



Please write clearly in block capitals.

Centre number

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Candidate number

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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.

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.

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

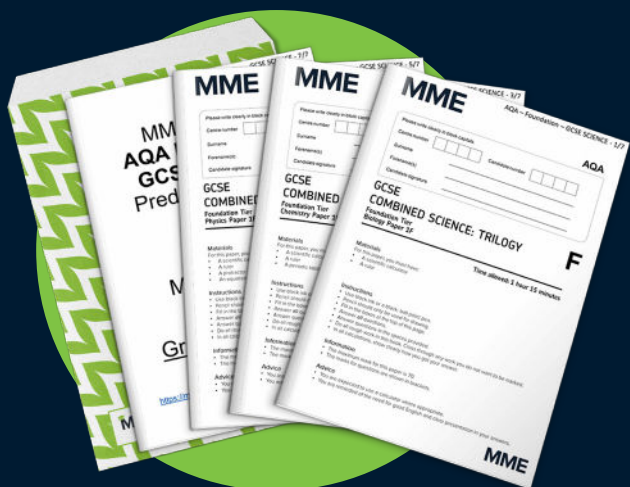


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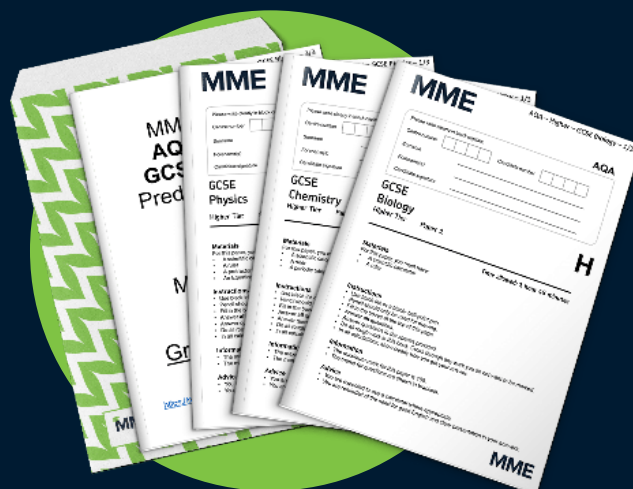
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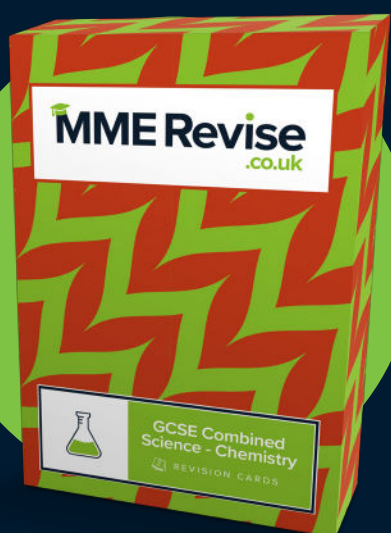
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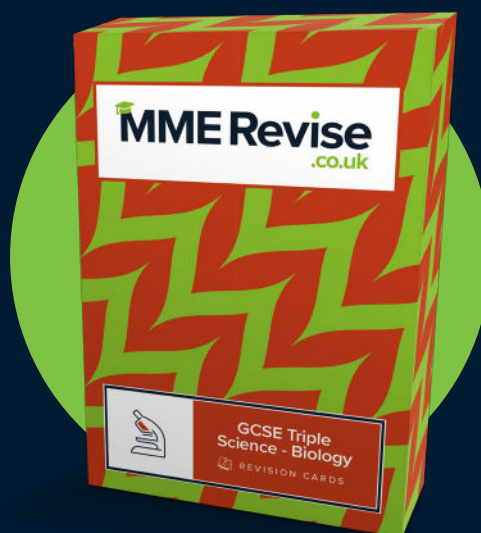
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0 1

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

0 1 . 1

Which reaction produces water?

[1 mark]

Tick (✓) **one** box.

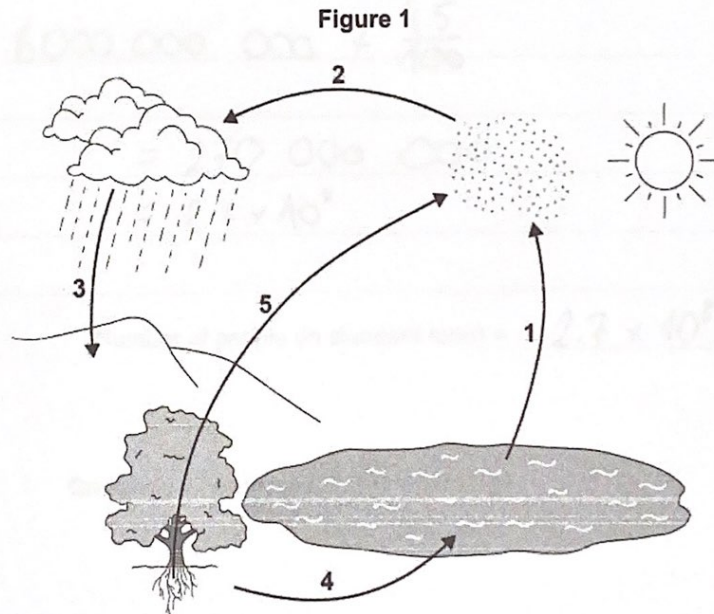
Aerobic respiration

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.



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

[5 marks]

1 Evaporation

2 Condensation

3 Precipitation

4 Drainage

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]

$$6000\ 000\ 000 \times \frac{4.5}{100}$$

$$= 270\ 000\ 000$$

$$= 2.7 \times 10^8$$

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

Question 1 continues on the next page

Turn over ►



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]

Microorganisms decompose dead leaves. They use them as a food source and respire this. This respiration releases carbon dioxide, hence releasing the carbon in the leaves back into the atmosphere with the help of microorganisms. This carbon dioxide in the atmosphere hence becomes available for photosynthesising plants to fix again through photosynthesis.



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. **16**

Turn over for the next question

Turn over ►



0 2

Water pollution is a problem for humans and wildlife.

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

[6 marks]

A growing human population uses more and more fertilisers and pesticides, as well as produces more waste. These interfere with water ways and natural habitats. The entering of nutrients from fertilisers and sewage can lead to eutrophication. Through this process algae rapidly grow, blocking out light for other plants. This leads to other plants dying and decomposers breaking them down. This creates an oxygen low water wasteland, nearly ecologically destroying everything.

On the other hand pesticides and other chemicals, such as microplastics can build up in organisms along the food chain. We call this bioaccumulation. This can lead to suffering and eventual death of these organisms. Same results could be achieved with continuous release and dumping of industrial waste chemicals into waterways. These can be carcinogenic, radiating and toxic to local fauna and flora.

6



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]

trampling

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]

Mark out two equal size grids (say $10\text{m} \times 10\text{m}$), one in the part of the field that is usually wet and the other on the dry part. Split each up into a grid with coordinates. Use a random number generator to generate coordinates and place the quadrat at these coordinates on the grid. Count the number of buttercups in each quadrat and record it in a table. Repeat this process several times (5-10) on both grids. At each quadrat also record the soil moisture with a soil moisture meter. For each grid calculate the mean number of buttercups per quadrat. Use the mean for each grid and the area of the total grid (100m^2) to estimate the total number of buttercups in each grid.

7

Turn over ►



0 7

0 4

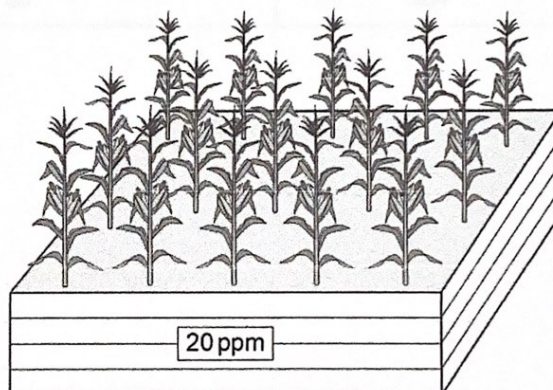
Scientists investigated the effect of soil nitrate ion concentration on the yield of corn.

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 light intensity

2 amount of water

Turn over ►



The scientists carried out a valid investigation.

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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



1 0

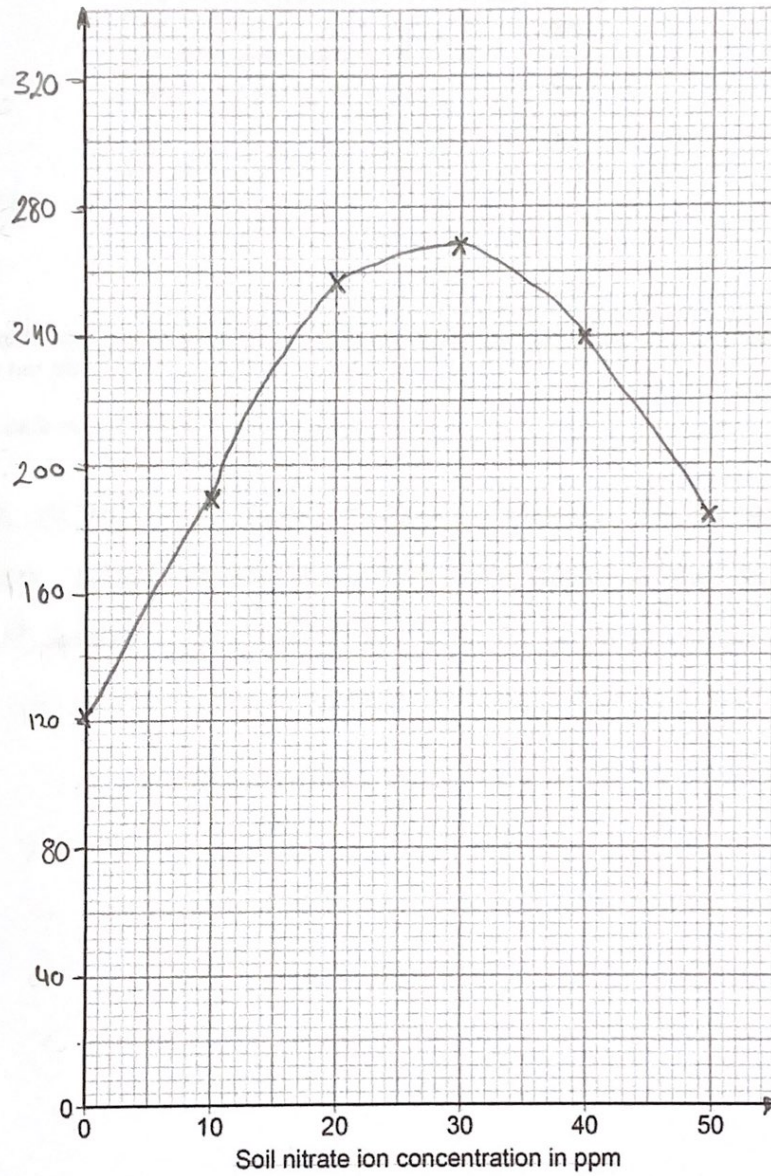
0 4 . 2 Complete Figure 3.

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



Turn over ►



Table 1 is repeated below.

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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 nitrate ion concentration increases the mass of corn also increases up till 30 ppm after which it starts to decrease.



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 the nitrate concentration up till 30 ppm would result in a greater yield, hence profit. However, increasing the nitrate concentration beyond 30 ppm would decrease yield, so would be a waste of money.

There may already be nitrates in the soil, so it's important to measure the amount of nitrate present and supplement it to make it up to 30 ppm, but not to add too much.

We must also consider that some of the nitrates added will wash out of fields when it rains into rivers and lakes, causing pollution.

12

Turn over for the next question

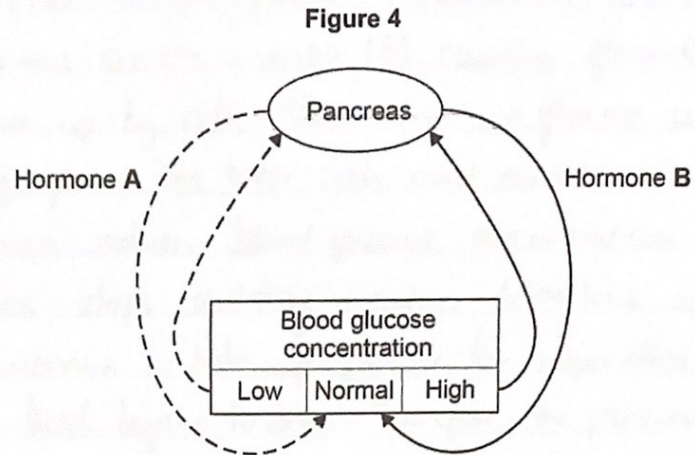
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0 5

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.



0 5 . 1

Name the type of hormonal control shown in Figure 4.

[1 mark]

negative feedback

0 5 . 2

Name hormones A and B in Figure 4.

[1 mark]

A glucagon

B insulin



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]

After a meal the blood glucose concentration increases. So, the pancreas secretes insulin (B) causing glucose to be taken up by cells. This taken up glucose is converted into glycogen in the liver cells and muscle cells. As this process reduces blood glucose concentration, the pancreas stops secreting insulin. Over time as other cells continue to take up glucose for respiration, blood glucose level begins to drop. Therefore, the pancreas starts to secrete glucagon (A). This stimulates the breakdown of glycogen in liver cells back into glucose. This glucose gets released back into the bloodstream increasing blood glucose concentration back to normal. The combination of these two enable relatively stable blood glucose levels. As at ^{high} ~~low~~ blood glucose levels no more glucagon is released.

Question 5 continues on the next page

Turn over ►



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 stimulates egg cells in the ovaries to mature, while LH causes this matured egg to be released from the ovaries at ovulation. The two hormones together will cause several eggs to mature and be released. As there are more eggs there is a higher probability of sperm fusing with one leading to fertilisation.

- 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]

The eggs that have matured and been released are collected from the ovary. These then get fertilised in a lab. These fertilised eggs get supplied with nutrients, so that they develop into embryos. These developed embryos are then inserted into the womb of the mother where they can embed into the lining of the uterus and develop.



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 To form liver cell the cells only go through one division, while for a sperm cell they go through two sets of divisions.
- 2 The two liver cells would be genetically identical to each other, while the four sperm cells would be genetically unique.
- 3 Sperm cells are haploid, so have 23 ~~pairs~~ chromosomes, while liver cells would have 23 pairs, so 46 chromosomes.

18

Turn over for the next question

Turn over ►



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	eukaryote
Kingdom	animalia
phylum	chordata
Class	mammalia
Order	carnivora
Family	ursidae
Genus	Ursus
Species	maritimus

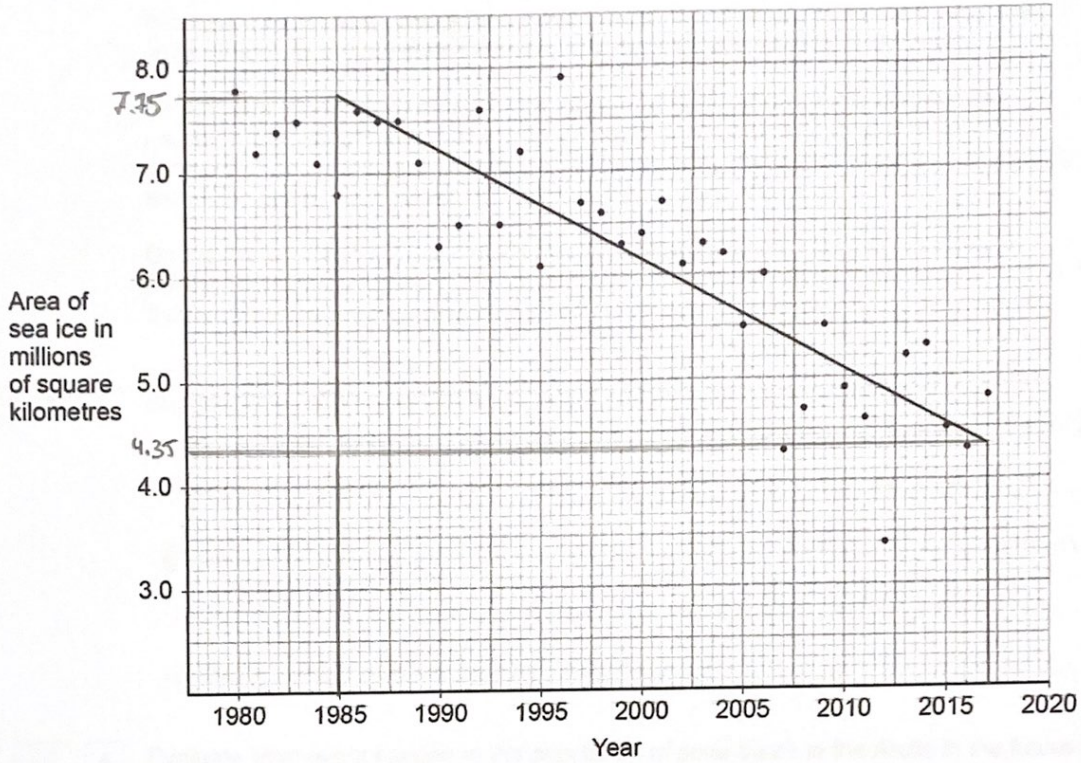


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Scientists have been measuring the area of sea ice in the Arctic since 1980.

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]

$$\begin{array}{l}
 1985 = 7.75 \\
 2017 = 4.35 \\
 2017 - 1985 = 32 \text{ years} \\
 7.75 - 4.35 = 3.4
 \end{array}
 \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} \text{rate} = \frac{3.4}{32} = 0.10625$$

$$= \underline{\underline{0.1}}$$

Rate of loss = 0.1 million square kilometres per year

Question 6 continues on the next page

Turn over ►



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]

There is fewer seals left on the ice accessible for polar bears to catch. Also young seals have grown up so can avoid, escape a polar bear more easily by swimming away.

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

Populations may increase as more laws are put in place to protect their habitat, food source and themselves from hunting. We might be able to halt CO₂ emissions and hence global warming restoring their habitat. However, their population can also decrease if global warming continues and melts more and more sea ice. This gives them less hunting ground and requires more energy to hunt making fewer individual survive. This also makes it harder for them to find mates and reproduce.

11

END OF QUESTIONS

