

Natural selection and genetic modification – Questions

Q1. *Bacillus thuringiensis* contains a gene that codes for a toxin.

Explain **one** advantage and **one** disadvantage of introducing this gene into crop plants.

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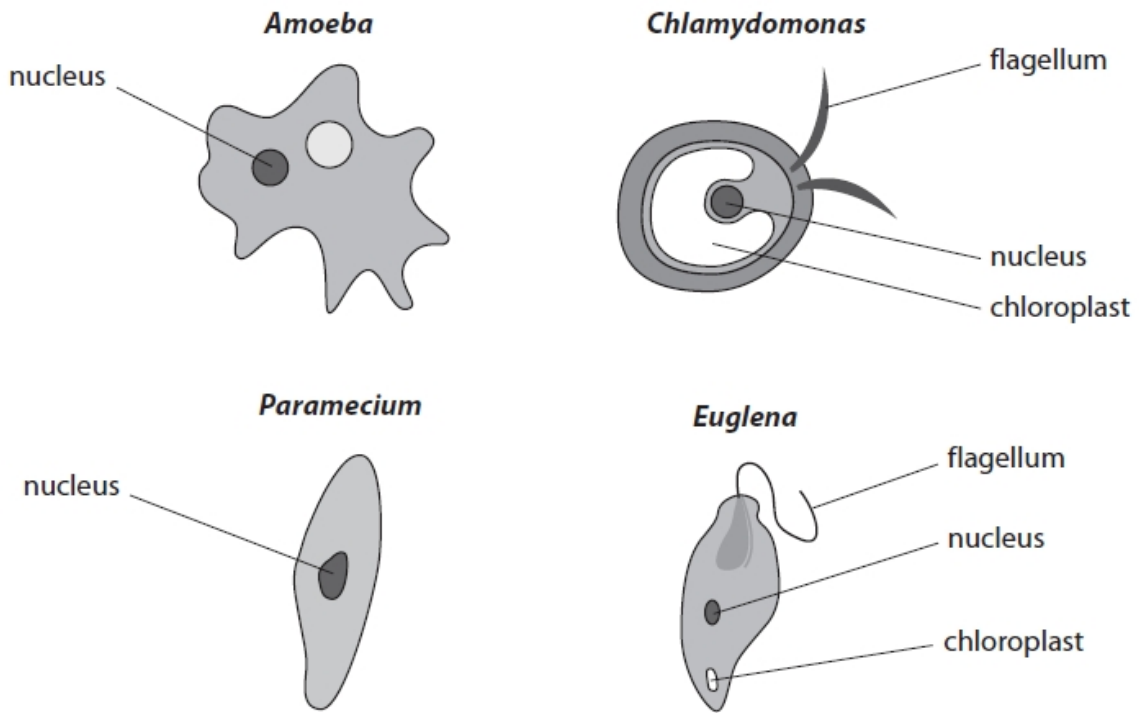
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Q2. Classification

(a) All the organisms in the diagram belong to one Kingdom.



(i) Which Kingdom do these organisms belong to?
Place a cross (☒) in the box next to your answer.

(1)

- A Animalia
- B Fungi
- C Protocista
- D Prokaryotes

(ii) In which structure are the chromosomes of these organisms found?
Place a cross (☒) in the box next to your answer.

(1)

- A cilia
- B chloroplast

- C flagellum
- D nucleus

(iii) Suggest **one** reason why both *Euglena* and *Chlamydomonas* could be placed into the Kingdom Plantae.

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(b) (i) *Euglena* is unusual because it is both heterotrophic and autotrophic.
Explain how this helps *Euglena* to survive.

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(ii) A scientist discovered a new species of *Euglena* in boiling acidic mud in Costa Rica.
Explain how this discovery could be validated by the scientific community.

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(Total for question = 8 marks)

Q3.

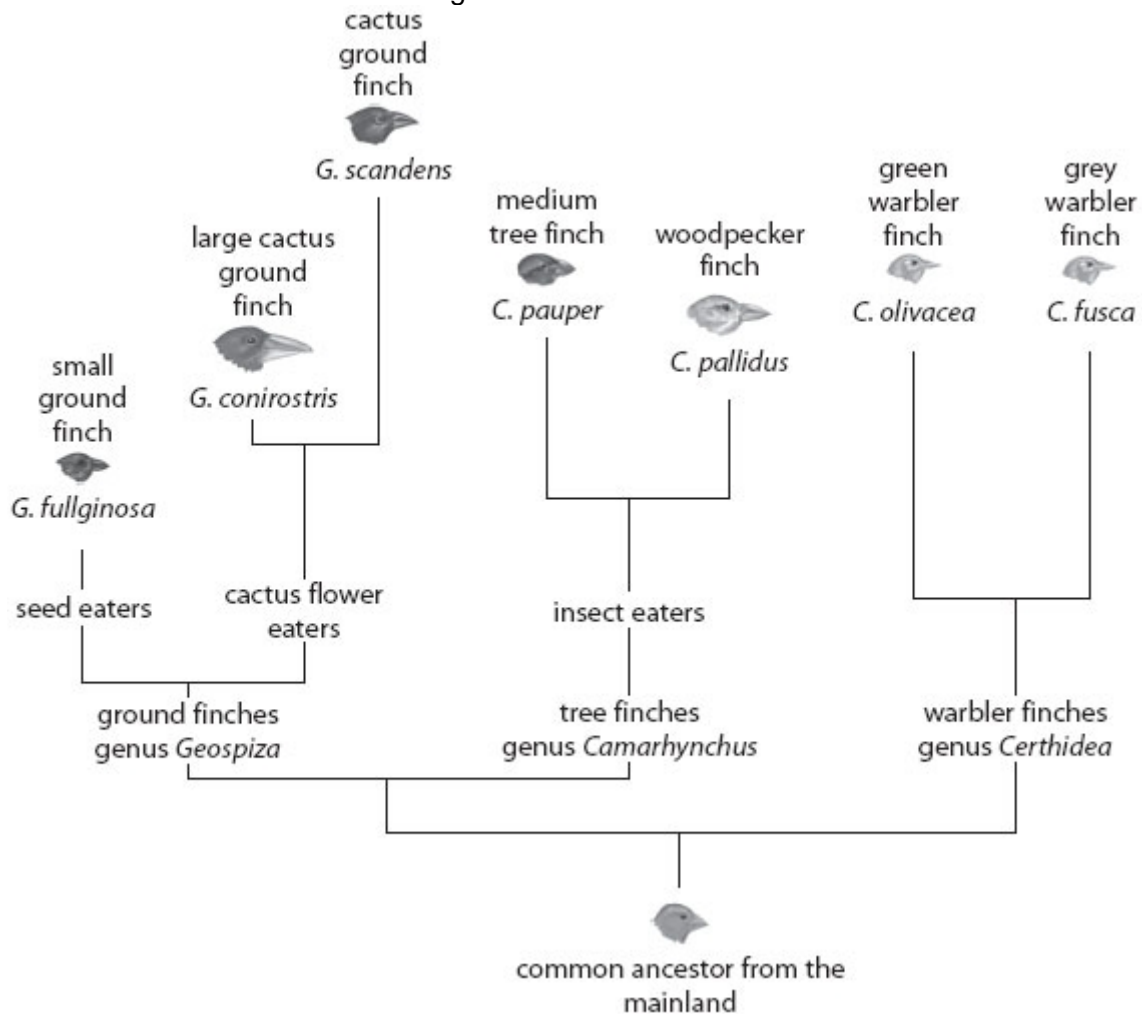
Suggest the advantages of cloning mammals, such as dogs, for use in medical research into human diseases.

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Q4.

Charles Darwin studied the variety of finches on the Galapagos Islands. He used this information to develop his theory of evolution. Some of the finches are shown in the diagram.



(a) (i) State the genus and the species of the large cactus ground finch. (2)

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(ii) Suggest how the size and shape of their beaks enabled all of these types of finches to survive. (2)

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(ii) Complete the sentence by putting a cross () in the box next to your answer. Darwin's finches are an example of speciation due to (1)

- A** selective breeding
- B** geographic isolation
- C** hybridisation

☒ D the development of ring species

(b) Suggest how these species of finches could have evolved.

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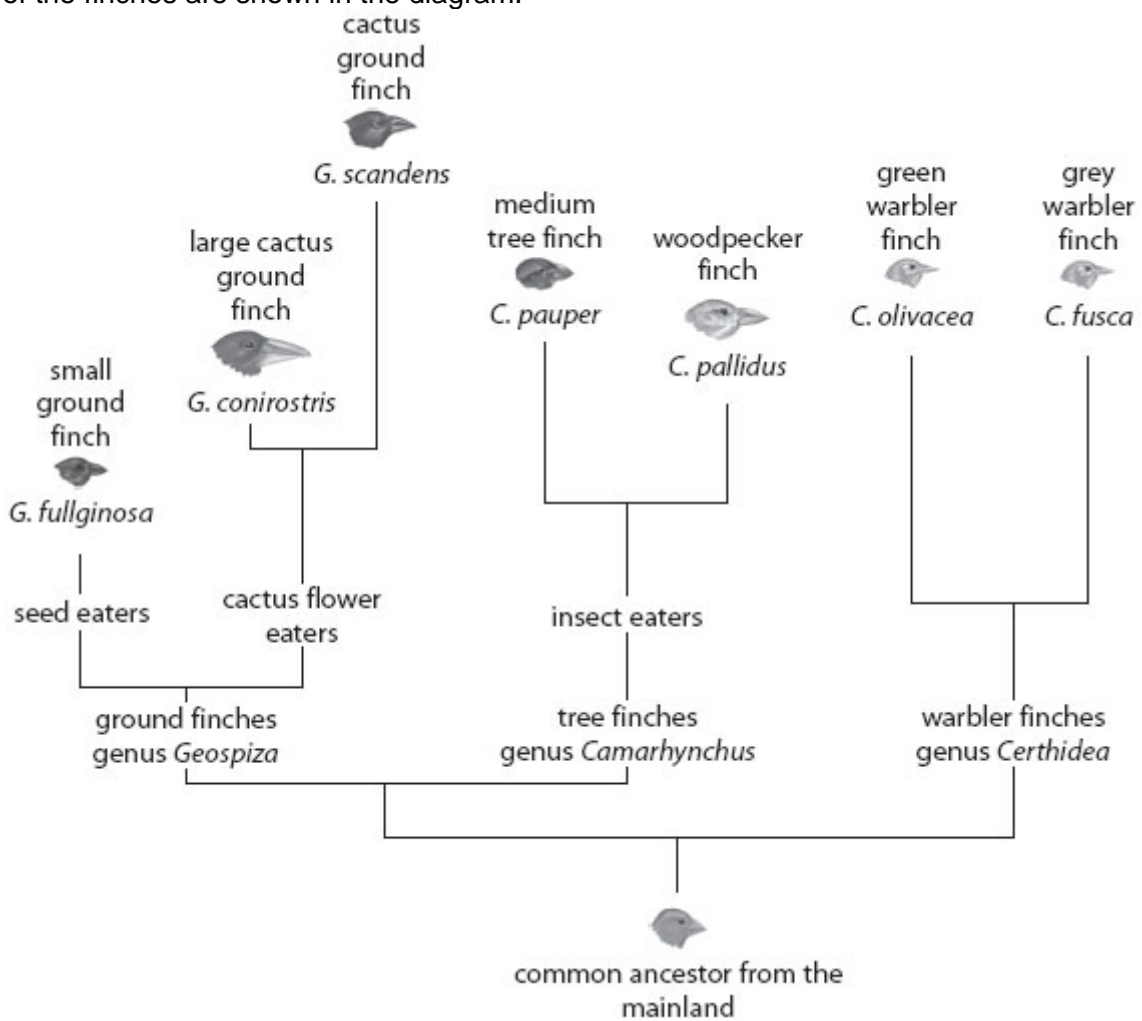
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(Total for Question is 8 marks)

Q5.

Charles Darwin studied the variety of finches on the Galapagos Islands. He used this information to develop his theory of evolution. Some of the finches are shown in the diagram.



(i) State the genus and the species of the large cactus ground finch.

(2)

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(ii) Suggest how the size and shape of their beaks enabled all of these types of finches to survive.

(2)

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(ii) Complete the sentence by putting a cross () in the box next to your answer.
 Darwin's finches are an example of speciation due to

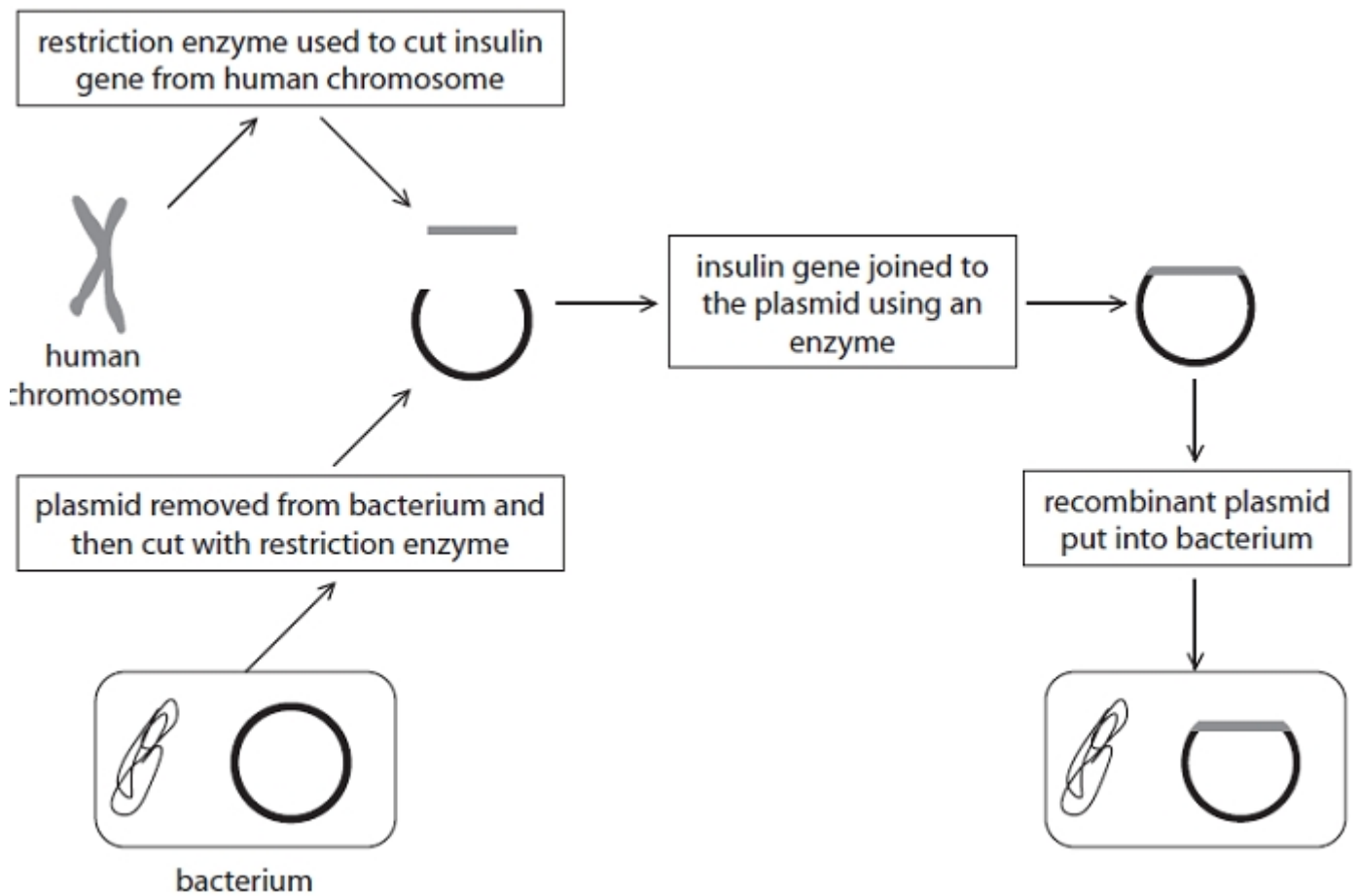
(1)

- A selective breeding
- B geographic isolation
- C hybridisation
- D the development of ring species

Q6.

Enzyme technology

The diagram shows how the human insulin gene can be used to genetically modify bacteria.



(a) (i) Name the enzyme used to join the insulin gene to the plasmid.

(1)

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(ii) Suggest why the same restriction enzyme was used to cut the human chromosome and the plasmid.

(2)

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*(b) Enzyme technology can be used in the production of foods including sweets, vegetarian cheese and lactose-free milk.

Describe how enzyme technology can be used to produce these food products.

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(c) Washing powders can be biological or non-biological.

Describe how biological washing powders can make clothes cleaner than nonbiological washing powders.

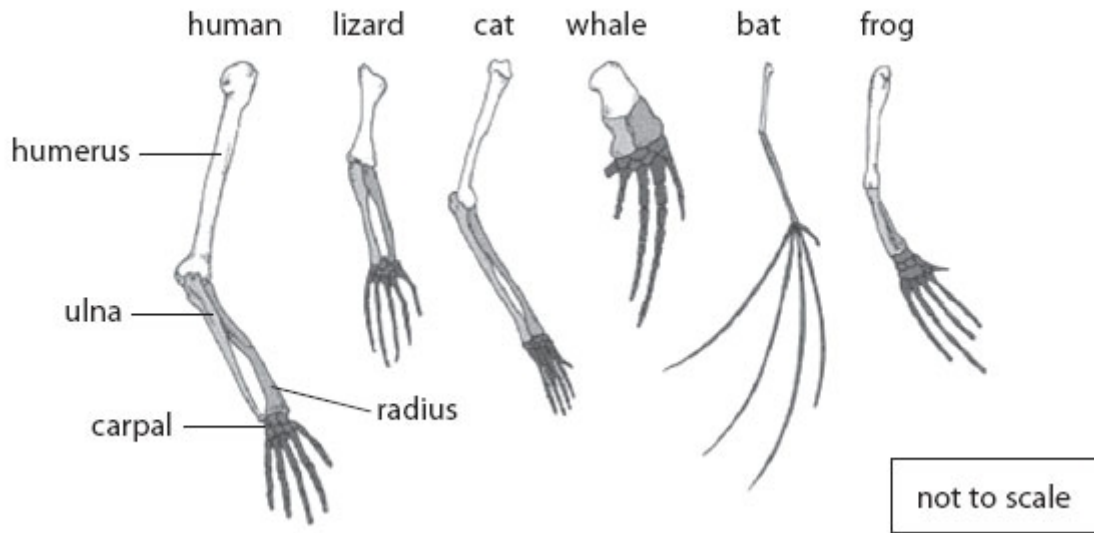
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(Total for question = 11 marks)

Q7.

The diagrams show the limbs of six organisms.



(a) Many scientists believe that these six organisms evolved from one common ancestor. Describe the evidence shown in the diagrams that supports this belief.

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(b) Fossils can provide evidence for evolution. Explain why the fossil record is incomplete.

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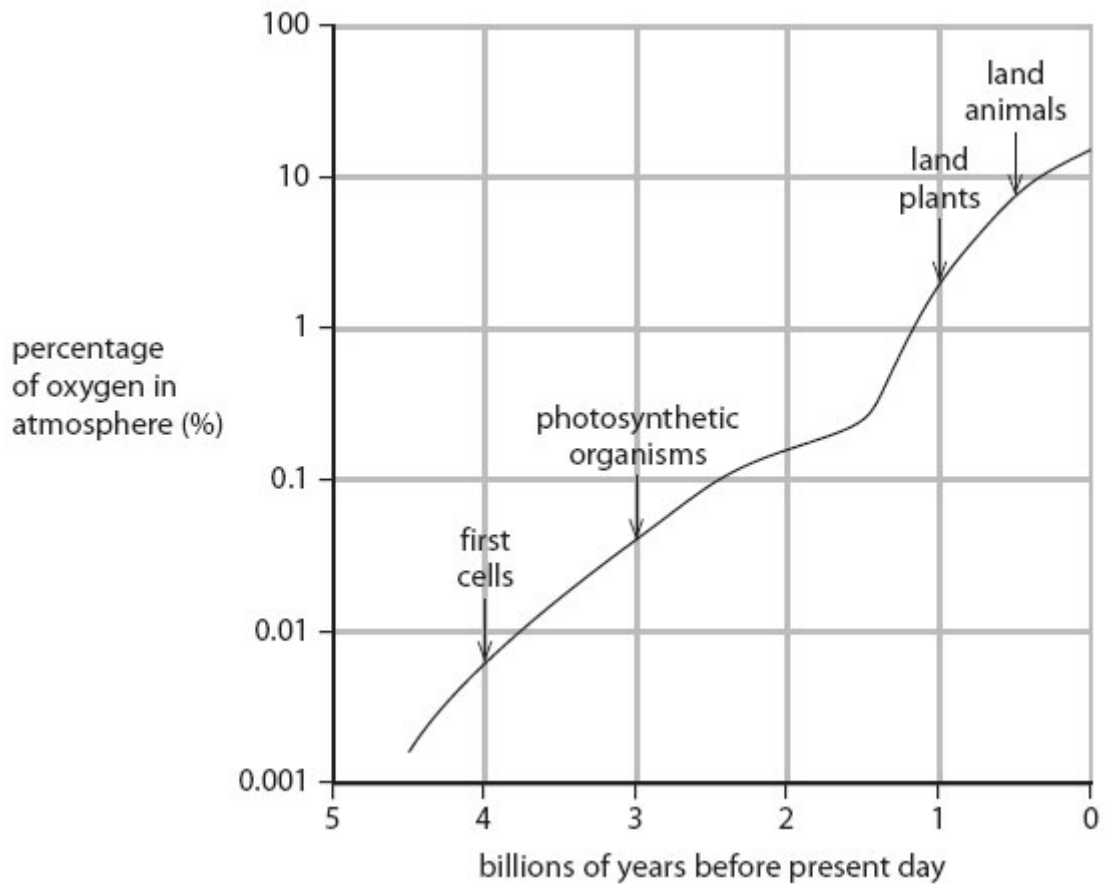
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(c) The graph suggests that the level of oxygen in the atmosphere was important for the evolution of many living organisms.



(i) How much oxygen was needed in the atmosphere for the evolution of land animals?

Put a cross () in the box next to your answer.

- A 0.009%
- B 0.09%
- C 0.9%
- D 9.0%

(1)

(ii) Suggest how photosynthesis could have changed the gas content of the atmosphere.

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(iii) Suggest why such a high percentage of oxygen in the atmosphere was needed for large land animals to evolve.

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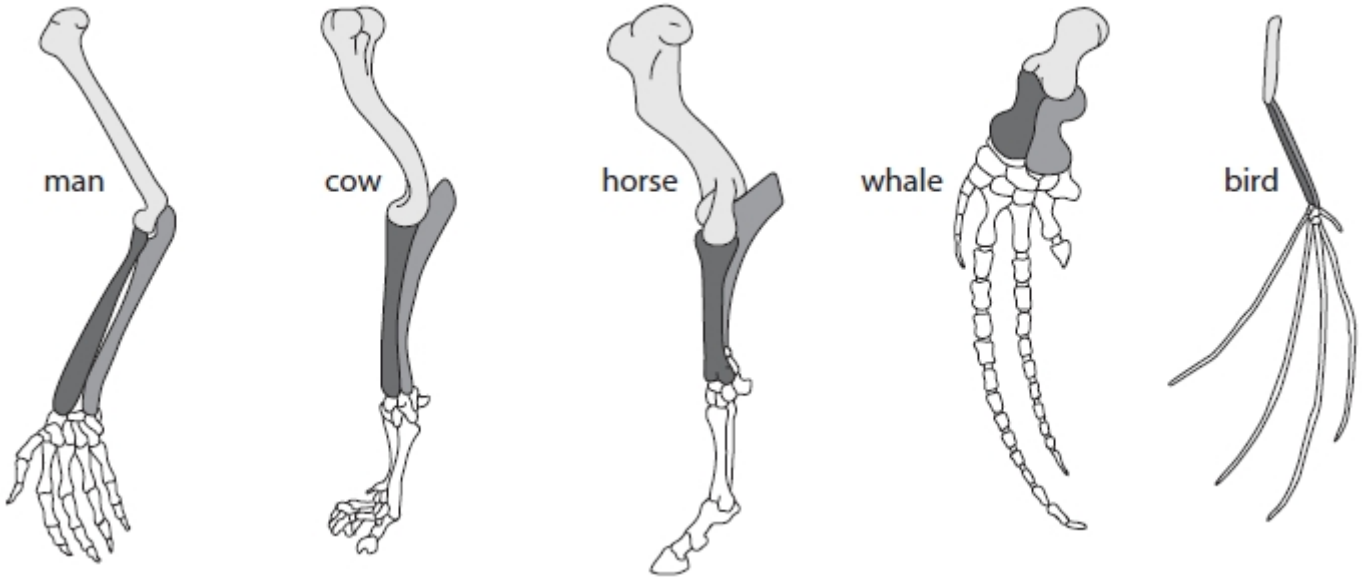
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Q8.

* The diagram shows some limbs of modern-day animals.



Explain how the study of the limbs of different species of vertebrates provides evidence for evolution.

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Q9.

Bacterial cells can be genetically modified using enzymes to produce the hormone insulin. Explain how enzymes are used to produce a genetically modified plasmid in a bacterial cell.

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(Total for question = 3 marks)

Q10.

The dodo was a flightless bird which is now extinct.
The photograph shows the skeleton of a dodo.




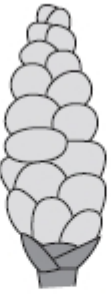

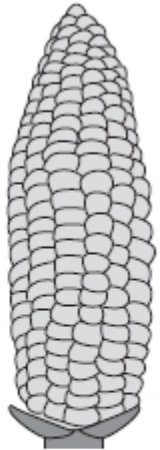

The dodo lived on the small island of Mauritius. It became extinct in 1681.
Using your knowledge of natural selection, suggest why the dodo may have become extinct.

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Q11.

The diagram shows the development of maize cobs over the last 1000 years of cultivation.

maize cobs				
mean mass of cob /g	15	45	70	90
date	1000 years ago  Present			

Describe how scientists can use plant breeding programmes to produce maize plants with larger cobs.

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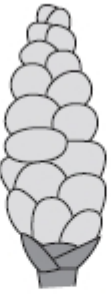

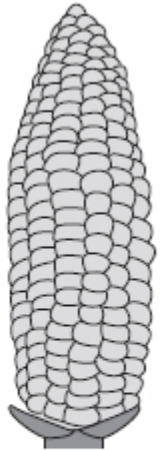

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Q12.

The diagram shows the development of maize cobs over the last 1000 years of cultivation.

maize cobs					
mean mass of cob /g	15	45	70	90	
date	1000 years ago				Present

There has been an increase in the use of pesticides during the last 1000 years.

Explain how the use of pesticides may benefit maize production.

(2)

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Q13.

In 2005, a scientist claimed to have found red blood cells in the fossilised bones of a *Tyrannosaurus rex* that lived 68 million years ago.



Explain why fossils of dinosaurs are often incomplete.

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Q14.

Fossils can provide evidence for evolution.
Explain why the fossil record is incomplete.

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Q15.

Genetic engineering can be used to produce plants that are resistant to herbicide.
One herbicide works by preventing the activity of an enzyme.
Some bacteria have a form of this enzyme that is not affected by the herbicide.
Suggest how genetic engineering can be used to produce plants resistant to this herbicide.

(3)

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Q16.

In 2011, South Korean scientists genetically engineered a cell from a beagle.
They then cloned this cell to create a beagle.
They called this beagle Tegen.
Tegen glows in the dark when UV light is shone on him.

beagle puppy



© Dentistry Today

Cloning involves cells that divide by mitosis.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

When a cell divides by mitosis it produces

(1)

- A two cells that are genetically different
- B two cells that are genetically identical
- C four cells that are genetically different
- D four cells that are genetically identical

(b) To genetically engineer the original cell so that it would glow, the scientists had to obtain a suitable gene.

(i) Describe the stages that a scientist would complete to obtain this gene.

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*(ii) Describe the stages used in the laboratory to clone and produce Tegen from the genetically engineered cell.

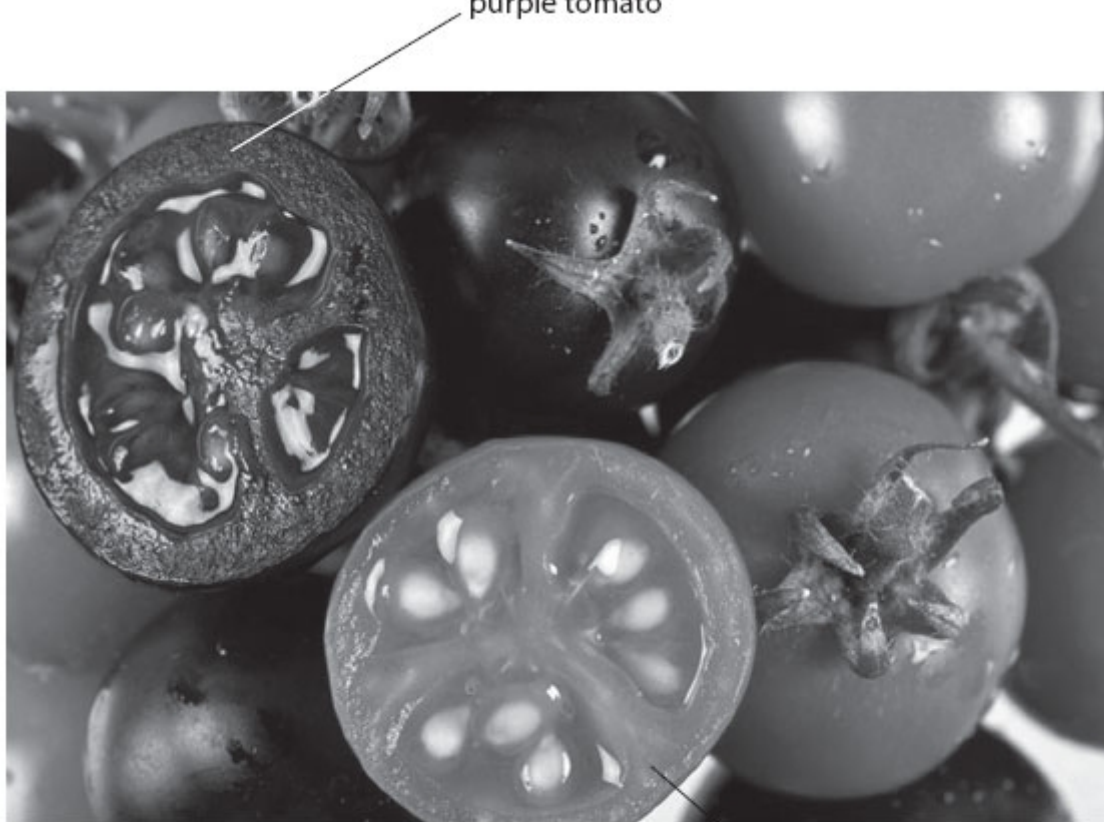
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Q17.

(a) Purple tomatoes are transgenic plants that have been produced by genetic engineering.



(i) As a result of genetic modification, these tomatoes produce a new substance which has health benefits and turns the tomatoes purple.
Name this substance.

(1)

(ii) What is inserted into the DNA of another plant to make it transgenic?
Put a cross () in the box next to your answer.

(1)

- A a gene from another species
- B a gene from the same species
- C chromosomes from the same species
- D proteins from another species

*(b) Describe how *Agrobacterium tumefaciens* can be used to create transgenic plants.

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(c) *Bacillus thuringiensis* contains a gene that codes for a toxin.
Explain **one** advantage and **one** disadvantage of introducing this gene into crop plants.

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(Total for Question = 12 marks)

Q18.

Genetic engineering can be used to produce plants that are resistant to herbicide.
One herbicide works by preventing the activity of an enzyme.
Some bacteria have a form of this enzyme that is not affected by the herbicide.
(a) Suggest how genetic engineering can be used to produce plants resistant to this herbicide.

(3)

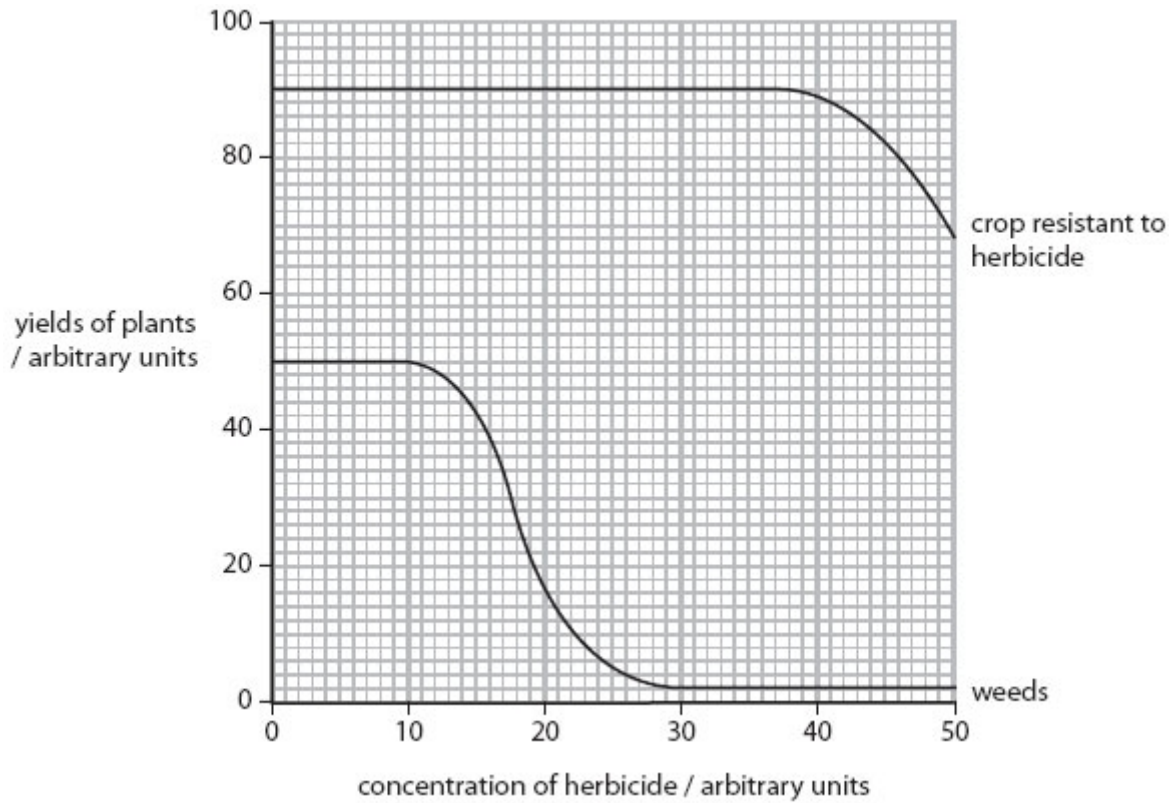
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(b) This herbicide is sprayed onto the leaves of plants.
Suggest which vessel could transport the herbicide from the leaf to other parts of the plant.

(1)

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(c) Fields of crops have weeds growing in them.
In an investigation, crops resistant to a herbicide were grown in different fields.
The crops were sprayed with different concentrations of the herbicide.
The mass of the crops and weeds were recorded.
The graph shows the results of this investigation.



(i) Describe the effects of the herbicide on the yield of weeds.

(2)

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(ii) Complete the sentence by putting a cross () in the box next to your answer.
The most appropriate concentration of herbicide to use is

(1)

- A 10 arbitrary units
- B 30 arbitrary units
- C 40 arbitrary units
- D 50 arbitrary units

(d) The table shows the number of species of weeds resistant to this herbicide from 1996 to 2004.

%%%	Year				
	1996	1998	2000	2002	2004
Number of species of weeds resistant to this herbicide	1	2	3	5	8

(i) Describe the trend shown in the data.

(1)

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(ii) Suggest reasons for this trend.

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Q19.

Figure 15 shows a Petri dish containing *E. coli* bacteria. The bacteria have been genetically modified to contain a phosphorescent gene so they glow in the dark.

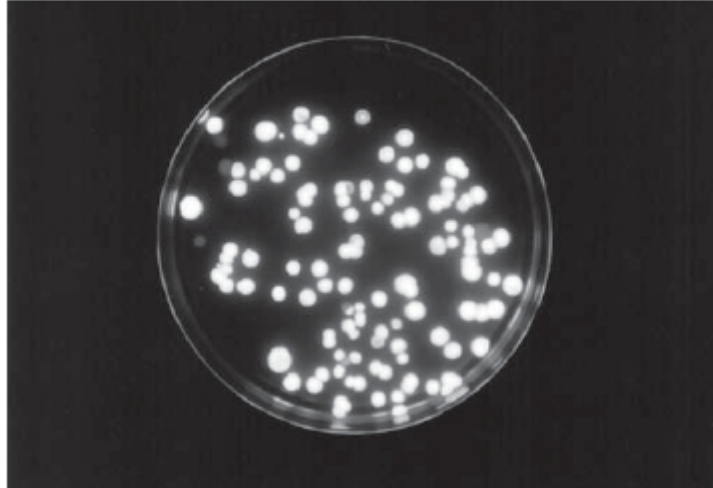


Figure 15

Explain how a bacterial cell can be genetically modified to glow in the dark.

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(Total for question = 4 marks)

Q20.

Corn is one of the world's most important crop plants.
Native Americans grew an early form of corn called teosinte.
Modern corn has been developed by selective breeding of teosinte plants.
Figure 3 shows some stages in the development of modern corn.

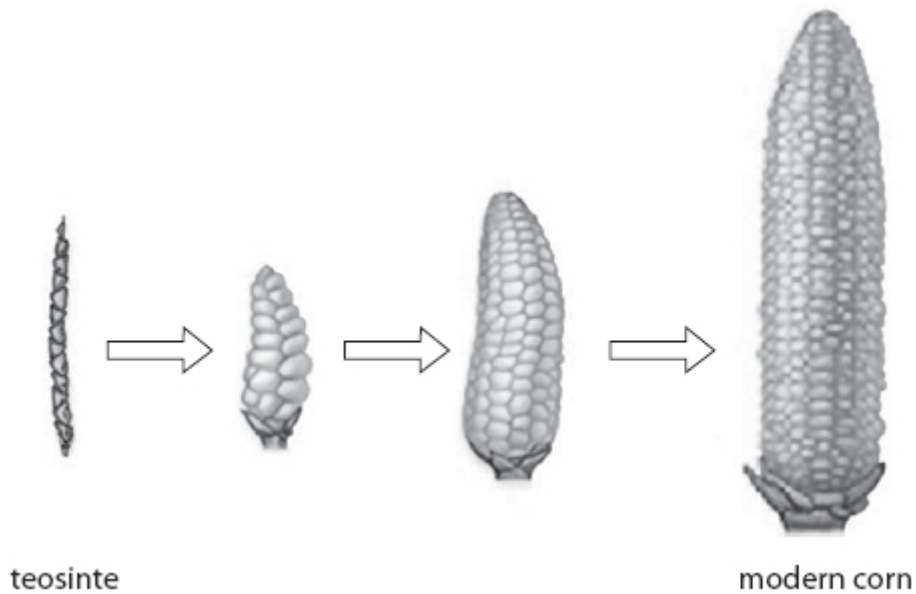


Figure 3

Genetic engineering can also be used to produce a new variety of modern corn.

Describe how the genome of this new variety of corn is different from the genome of corn that has not been genetically engineered.

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(Total for question = 2 marks)

Q21.

Corn is one of the world's most important crop plants.

Native Americans grew an early form of corn called teosinte.

Modern corn has been developed by selective breeding of teosinte plants.

Figure 3 shows some stages in the development of modern corn.

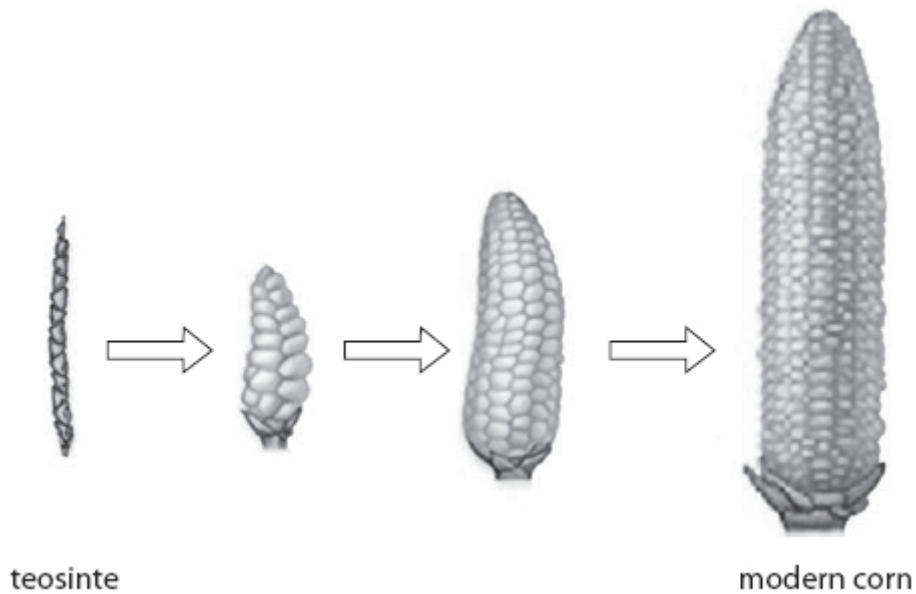


Figure 3

Describe how selective breeding has produced modern corn.

(3)

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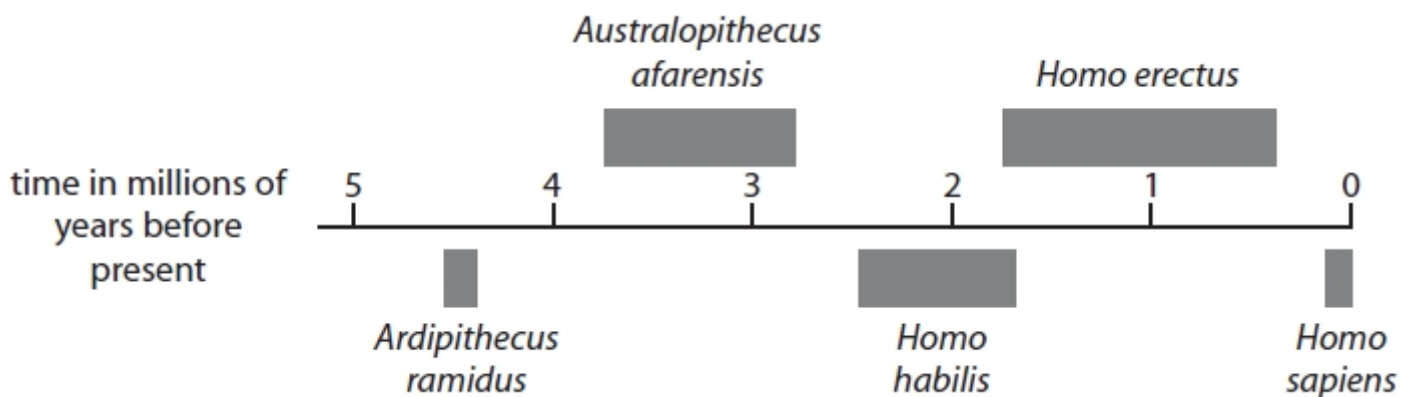
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(Total for question = 3 marks)

Q22.

Human evolution and behaviour

The timeline shows when *Homo sapiens* and some of their ancestors are thought to have inhabited the Earth.



(a) (i) Complete the sentence by putting a cross (X) in the box next to your answer.

The species which is thought to have inhabited the Earth for the longest period of time is

(1)

- A *Australopithecus afarensis*
- B *Homo erectus*
- C *Homo habilis*
- D *Homo sapiens*

(ii) Estimate the number of years that *Homo habilis* inhabited the Earth.

(1)

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(b) Scientists in Africa discovered part of a fossilised skull.

The skull was identified as belonging to the species *Homo erectus*.

Describe the methods scientists may have used to identify the skull as belonging to the species *Homo erectus*.

(2)

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(c) *Homo sapiens* evolved in Africa and then migrated to other areas of the world.

Mitochondrial DNA analysis can be used to map human migration.

Compare the benefits of using mitochondrial DNA rather than nuclear DNA to map human migration.

(3)

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(d) One group of *Homo sapiens* migrated to an environment where there was a large waterfall.

At first, the noise of the waterfall kept them awake at night but they got used to the noise over time.

Explain this behavioural response.





(2)

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(Total for question = 9 marks)

Q23.

The diagram shows four Stone Age tools discovered at different archaeological sites in Europe.

			
handaxe	arrow head	cutting stone	hammer stone

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The Stone Age tool made most recently is the

(1)

- A handaxe
- B arrow head
- C cutting stone
- D hammer stone

(ii) Suggest how these tools may have helped early humans to survive.

(2)

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Q24.

Describe how fossil evidence can be used to show that humans have evolved.

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Q25.

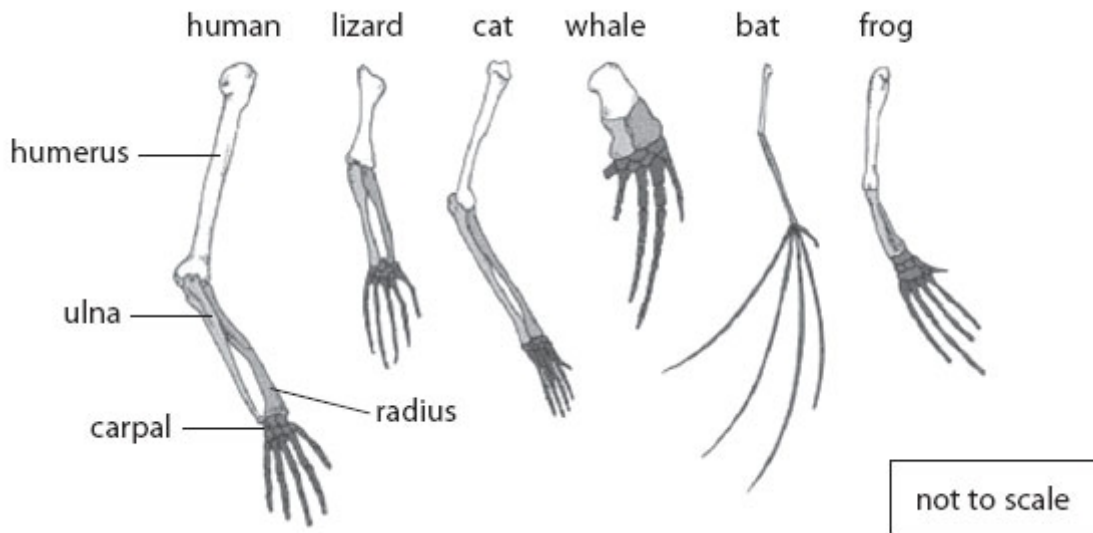
Complete the sentence by putting a cross () in the box next to your answer.
The formation of a new species due to geographical isolation is called

- A** adaptation
- B** competition
- C** hybridisation
- D** speciation

(1)

Q26.

The diagrams show the limbs of six organisms.



Many scientists believe that these six organisms evolved from one common ancestor.
Describe the evidence shown in the diagrams that supports this belief.

(3)

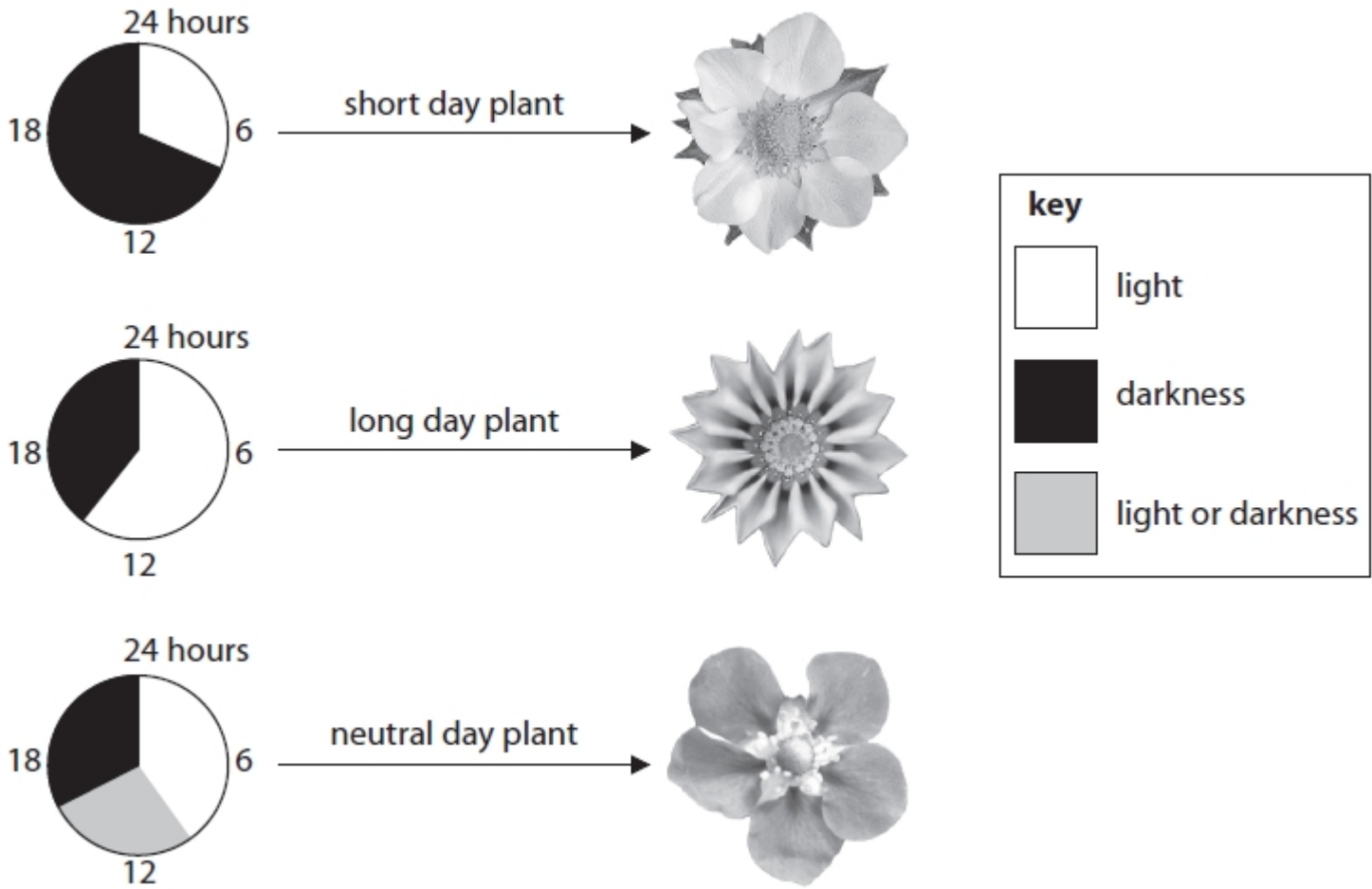
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Q27.

Plants and animals

The diagram shows the number of hours of darkness and light needed for flowering in three different plant

groups.



(a) (i) State the number of hours of darkness needed for a long day plant to flower.

(1)

..... hours

(ii) A gardener has 500 short day plants.
85% of these plants flowered in March.
Calculate the number of plants flowering in March.

(2)

..... plants

(iii) Suggest a benefit to a plant of being day neutral.

(1)

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(iv) Complete the sentence by putting a cross (☒) in the box next to your answer.
Plants flowering in response to the number of hours of darkness and light is an example of

(1)

- A circadian rhythms
- B germination
- C photoperiodism lymphocytes
- D phototropism

(b) (i) The leaves of some species of bamboo plants contain the poison cyanide.
Suggest how these bamboo plants benefit from having poisonous leaves.

(1)

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(ii) The photograph shows a greater bamboo lemur.



The greater bamboo lemur is adapted to tolerate cyanide.

This means that it can eat bamboo leaves containing cyanide.

Explain how the co-evolution of bamboo plants and the greater bamboo lemur could have occurred.

(2)

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(c) Two ethologists, Bergey and Patel, studied the call types used in communication between greater bamboo lemurs.

The table is a summary of their findings.

call types	behaviour
agitated calls	aggression
bahh calls	submission
breath out calls	aggression
contact calls	submission and aggression
purr calls	friendship and resting
squeal calls	submission
woof calls	aggression

(i) Complete the sentence by putting a cross (X) in the box next to your answer.
The behaviour associated with most call types is

- A aggression
- B friendship
- C resting
- D submission

(1)

(ii) Explain the benefit of communicating using sound rather than facial expressions.

(2)

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(Total for question = 11 marks)

Q28.

Corn is one of the world's most important crop plants.

Native Americans grew an early form of corn called teosinte.

Modern corn has been developed by selective breeding of teosinte plants.

Figure 3 shows some stages in the development of modern corn.

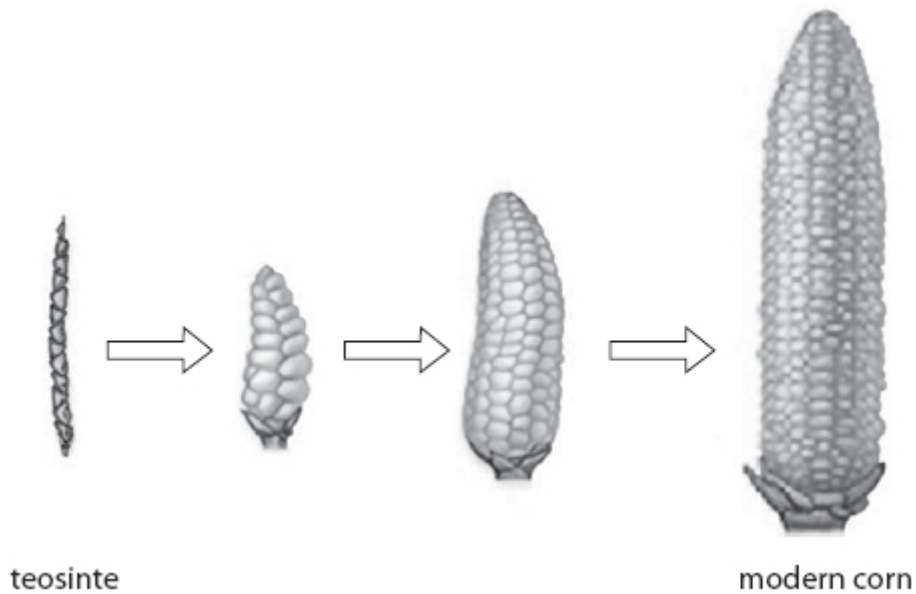


Figure 3

Give reasons why native Americans selectively bred teosinte.

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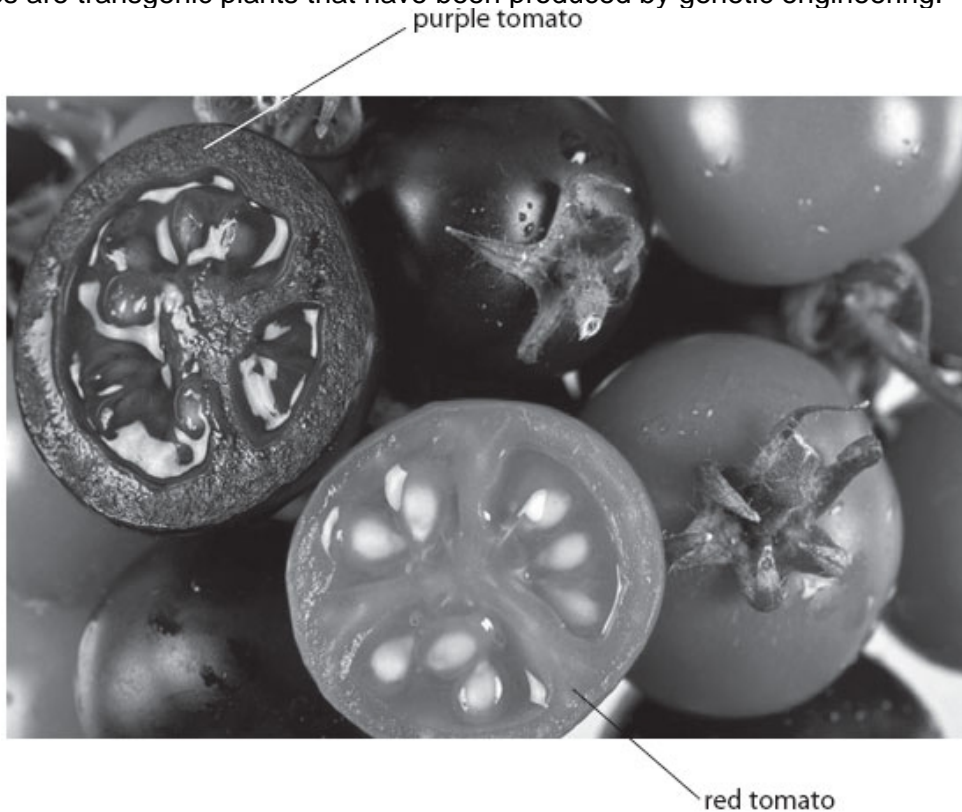
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(Total for question = 2 marks)

Q29.

Purple tomatoes are transgenic plants that have been produced by genetic engineering.



(i) As a result of genetic modification, these tomatoes produce a new substance which has health benefits and turns the tomatoes purple.
Name this substance.

(1)

.....
(ii) What is inserted into the DNA of another plant to make it transgenic?

Put a cross () in the box next to your answer.

(1)

- A a gene from another species
- B a gene from the same species
- C chromosomes from the same species
- D proteins from another species

Q30.

The dodo was a flightless bird which is now extinct.
The photograph shows the skeleton of a dodo.



(a) (i) Explain why the dodo was placed in the kingdom Animalia.

(2)

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(ii) The dodo was classified as a chordate.

Using the information in the photograph, explain why scientists classified the dodo into the phylum Chordata.

(1)

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(iii) The binomial name for the dodo is *Raphus cucullatus*.

Complete the sentence by putting a cross () in the box next to your answer.

The name *Raphus* refers to the dodo's

(1)

- A family
- B genus
- C order
- D phylum

(b) The dodo lived on the small island of Mauritius. It became extinct in 1681.

Using your knowledge of natural selection, suggest why the dodo may have become extinct.

(3)

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(c) Complete the sentence by putting a cross () in the box next to your answer.

The formation of a new species due to geographical isolation is called

(1)

- A adaptation
- B competition
- C hybridisation
- D speciation

(d) Describe the causes of variation in a population.

(2)

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(Total for Question = 10 marks)