



Please write clearly in block capitals.

Centre number

Candidate number

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE BIOLOGY

H

Higher Tier Paper 2H

Monday 1 June 2020

Afternoon

Time allowed: 1 hour 45 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 100.
- 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	
7	
8	
TOTAL	



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IB/M/Jun20/E20

8461/2H

Answer all questions in the spaces provided.

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0 1

This question is about the decay of milk.

0 1 . 1

Name **two** types of microorganism that cause decay.

[2 marks]

1 bacteria

2 fungi

0 1 . 2

Cows' milk is pH 6.6.

As milk decays, lipids in the milk are broken down.

One of the products of the breakdown of lipids causes the pH of milk to decrease.

Name the product that causes the pH to decrease.

[1 mark]

fatty acids



A student investigated the effect of temperature on the time taken for different types of milk to decay.

This is the method used.

1. Put cows' milk in six test tubes.
2. Keep each test tube at a different temperature.
3. Measure the pH of the milk in each tube every day for 12 days.
4. Record the number of days taken to reach pH 5.
5. Repeat steps 1 to 4 with goats' milk and with almond milk.

0 1 . 3 Give **one** way the pH can be measured.

[1 mark]

Universal indicator

0 1 . 4 Give **two** control variables the student should have used in this investigation.

[2 marks]

- 1 Volume of milk
- 2 Amount of exposure to the air.

Question 1 continues on the next page

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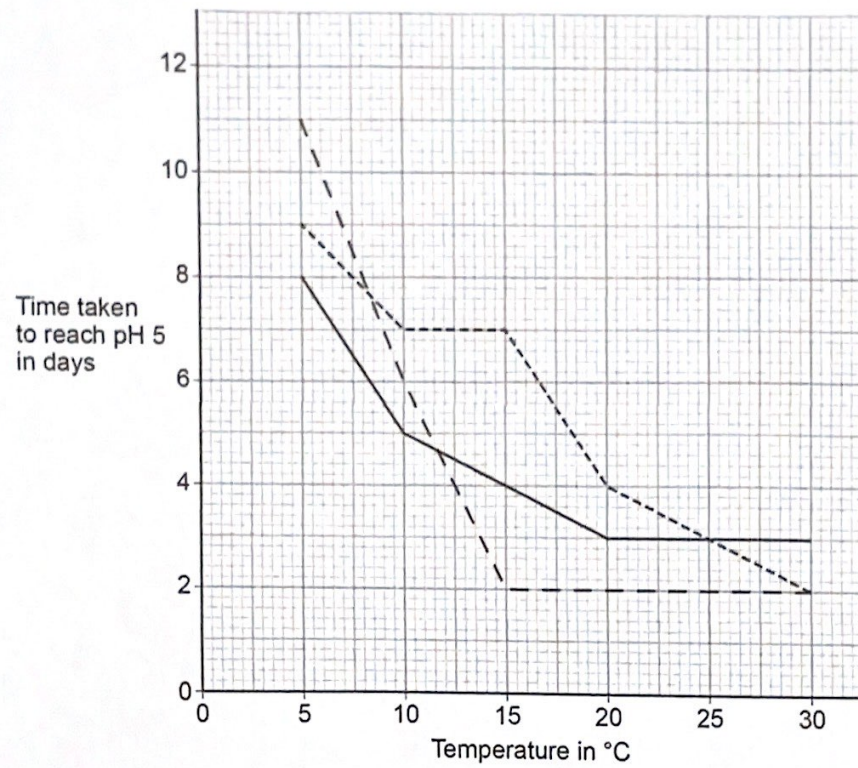


The student improved the investigation to produce valid results.

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Figure 1 shows the results.

Figure 1



Key

- Cows' milk
- - - Goats' milk
- Almond milk

0 1 . 5 Which type of milk stays fresh the longest at 10 °C?

[1 mark]

almond



0 1 . 6 Describe the effect of temperature on the time taken for goats' milk to reach pH 5.

Use data from Figure 1 in your answer.

[2 marks]

As the temperature increases up to 15 °C
the time taken to reach pH 5 decreases.
Above 15 °C the time taken to reach pH 5
stays the same.

0 1 . 7 The time taken for cows' milk to reach pH 5 at 10 °C is less than the time taken for cows' milk to reach pH 5 at 5 °C.

Suggest one reason why.

[1 mark]

The bacteria will be dividing faster in
warmer temperatures

0 1 . 8 Suggest two reasons why the different types of milk took different lengths of time to reach pH 5.

[2 marks]

- 1 Different concentrations of lipids and proteins
- 2 Different starting pH.

Question 1 continues on the next page

Turn over ►



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0 1 9 The student said:

'The temperature milk is stored at affects how likely
the milk is to cause food poisoning.'

How can the investigation be developed to find out if the student is correct? [1 mark]

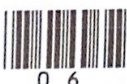
Tick (✓) **one** box.

Determine the types of bacteria present in the milk

Record the pH every 12 hours

Use more than three different types of milk

13

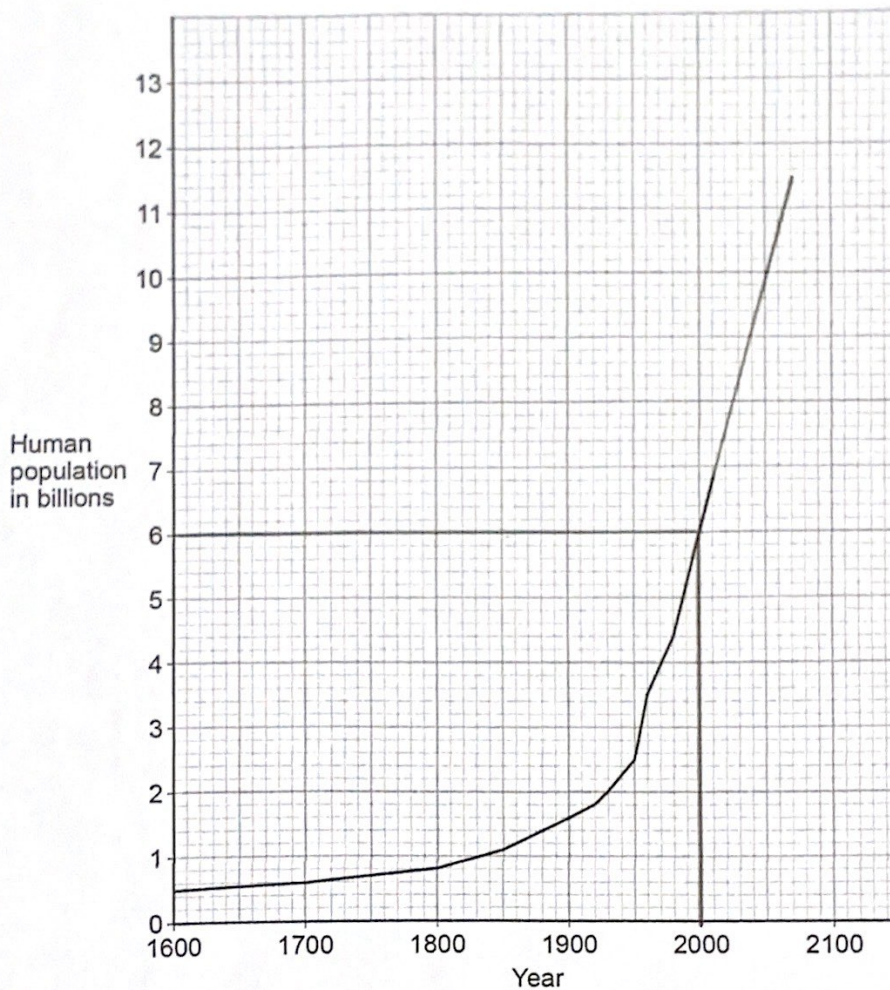


0 2

Figure 2 shows the human population from 1600 to 2010.

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Figure 2



In 1900 the human population was 1.6 billion.

0 2 . 1

Calculate how many times greater the human population was in the year 2000 compared with the year 1900.

[2 marks]

$$\frac{6}{1.6} = 3.75$$

Number of times greater = 3.75



0 8

0 2 . 2 In 1950 the human population was 2.5 billion.

Calculate the mean annual increase in the human population between 1900 and 1950.

[2 marks]

$$2.5 - 1.6 = 0.9$$

$$\frac{0.9}{50} = 0.018$$

Mean annual increase = 0.018 billion per year

0 2 . 3 Predict the human population in 2050 if the current rate of population increase continues.

You should draw an extrapolation line on Figure 2.

[2 marks]

Predicted human population = 10 billion

0 2 . 4 The increasing human population has caused a decline in fish stocks.

Describe how fishing quotas can help to return fish stocks to a sustainable level.

[2 marks]

Fishing quotas mean less fish are caught and the ^{remaining} ~~remaining~~ fish can reproduce and return fish stocks to a suitable level.

Question 2 continues on the next page

Turn over ►



0 2 . 5 Farming techniques have changed in recent years.

Describe:

- why more land is being used for farming
- how increased farming has decreased biodiversity.

[6 marks]

The growing human population means there is an increased demand for food and fuel. Deforestation occurs to clear the land for growing crops for food and biofuel and for rearing livestock for food. Deforestation causes habitat loss and consequently migration and extinction and therefore decreased biodiversity. Peat is also used for compost and burnt for fuel. Peat contains a lot of carbon that is released into the atmosphere when burnt or disturbed ~~which~~ as carbon dioxide which contributes to global warming. If species are unable to survive the changes in climate caused by this then they could become extinct and biodiversity will reduce. The use of pesticides and fertilisers to grow more crops can have disastrous consequences for insect populations and marine ecosystems and can damage whole food chains. Hedgerows inbetween fields are often destroyed to make room for more crops which removes habitats and encourages migration to find alternative food and shelter which decrease biodiversity in the area. Global warming is also worsened by the increase of carbon dioxide produced from farm animals and machinery which may effect ~~effect~~ biodiversity if species struggle to survive in the changing climates and become extinct or have to migrate.



0 2 . 6 Genetic modification of crop plants can help meet the demands of the increasing human population.

Golden rice is a genetically modified (GM) crop.

What is the advantage of golden rice compared with non-GM rice?

[1 mark]

Tick (✓) **one** box.

Golden rice contains protein-rich mycoprotein

Golden rice has improved nutritional value

Golden rice produces human insulin

0 2 . 7 Suggest **one** reason why some people are concerned about the use of golden rice.

[1 mark]

The gene may contaminate other
species of rice.

16

Turn over for the next question

Turn over ►



0 3

This question is about plant hormones.

0 3 . 1

Farmers can spray seeds with gibberellins to start germination.

What are **two** other uses of gibberellins?**[2 marks]**Tick (✓) **two** boxes.

To help in tissue culture

To help roots form

To increase fruit size

To kill weeds

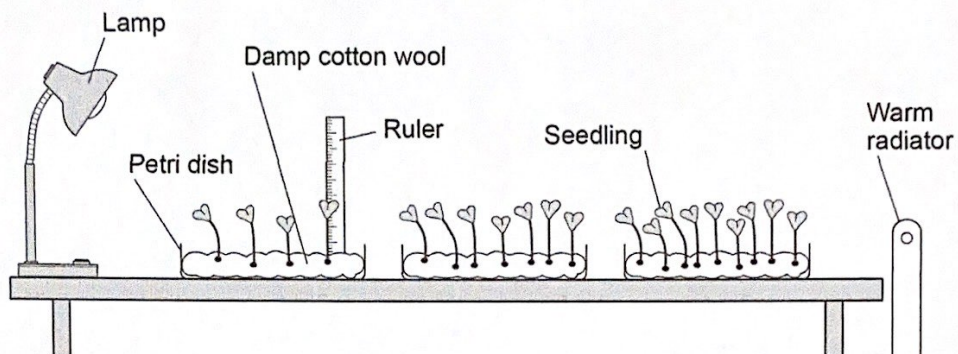
To promote flower production



Students investigated the effect of light intensity on the height of seedlings.

Figure 3 shows the equipment.

Figure 3



0 3 . 2 Describe **two** improvements the students should make to their investigation.

[2 marks]

- 1 Keep the temperature the same by keeping
samples equal distance from the radiator
- 2 Use an equal number of seedlings in
each dish.

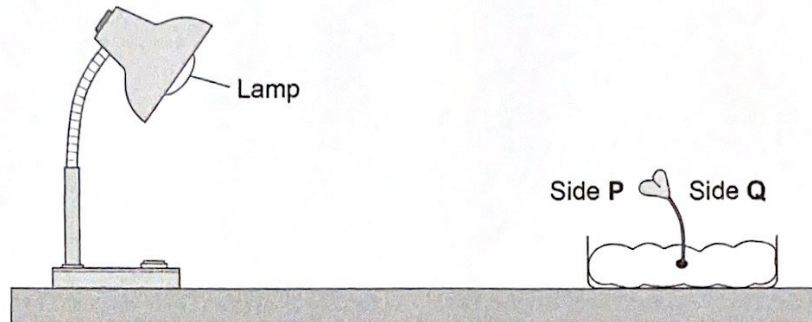
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Figure 4 shows a seedling growing towards a lamp.

Figure 4



0 3 . 3 Suggest how the students measured the length of the curved seedling in Figure 4. [1 mark]

Straighten the seedling and measure
the length with a ruler.



- 0 3 . 4 Explain what happened to the growth of the seedling on side Q compared with the growth on side P.

[3 marks]

The side nearest the lamp (P) receives more light than side Q therefore there will be an unequal distribution of auxin. The increased amount of auxin on side Q causes more growth on that side and causes the seedling to bend towards the light.

- 0 3 . 5 Bananas are often stored separately from other fruits because bananas release a plant hormone.

Why does storing bananas with other fruits cause the other fruits to ripen faster?

[1 mark]

Bananas release ethene

9

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0 4 DNA is a polymer of nucleotides.

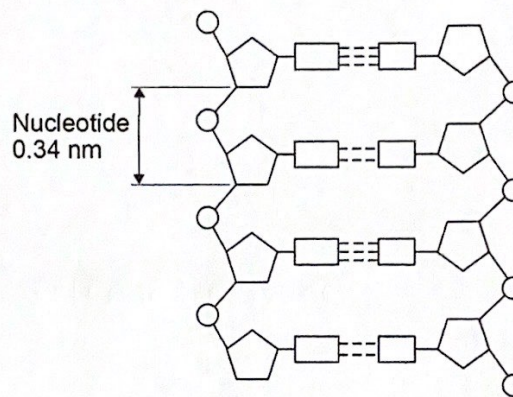
0 4 . 1 Why is DNA described as a polymer?

[1 mark]

It has many nucleotides (monomers) joined together

Figure 5 shows part of a DNA molecule.

Figure 5



0 4 . 2 Describe the structure of a nucleotide.

[4 marks]

Nucleotides are made up of a phosphate attached to a 5 carbon sugar (pentose). The sugar is attached to a base. The bases are adenine (A), thymine (T), Guanine (G) and cytosine (C).



0 4 . 3 The length of a DNA double helix increases by 0.34 nm for every pair of nucleotides.

The total number of nucleotides in a human body cell is 1.2×10^{10} .

Calculate the total length of double helix in a human body cell.

Give your answer in metres. Use information from **Figure 5**.

[5 marks]

$$1.2 \times 10^{10} = 12\,000\,000\,000$$

$$0.34 \times 12\,000\,000\,000 = 4\,080\,000\,000$$

$$\frac{4\,080\,000\,000}{1\,000\,000\,000} = 4.08$$

$$4.08 \div 2 = 2.04$$

due to base pairs

Total length = 2.04 m

0 4 . 4 Some parts of DNA do **not** code for proteins.

Describe how non-coding parts of DNA can affect the expression of genes.

[1 mark]

Can switch genes on and off.

11

Turn over for the next question

Turn over ►



0 5

There are two types of cell division: mitosis and meiosis.

0 5 . 1

Describe **three** differences between the processes of mitosis and meiosis.

[3 marks]

1 mitosis produces 2 daughter cells but
meiosis produces 4 daughter cells

2 Mitosis only includes 1 cell division,
meiosis involves 2 cell divisions.

3 Mitosis produces genetically identical cells
but meiosis produces genetically different cells

0 5 . 2

Describe **one** similarity between the processes of mitosis and meiosis.

[1 mark]

DNA is doubled.

Question 5 continues on the next page

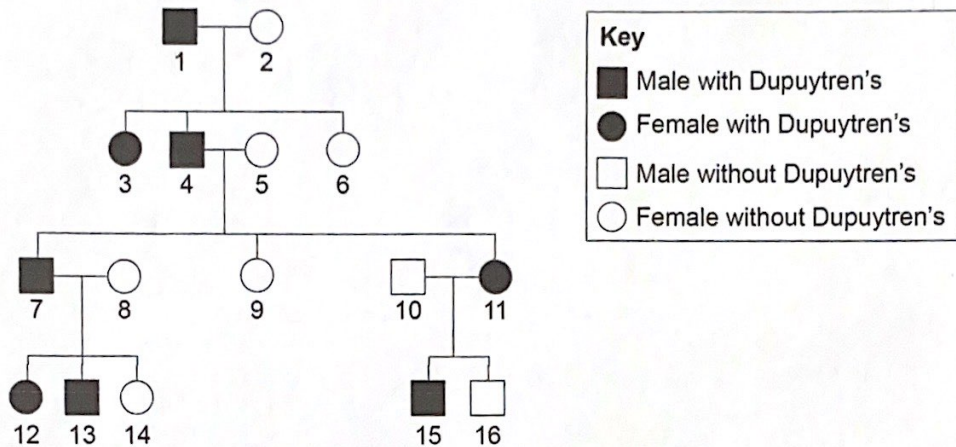
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Dupuytren's is a disorder that affects the hands.

Figure 6 shows the inheritance of Dupuytren's in one family.

Figure 6



Dupuytren's is caused by a dominant allele in this family.

D = dominant allele

d = recessive allele

05.3 Give the genotype of person 1.

Explain your answer.

[2 marks]

Genotype Dd

He has dupuytren's so must have D and
Produces children without dupuytren's (6)
so must also have d in order to produce
a homozygous recessive child (dd).



0 5 . 4 Person 7 and person 8 in Figure 6 are expecting a fourth child.

What is the probability of the child having Dupuytren's?

You should:

- draw a Punnett square diagram
- identify which offspring have Dupuytren's

[5 marks]

	person 7	
	D	d
person 8	d	Dd
	d	Dd

The offspring with genotype Dd (circled in the punnett square) have Dupuytren's

$$\frac{2}{4} = \frac{1}{2} = 0.5$$

Probability = 0.5

0 5 . 5 Explain how Figure 6 shows the allele for Dupuytren's is **not** on the Y chromosome.

[2 marks]

Females 3, 11 and 12 all have
Dupuytren's and females do not have a
Y chromosome.

13

Turn over for the next question

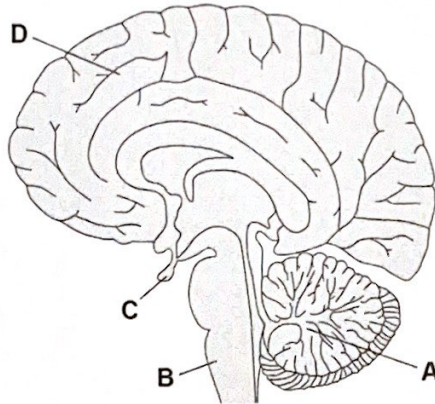
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0 6

Figure 7 shows the brain.

Figure 7



0 6 . 1

Which part of the brain becomes more active if a person balances on one leg instead of standing on two legs?

[1 mark]

Tick (✓) **one** box.

A B C D

0 6 . 2

Name the part of the brain that is responsible for making a decision.

[1 mark]

cerebral cortex



0 6 . 3 In most MRI scanners the person being scanned needs to stay completely still.

A functional MRI (fMRI) scanner allows a person to move while the scanner makes images of the person's brain activity.

Suggest how the fMRI scanner could help to find out more about the brain damage a person has.

[3 marks]

Because the person can move while doing the scan, the person could be instructed to perform different tasks in order to see which parts of the brain are active and so we can see exactly where the brain damage is and compare the brain function to someone without brain damage.

0 6 . 4 Describe how the brain receives information about light entering the eye.

You should include the names of structures in your answer.

[3 marks]

The cells in the retina are sensitive to light. They generate an electrical impulse that gets carried by sensory neurones and the optic nerve to the brain.

Question 6 continues on the next page

Turn over ►



06.5

The eyes of some birds contain cells that detect ultraviolet (UV) light.

UV light is reflected by some fruits and the urine of small mammals.

Explain how birds that detect UV light have evolved from birds that could not detect UV light.

[6 marks]

There will have been a random mutation in a gene that causes a new protein to be made in the retina of the bird. This causes the bird to be able to detect more variation in the wavelengths of light and see UV. The birds with this new mutation are more likely to see fruits that reflect UV and where small mammals are and have been. This gives them an advantage because they can get more fruit/food and avoid being eaten by the small mammals and outcompete other birds that don't have the mutation. The birds with the mutation are therefore more likely to survive and reproduce by natural selection. They will pass on the mutation to their offspring and over many generations becomes a ~~part of~~ more permanent part of the birds genomes.

14



07

A new dog food has been developed that does **not** contain meat from cows, sheep or chickens.

The new dog food contains insects.

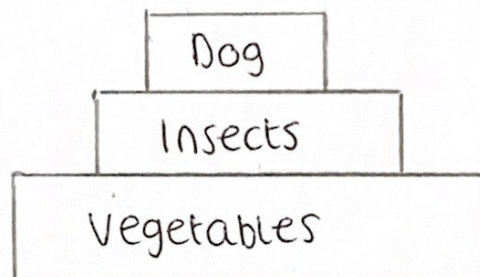
The insects in the dog food factory are fed on waste vegetables.

07.1

Sketch the pyramid of biomass for the food chain that produces food for dogs from insects.

Label the pyramid.

[2 marks]



07.2

Describe **two** reasons why the biomass of the insects eaten by dogs does **not** all become biomass of the dogs.

[2 marks]

- 1 carbon dioxide will be lost when the dog respire
- 2 not all parts of the insects are absorbed.



07.3

Explain how making dog food from insects could improve human food security in the future.

[4 marks]

Less land is required to make the dog food so there will be more space to grow crops for humans to feed the growing population. Also less methane will be produced from animals so there will be less global warming and therefore less effects of global warming on human food production such as flooding of farmlands.

8

Turn over for the next question

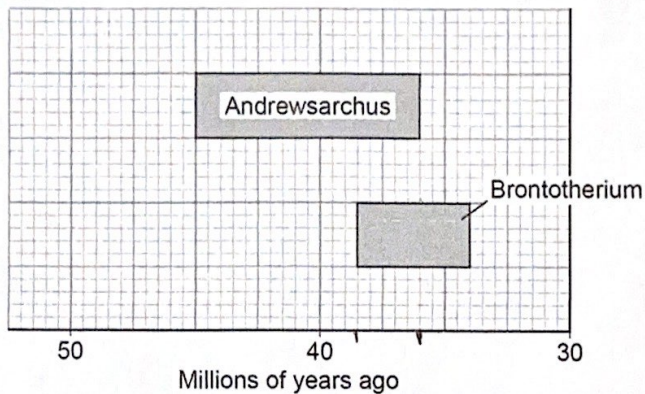
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0 8

Figure 8 shows when two mammals existed in Asia.

Figure 8



0 8 . 1

Determine the number of years both Andrewsarchus and Brontotherium existed together.

[2 marks]

$$38.5 \text{ million} - 36 \text{ million} = 2.5 \text{ million}$$

$$\text{Time} = 2.5 \text{ million years}$$



0 8 . 2 The oldest fossils of human ancestors found in this area are 700 000 years old.

Andrewsarchus was a carnivore and Brontotherium was a herbivore.

Suggest how the extinction of Andrewsarchus could have resulted in the extinction of Brontotherium.

[3 marks]

The extinction of Andrewsarchus could have led to population increase of another herbivore that was previously eaten by the carnivorous Andrewsarchus. Because the other herbivore is no longer being predated there is more competition with brontotherium that could have led to the extinction of the species if out competed

0 8 . 3 Information about extinct animals is often **not** clear because the fossil record is incomplete.

Give **three** reasons why the fossil record is **not** clear for older species.

[3 marks]

- 1 Fossils are buried deeper so are harder to find
- 2 Fossils are more likely to have been destroyed by geological activity
- 3 Dating older fossils is hard

Question 8 continues on the next page

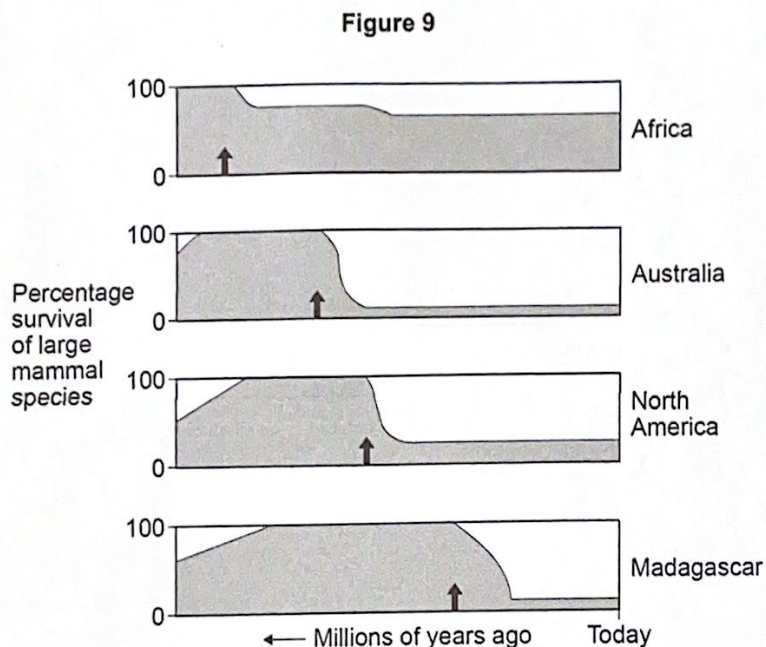
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Figure 9 shows the percentage (%) survival of large mammal species in four areas of the world.

The time at which humans first appeared in each of the four areas is also shown.



Key

↑ Humans first appeared in area ■ Percentage survival of large mammal species



A mass extinction is a rapid decrease in biodiversity on Earth.

0 8 . 4 A student stated:

'The data in Figure 9 shows that humans caused mass extinctions.'

Evaluate the student's statement.

[6 marks]

There is a significant decrease in large mammals but the decrease is larger in some areas (Australia, North America, Madagascar) than others (Africa). The decrease does occur when humans enter areas which would support the statement. The data shows that the decreases happened at different times in the areas so is not likely due to a world wide climate change / natural disaster and supports the statement. The decrease is not immediate after the appearance of humans which may suggest the human population grew ^{first which caused} ~~then causing~~ the extinction of the animals. The data only shows large animals and there was always some left so it isn't fair to say it was a 'mass extinction'. Also correlation doesn't always mean causation so the decrease could be due to other factors, we would need information about climate change, predators, pathogens, food sources etc. in order to determine if humans really are to blame. The rate of decrease varied with area and we only have data for 4 areas. Therefore we need information from more places to determine if humans really are the cause.

Question 8 continues on the next page

Turn over ►



0 8 . 5 Give **one** disadvantage and **one** advantage of mass extinction events.

Answer in terms of evolution.

[2 marks]

Disadvantage reduction in range of alleles

Advantage allows for evolution of new species

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END OF QUESTIONS

