills from extraction / rigs / tankers in oceans
o acid rain formation
o acidification of lakes
o increased carbon dioxide emissions causes acidification of oceans
Buildup of waste products
• litter / plastics (thrown in rivers / lakes / seas)
o example of effect on living organisms, such as plastics consumed or plastics build up in stomach or plastics get stuck around beaks
o (most) plastics are not biodegradable
o build-up of microplastics in water animals
Consequence of the above is that organisms living in rivers / lakes / seas are harmed / die

6

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0 3 On a school field:

- one area of the soil was usually wet
- another area of the soil was usually dry.

Students investigated the effect of water in the soil on the number of buttercup plants growing in each area.

0 3 . 1 Water is an abiotic factor.

Name **one biotic** factor which may affect the number of buttercups growing on the field.

[1 mark]

pathogens

0 3 . 2 Describe a method to investigate if the amount of water in the soil affects the number of buttercups in the field.

[6 marks]

- transect between wet area and dry area
- place quadrat(s) regularly along transect
- count / record number of buttercups (in the quadrat)
- use at least 5 quadrats along transect
- take soil moisture readings
- use suitable equipment for readings, eg soil moisture meter

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ANSWER IN THE SPACES PROVIDED

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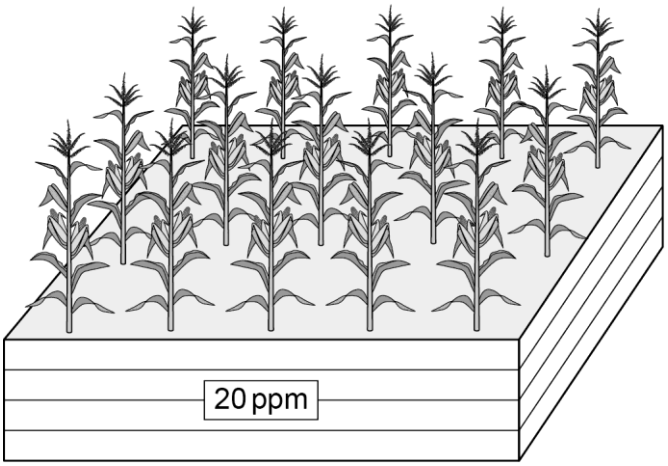
0 4 Scientists investigated the effect of soil nitrate ion concentration on the yield of corn.

This is the method used.

1. Corn plants were grown in a large box of soil.
2. The soil nitrate ion concentration in the box was kept at 0 parts per million (ppm).
3. All the corn from each plant in the box was removed and weighed.
4. The mean mass of corn per plant was calculated.
5. Steps 1 to 4 were repeated for boxes containing soil with different concentrations of nitrate ions.

Figure 2 shows the corn plants in the box with a 20 ppm soil nitrate ion concentration.

Figure 2



0 4 . 1 Give **two** variables the scientists should have controlled in this investigation.

[2 marks]

1 Water

2 Temperature

The scientists carried out a valid investigation.

Table 1 shows the scientists' results.

Table 1

Soil nitrate ion concentration in ppm	Mean mass of corn per plant in grams
0	122
10	190
20	256
30	268
40	240
50	184

Do not write outside the box

0 4 . 2 Complete **Figure 3**.

You should:

- label the *y*-axis
- use a suitable scale for the *y*-axis
- plot the data from **Table 1**
- draw a line of best fit.

[4 marks]

Figure 3

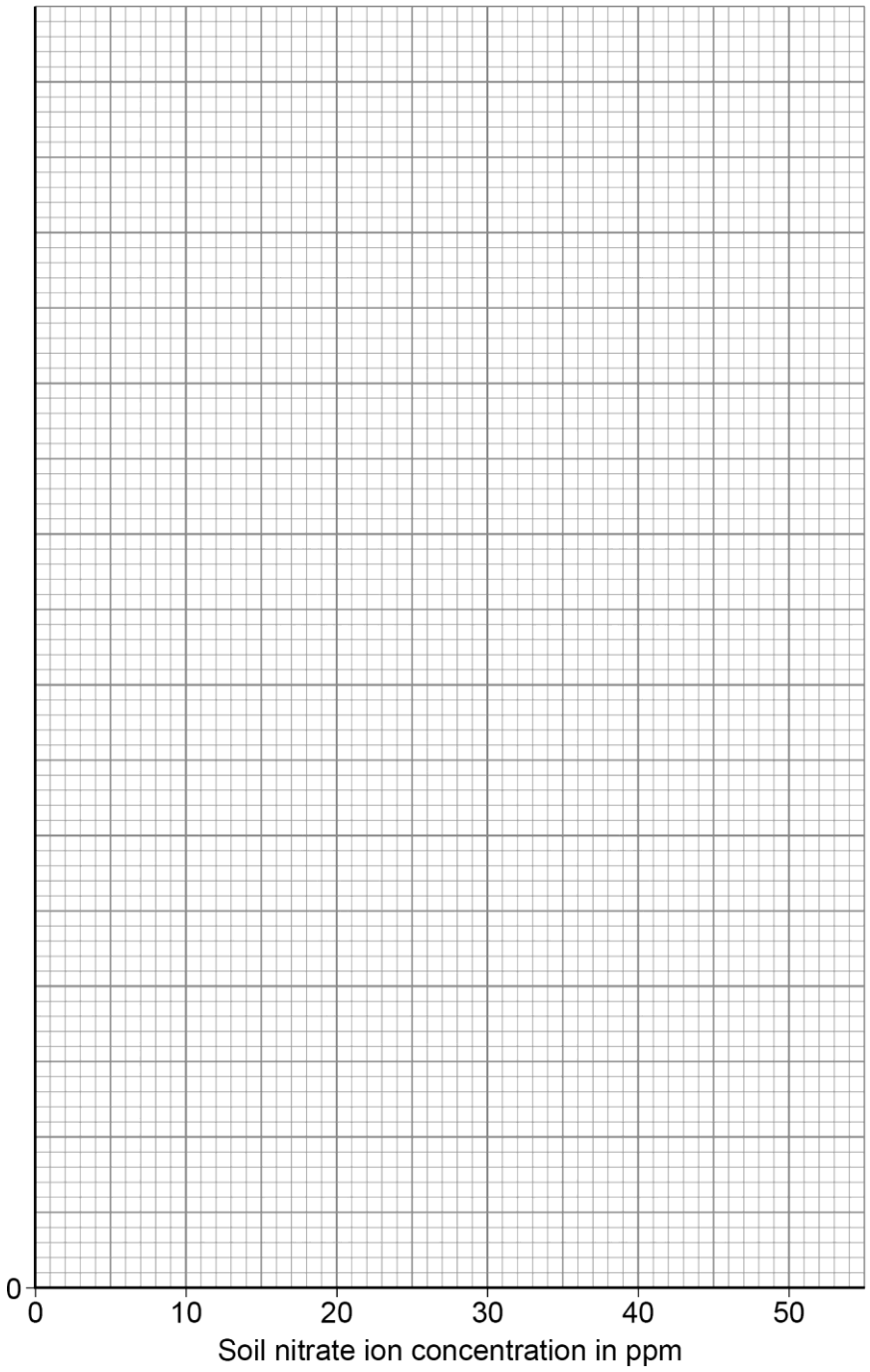


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Table 1 is repeated below.

Table 1

Soil nitrate ion concentration in ppm	Mean mass of corn per plant in grams
0	122
10	190
20	256
30	268
40	240
50	184

0 4 . 3 Describe the relationship between soil nitrate ion concentration and the mean mass of corn per plant.

Use data from **Table 1** in your answer.

[2 marks]

as (soil) nitrate / concentration increases, (mean) mass (of corn) increases and then decreases
with a maximum (mean mass of corn) at 30 (ppm)

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0 4 . 4 Farmers add nitrate fertiliser to fields where they grow corn.

Nitrate fertilisers are expensive.

Evaluate the economic and environmental implications of adding fertiliser to soil in nitrate ion concentrations ranging from 0 to 50 ppm

[4 marks]

- increasing nitrate / ion (concentration) up to 30 ppm will give high(er) yield / income / sales
- greater than 30 ppm will decrease yield / mass / income / sales and therefore waste money / fertiliser
- any increase in yield / mass / income / sales must be balanced with cost (of fertiliser)
- quantity to add will depend on original nitrate (ion concentration) of soil

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Turn over for the next question

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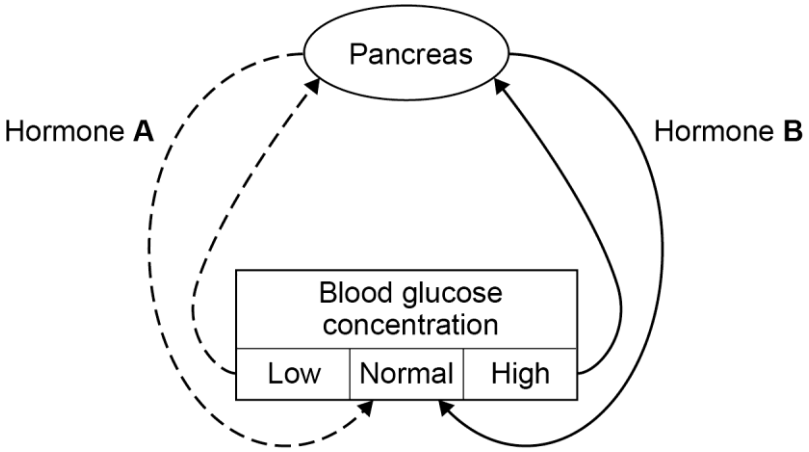
0 5 Blood glucose concentration in the human body needs to be kept within the normal range.

Figure 4 shows that two hormones control blood glucose concentration.

Figure 4



0 5 . 1 Name the type of hormonal control shown in **Figure 4**.

[1 mark]

Negative feedback (control)

0 5 . 2 Name hormones **A** and **B** in **Figure 4**.

[1 mark]

A glucagon

B insulin

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0 5 . 3 Explain how the two hormones in **Figure 4** keep the blood glucose concentration within the normal range for 3 hours after a meal.

[6 marks]

when blood glucose concentration is high after a meal) insulin / B is secreted (by the pancreas) causing glucose to enter cells
(glucose is) converted to glycogen in the liver / muscle (cells for storage)
(this causes) blood glucose concentration to return to normal so insulin / B secretion slows / stops / decreases
when blood glucose concentration is low glucagon / A is secreted (by the pancreas)
(which causes) breakdown of glycogen in the liver (into glucose)
(this causes) blood glucose concentration to return to normal so glucagon / A secretion slows / stops / decreases

Question 5 continues on the next page

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Female reproductive hormones are used to treat infertility in women.

0 5 . 4 Follicle Stimulating Hormone (FSH) and then Luteinising Hormone (LH) can be injected into a woman to help her become pregnant by sexual intercourse.

Explain how injecting FSH and then LH will help a woman to become pregnant.

[3 marks]

FSH causes (several) ova / eggs to mature (in the ovary)
(then) LH causes ovulation
or
LH causes release of the ova / eggs
so more eggs / ova present
therefore higher probability / chance of fertilisation
or
so more eggs / ova present
therefore higher probability / chance of sperm fusing with an egg

0 5 . 5 In some women the injections of FSH and LH are the first steps for In Vitro Fertilisation (IVF).

Describe the remaining steps in IVF.

[4 marks]

collection of (mature) egg(s) from the ovary
(which are) fertilised (in the laboratory)
develop into embryo(s) (in the laboratory)
embryo(s) inserted into uterus / womb

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0 5 . 6 There are two different processes of cell division in humans.

Describe **three** differences between cell division to form sperm cells compared with cell division to form liver cells.

[3 marks]

1 meiosis forms sperm and mitosis forms liver (cells)

2 two cell divisions to form sperm and one cell division to form liver (cells)

3 four genetically different sperm cells and two genetically identical liver cells

18

Turn over for the next question

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0 6 The polar bear is a mammal that lives in arctic habitats.

0 6 . 1 Complete **Table 2** for the classification of the polar bear, *Ursus maritimus*.

[2 marks]

Table 2

Classification group	**Name**
Domain	Eukaryota
Kingdom	Animilia
Phylum	chordata
Class	mammalia
Order	carnivora
Family	ursidae
Genus	Ursus
Species	maritimus

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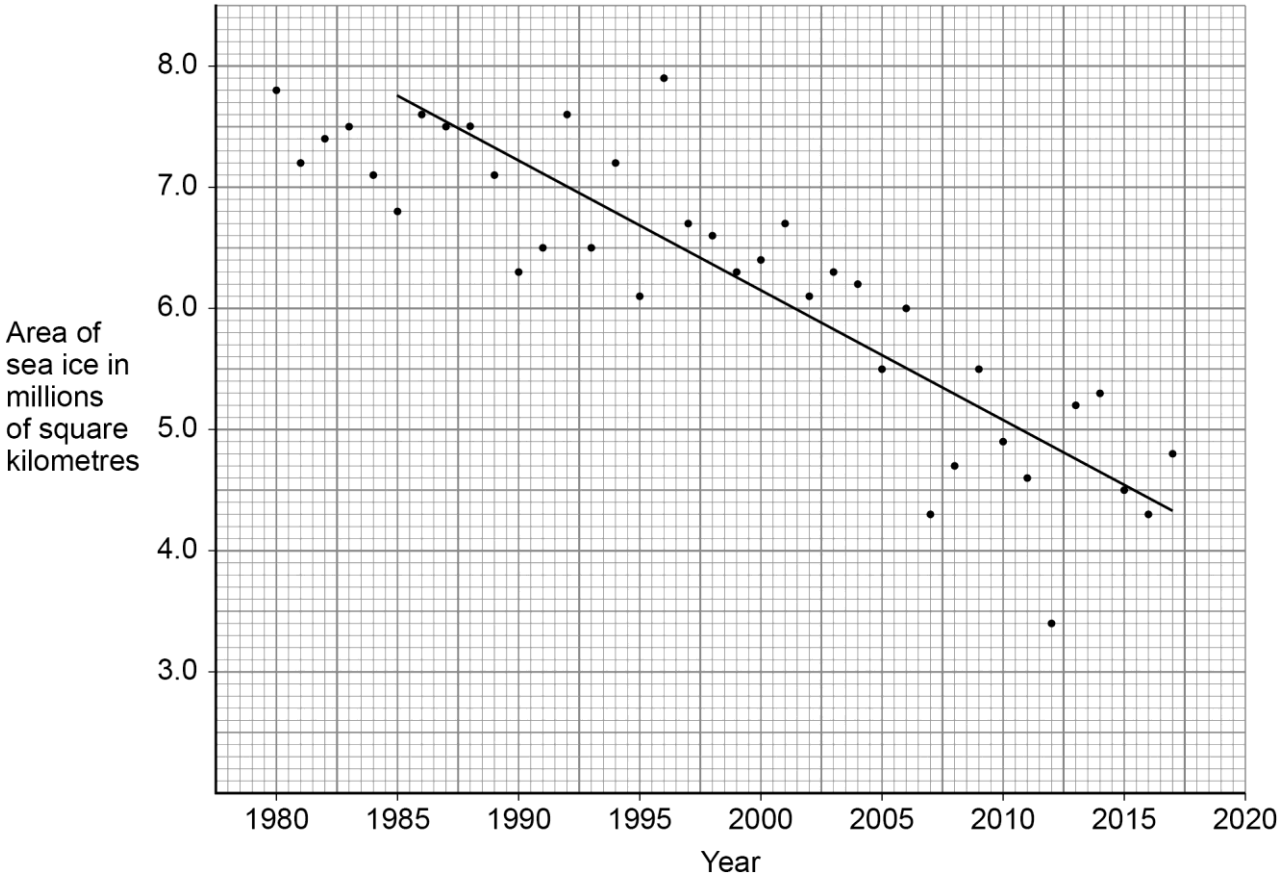
Scientists have been measuring the area of sea ice in the Arctic since 1980.

Figure 5 shows the area covered by sea ice every September.

Figure 5



0 6 . 2 Determine the annual rate of loss of sea ice between 1985 and 2017.

A trend line has been drawn on **Figure 5** to help you.

[3 marks]

= 3.43

32

Rate of loss = 0.1 million square kilometres per year

Question 6 continues on the next page

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The total number of polar bears living on the arctic ice is not known.

The hunting of polar bears has been banned or reduced in some areas.

In some populations the average mass and height of polar bears has decreased.

Polar bears eat seals. Seals live on the sea ice in winter and raise their pups there in early spring. In the summer seals live mainly in the sea catching fish to eat.

Polar bears spend much of the year hunting seals on the sea ice and in the sea nearby. The sea ice area is at its lowest each year in September at the end of summer. The polar bears feed mainly in early spring, and again in autumn to build fat stores to survive the next winter.

During the winter of 2017 scientists measured the metabolic rates of nine female polar bears and found them to be much higher than expected. Cameras attached to the female polar bears showed they had to swim long distances to find seals to eat.

0 6 . 3 Suggest why polar bears find it harder to catch seals in autumn than in spring.

[2 marks]

- More competetion between polar bears
- No seals left on ice

0 6 . 4 Evaluate what might happen to the population of polar bears in the Arctic in the future.

[4 marks]

may decrease because:
- global warming is melting sea ice
- less sea ice each year so less habitat / hunting area
- as ice / habitat disappears seals will decrease in number
- having to swim longer distances to find seals, wastes energy
- increased metabolic rate means more food is required
- not building up fat stores in the autumn means fewer will survive each winter
- decrease in mass / height may reduce hunting ability / strength
- hunting in some / most areas continues
- less likely to find mates
- eventually the species may become extinct

may increase / maintain numbers if:
- more laws put in place to stop hunting or laws to stop hunting will allow bears to reproduce
- quotas introduced to reduce hunting
- nations / people work to reduce carbon dioxide emissions to halt global warming
- (feeding / hunting) behaviour of polar bears changes

11

END OF QUESTIONS

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