PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

BIOLOGY



EXAM QUESTION PACK

TOPIC 4: NATURAL SELECTION AND GENETIC MODIFICATION (PAPER 1)

SCORE	PERCENTAGE
/113	%

STEMUP

These questions belong to Pearson Edexcel, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by Pearson Edexcel. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with Pearson Edexcel and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. Pearson Edexcel has not endorsed, approved or been involved in the production of it. Pearson Edexcel and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

Pearson Edexcel publishes its past papers, mark schemes and examiner reports. Always check the current specification at qualifications.pearson.com before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

Figure 1 shows the times when *Homo sapiens* and some of their ancestral species are thought to have lived.

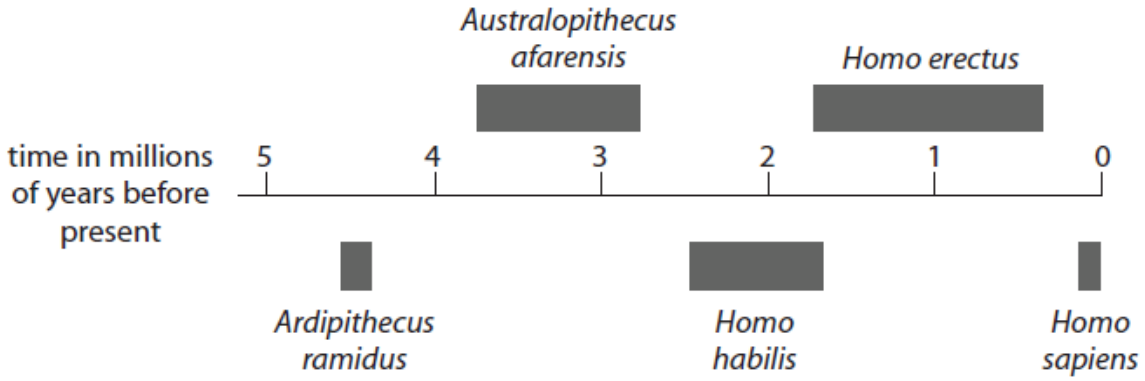


Figure 1

Fossil remains of *Ardipithecus ramidus* were discovered in Ethiopia.

(i) Describe the evidence that scientists might have used to show that *Ardipithecus ramidus* inhabited the Earth earlier than *Homo habilis*.

(2)

.....

.....

.....

.....

(ii) Suggest an explanation for the extinction of *Homo habilis*.

(2)

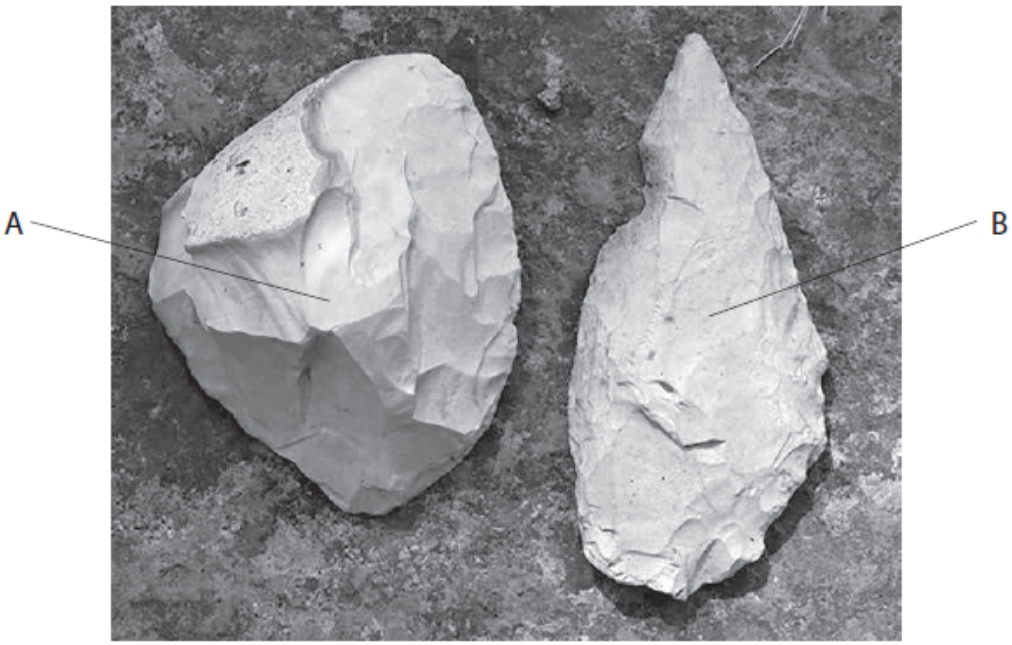
.....

.....

.....

.....

(iii) Figure 2 shows two stone tools, one used by *Homo habilis* and one used by *Homo erectus*.



(Source: Frederic Surmely/look at sciences/Science Photo Library)

Figure 2

Explain which stone tool was most likely to be used by *Homo erectus*.

Use information from Figure 1 and Figure 2.

(2)

.....

.....

.....

.....

(Total for question = 6 marks)

Q2.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Birds are classified in the domain Eukarya.

(i) Why are the cells from birds described as eukaryotic?

(1)

☒ **A** they have membrane-bound organelles

☒ **B** they do not have nuclei

☒ **C** they have a rigid cell wall

☒ **D** they have a cell membrane

(ii) Give **one** reason why the three domain classification system was proposed.

(1)

.....

.....

.....

(Total for question = 2 marks)

Q3.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

In 2017, a new strain of *Klebsiella pneumoniae* bacteria was discovered that was resistant to 26 different antibiotics.

(i) Explain how *Klebsiella pneumoniae* bacteria developed resistance to antibiotics.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) State how the use of antibiotics could contribute to *Klebsiella pneumoniae* bacteria developing resistance to antibiotics.

(1)

.....

.....

(iii) *Klebsiella pneumoniae* is a prokaryotic cell.

Which is a characteristic feature of a prokaryotic cell?

(1)

☒ **A** it has chloroplasts

☒ **B** it does not have a nucleus

☒ **C** it does not have ribosomes

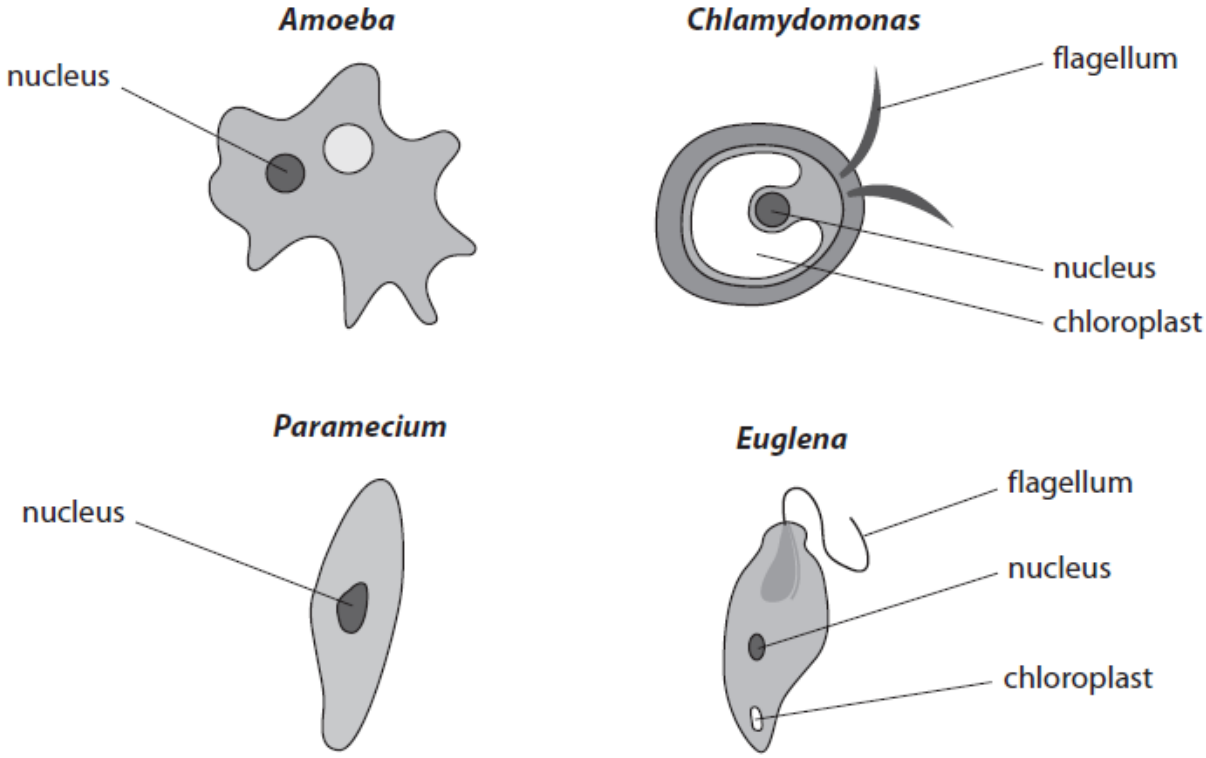
☒ **D** it cannot reproduce without a host

(Total for question = 6 marks)

Q4.

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** Protoctista

☒ **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.

(1)

.....

.....

(b) (i) *Euglena* is unusual because it is both heterotrophic and autotrophic.

Explain how this helps *Euglena* to survive.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

(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.

(2)

.....

.....

.....

.....

.....

(Total for question = 8 marks)

Q5.

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

(3)

.....

.....

.....

.....

.....

.....

.....

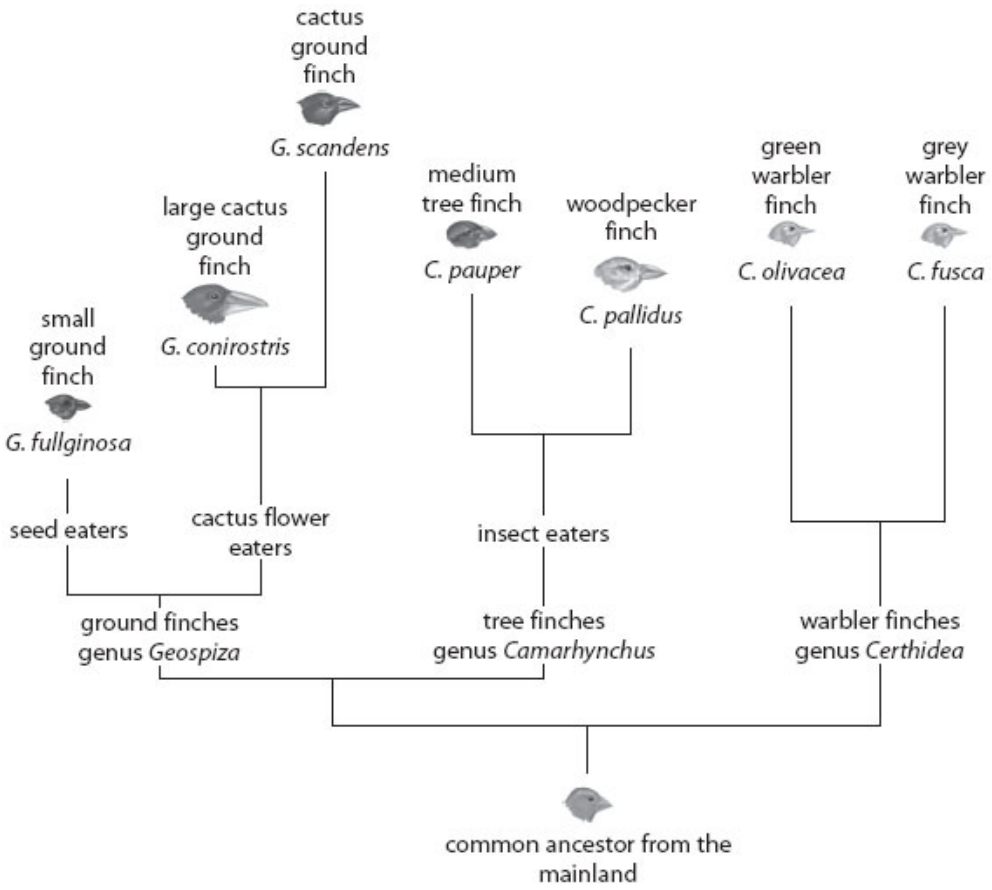
.....

Q6.

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)

genus .....

species .....

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

(2)

.....

.....

.....

.....

(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.

(3)

.....

.....

.....

.....

.....

.....

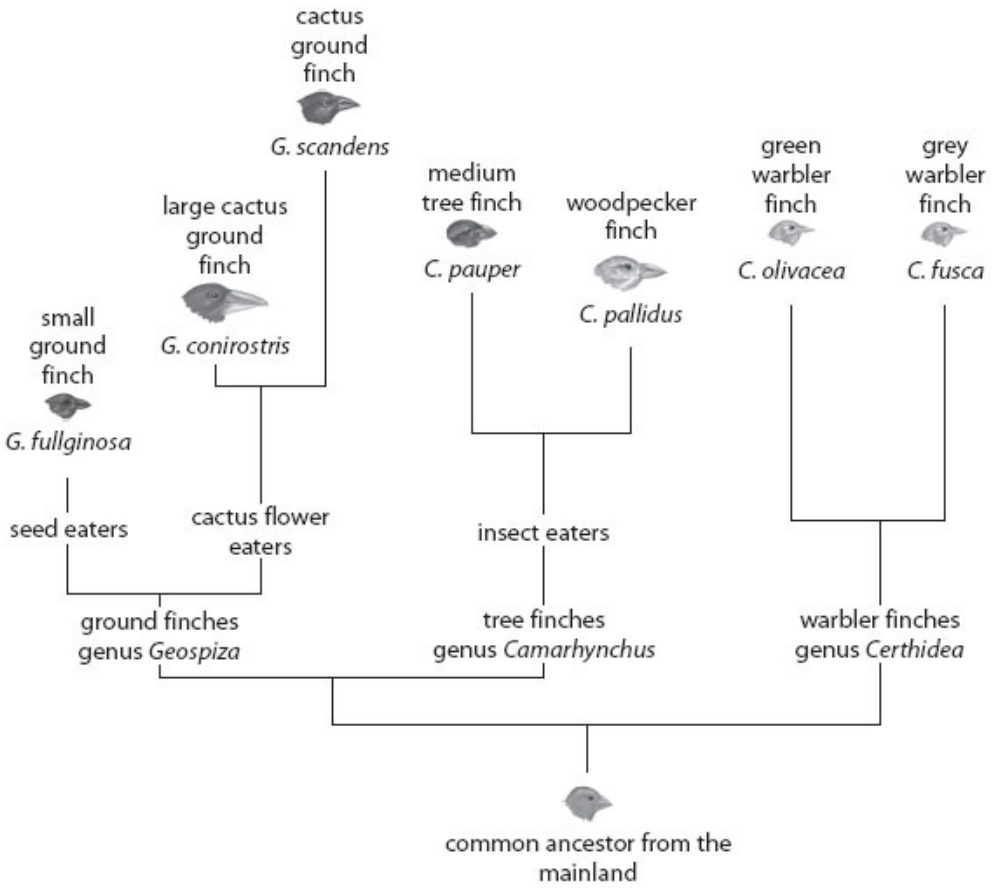
(Total for Question is 8 marks)

Q7.

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)

genus .....

species .....

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

(2)

.....

.....

.....

.....

(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

Q8.

Penicillin, isolated from a fungus, was the first antibiotic used to treat bacterial infections and is still widely used today

Scientists have genetically engineered bacteria to produce large amounts of penicillin.

Describe how scientists would produce a genetically modified bacterium that produces penicillin.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q9.

The population of humans on Earth has increased significantly leading to food shortages.

The growth of drought-resistant crop plants could lead to an increase in food supply.

Describe how drought-resistant crop plants can be produced.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q10.

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.

Describe how selective breeding has produced modern corn.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q11.

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.

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.

(2)

.....

.....

.....

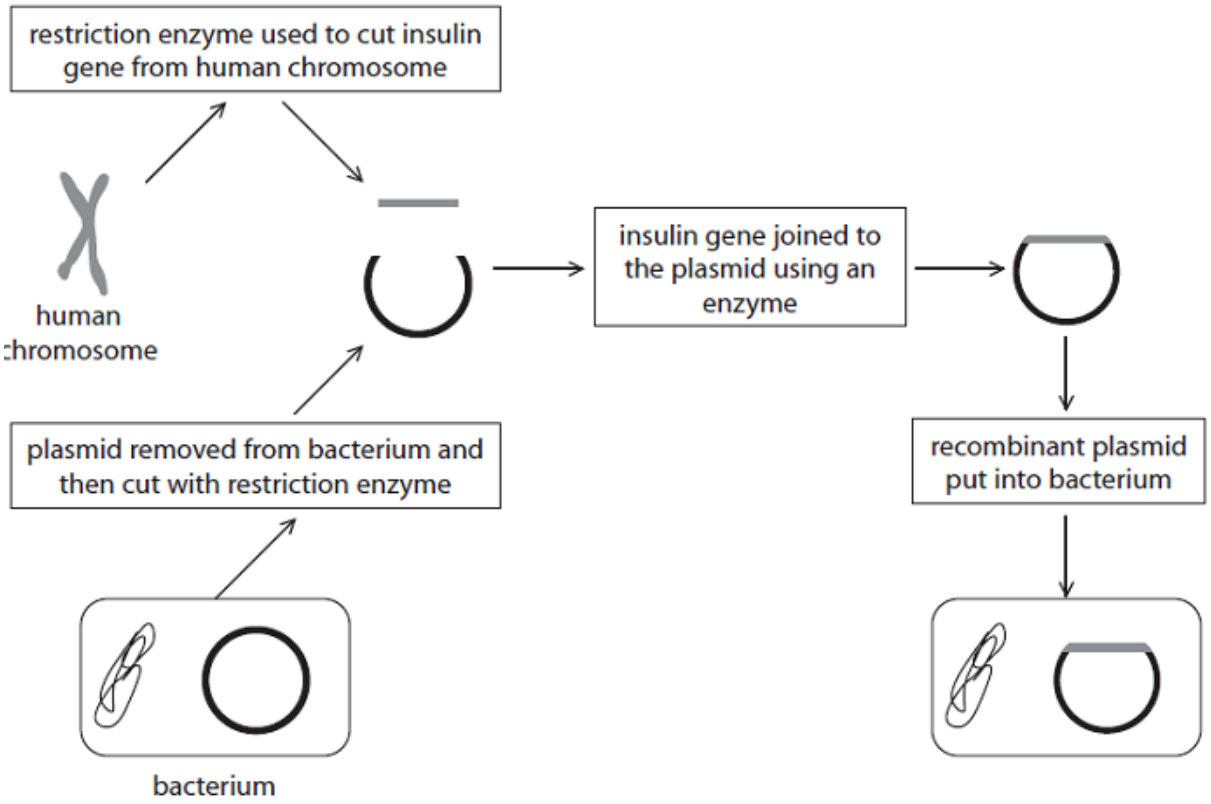
.....

(Total for question = 2 marks)

Q12.

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)

.....

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

(2)

.....

.....

.....

.....

*(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.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

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

(2)

.....

.....

.....

.....

.....

.....

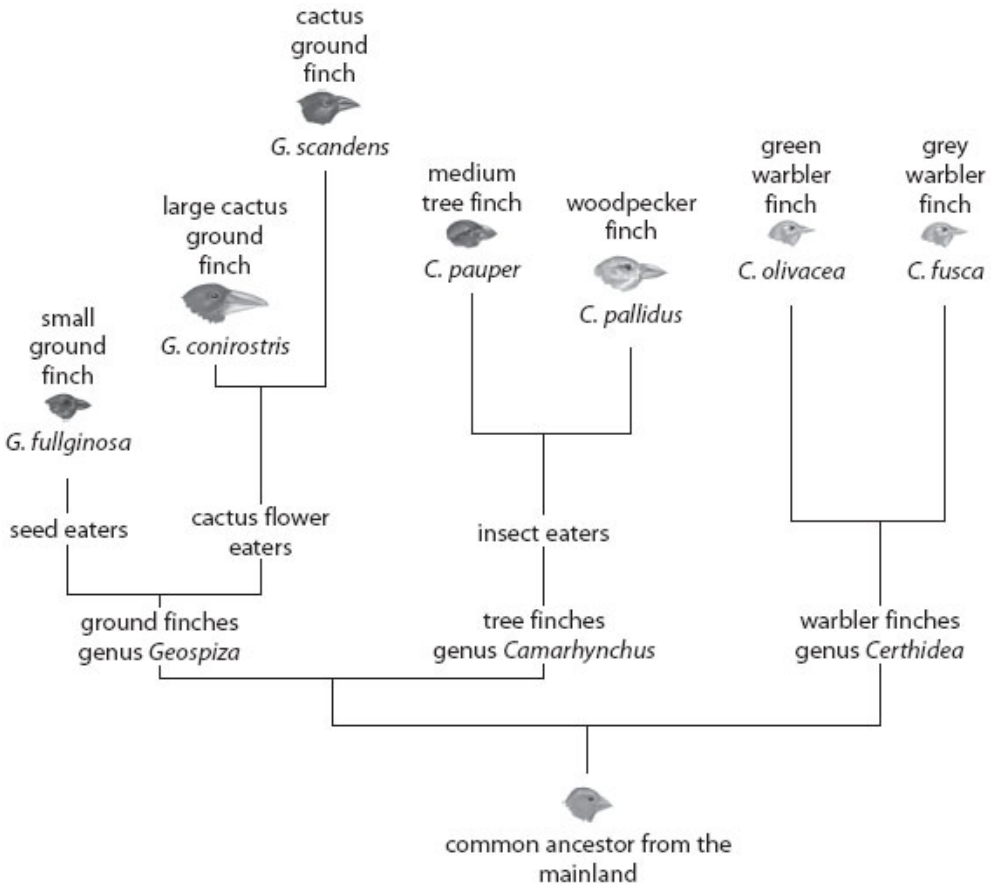
(Total for question = 11 marks)

Q13.

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.



Suggest how these species of finches could have evolved.

(3)

.....

.....

.....

.....

.....

.....

Q14.

Figure 11 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.

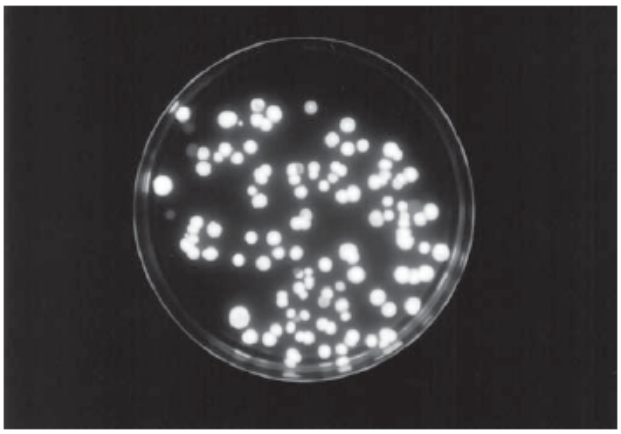


Figure 11

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

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q15.

Yeast cells can be genetically modified to produce a painkiller.

This painkiller is usually obtained from opium poppies.

One method for genetically modifying a yeast cell uses a plasmid containing the desired gene.

(i) Explain how a gene can be inserted into a plasmid.

(2)

.....

.....

.....

.....

.....

.....

(ii) Discuss the possible benefits and risks of producing painkillers from genetically modified yeast cells rather than extracting the painkillers from poppies.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 5 marks)

Q16.

* MRSA is a bacterium that has evolved to become resistant to antibiotics.

With reference to Darwin's theory of evolution by natural selection, explain how MRSA bacteria have evolved to become resistant to antibiotics.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q17.

Scientists think that great tits living now have longer beaks because of the increased use of bird feeders during the last 50 years.

Explain how natural selection could have caused an increase in beak length because of the use of bird feeders.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q18.

Figure 3 shows a plasmid containing the human insulin gene.

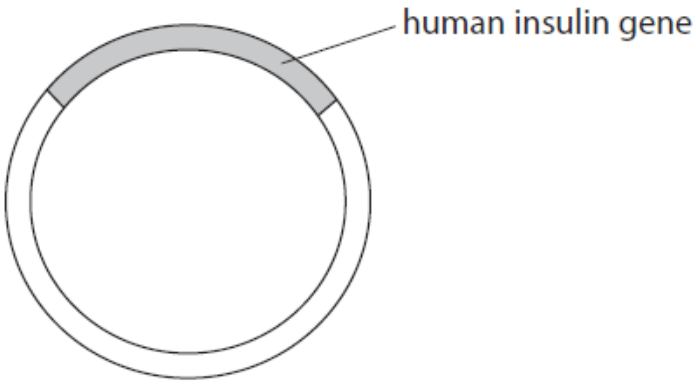


Figure 3

Explain how the human insulin gene can be inserted into a plasmid.

(3)

.....

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q19.

Colistin is an antibiotic used to treat infections in the bloodstream.

Some bacteria are resistant to Colistin.

Explain how these bacteria have become resistant to Colistin.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q20.

Chymosin can be produced by genetically modified bacteria.

Figure 8 shows a bacterial cell.

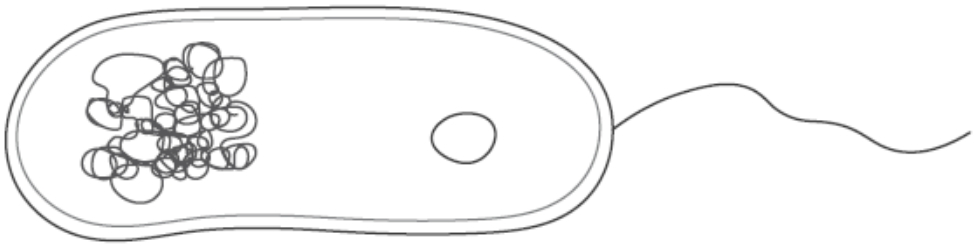


Figure 8

Explain how to genetically modify a bacterial cell to produce chymosin.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 3 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.

Explain why restriction enzymes are used in the process of genetic engineering.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q22.

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.

(3)

.....

.....

.....

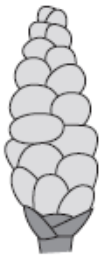
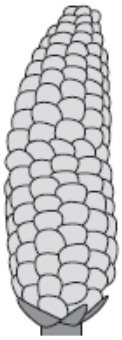
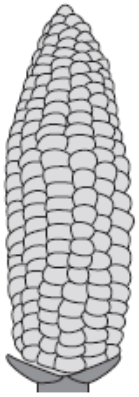
.....

.....

.....

Q23.

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.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

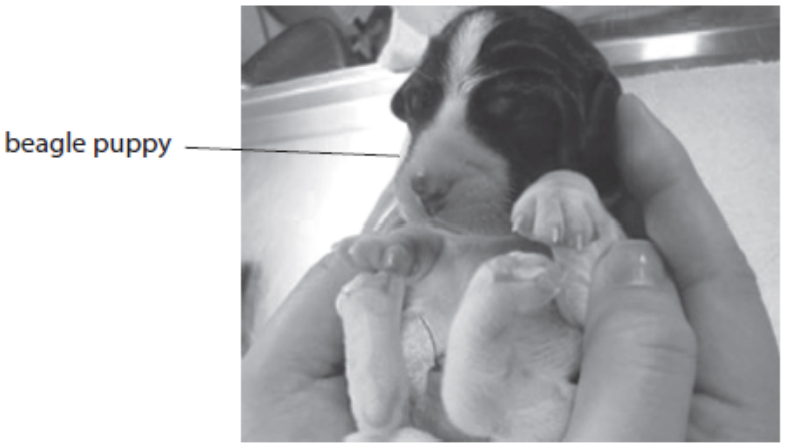
Q24.

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 Tegon.

Tegon glows in the dark when UV light is shone on him.



© 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.

(2)

.....

.....

.....

.....

.....

.....

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

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Q25.

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.

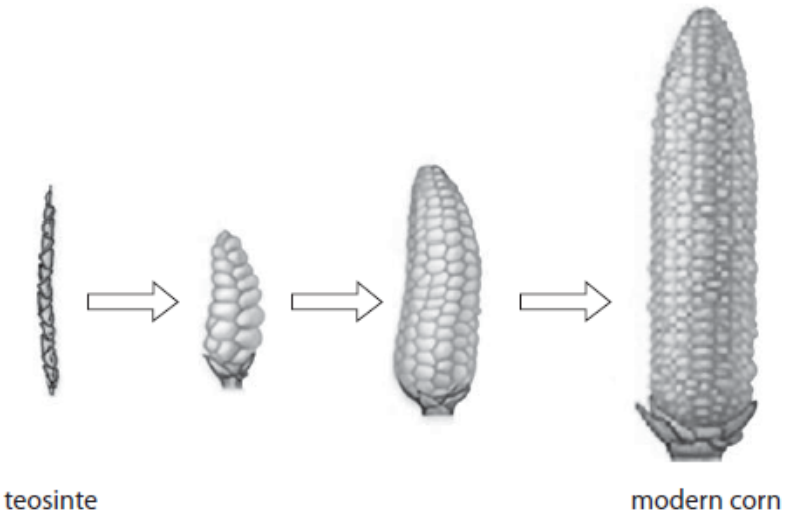


Figure 3

Give reasons why native Americans selectively bred teosinte.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q26.

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)

.....

.....

.....

.....

.....

.....

(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)

.....

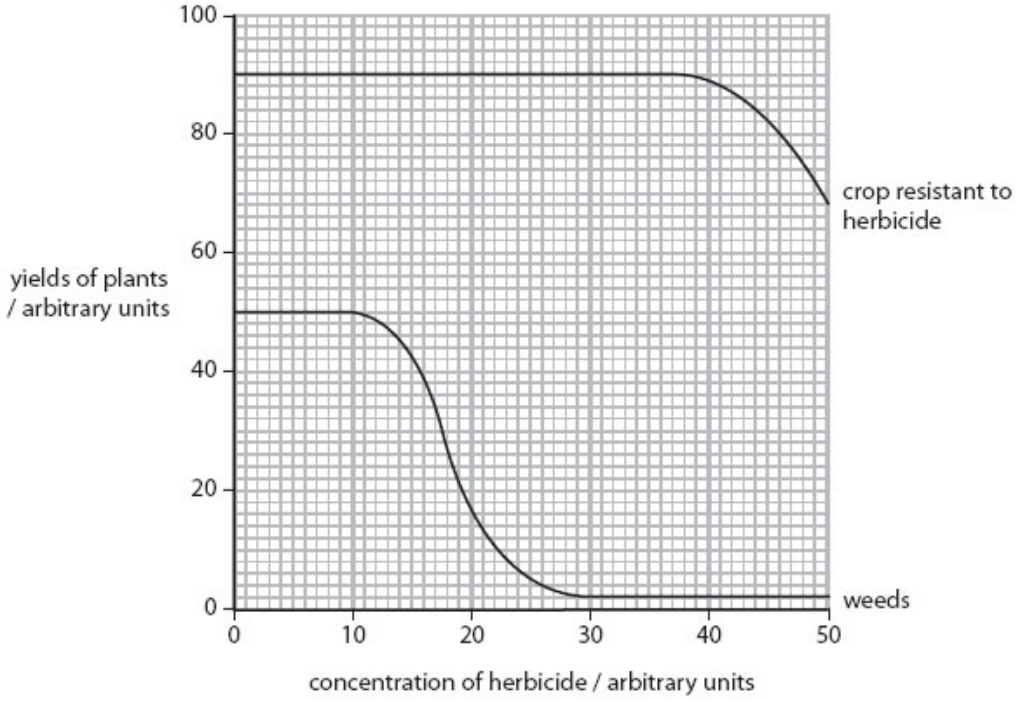
(c) Fields of crops have weeds growing in them.

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)

.....

.....

.....

.....

(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)

.....

.....

(ii) Suggest reasons for this trend.

(2)

.....

.....

.....

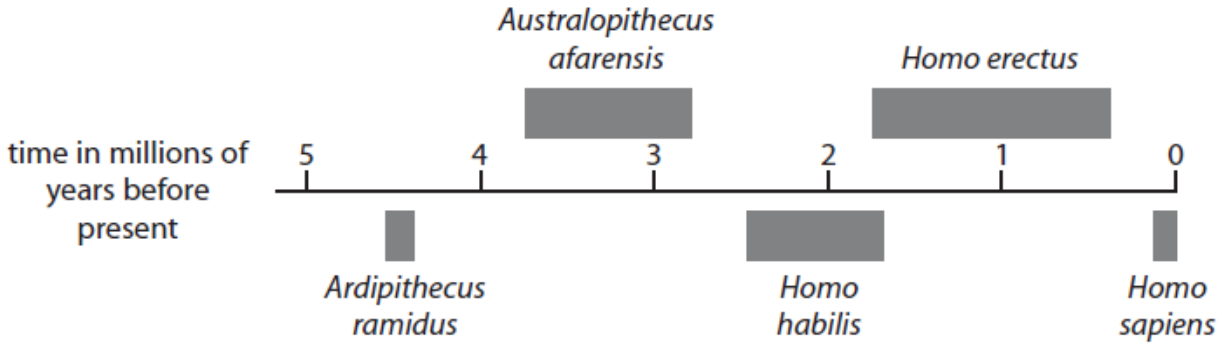
.....

(Total for Question is 10 marks)

Q27.

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 (☒) 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)

.....

(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)

.....

.....

.....

.....

(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)

.....

.....

.....

.....

.....

.....

.....

.....

(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)

.....

.....

.....

.....

.....

(Total for question = 9 marks)

Q28.

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)

.....

.....

.....

.....

.....

Q29.

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

(2)

.....

.....

.....

.....

.....

.....

Q30.

Answer the question with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Organisms can be classified by the five kingdom or three domain method.

(i) What is the name of the domain that plants belong to?

(1)

☒ **A** Eukarya

☒ **B** Archaea

☒ **C** Monera

☒ **D** Protista

(ii) Plant cells contain chloroplasts.

What happens in a chloroplast?

(1)

☒ **A**	oxygen produced	sunlight absorbed by chlorophyll
☒ **B**	carbon dioxide produced	sunlight absorbed by mitochondria
☒ **C**	oxygen produced	sunlight absorbed by mitochondria
☒ **D**	carbon dioxide produced	sunlight absorbed by chlorophyll

(iii) Give a reason why the three domain method of classification has been suggested.

(1)

.....

.....

(Total for question = 3 marks)

Q31.

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

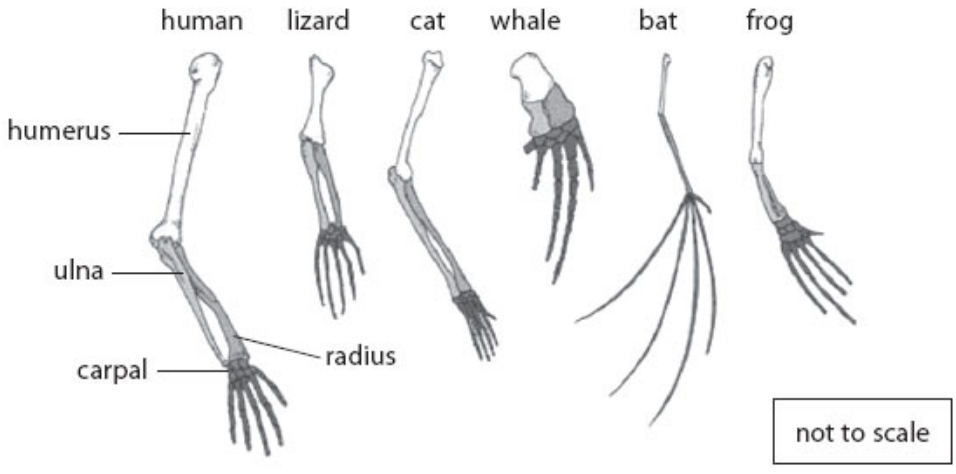
☒ **B** competition

☒ **C** hybridisation

☒ **D** speciation

Q32.

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)

.....

.....

.....

.....

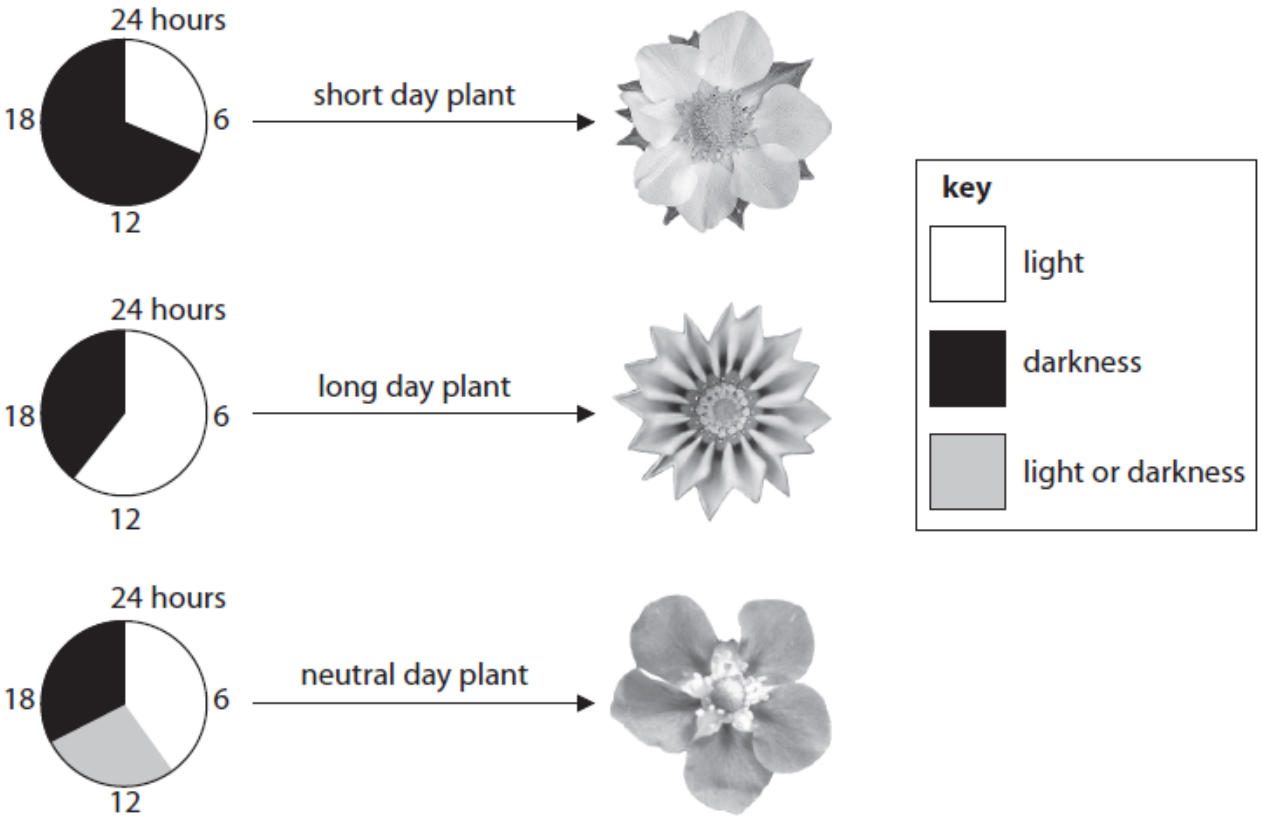
.....

.....

Q33.

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)

.....

.....

(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)

.....

.....

(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)

.....

.....

.....

.....

.....

.....

(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 (☒) in the box next to your answer.

The behaviour associated with most call types is

(1)

☒ **A** aggression

☒ **B** friendship

☒ **C** resting

☒ **D** submission

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

(2)

.....

.....

.....

.....

.....

.....

(Total for question = 11 marks)

Q34.

Resistant organisms

(a) The photograph shows the common rat *Rattus norvegicus*.



State the level of classification for both parts of the binomial name *Rattus norvegicus*.

(2)

Rattus

.....

norvegicus

.....

(b) Some rats have a mutation which enables them to eat the rat poison Warfarin and survive.

Suggest how the use of Warfarin could lead to an increase in the number of rats with this mutation.

(2)

.....

.....

.....

.....

.....

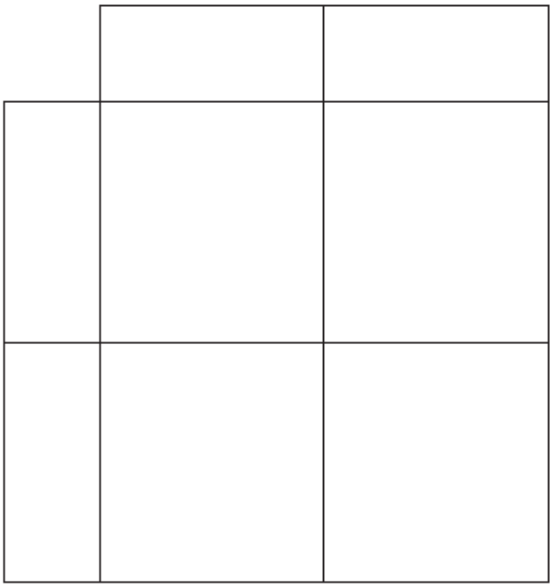
.....

(c) The allele for Warfarin resistance is recessive.

Complete the Punnett square to show how two rats, both heterozygous for Warfarin resistance, could produce Warfarin resistant offspring.

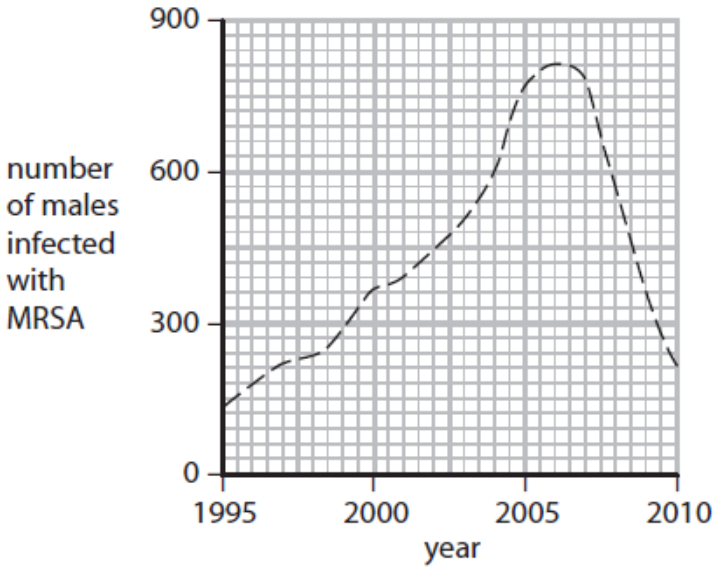
Use **R** and **r** to show the dominant and recessive alleles.

(2)



*(d) Hospitals have introduced programmes to reduce MRSA infections in patients because antibiotics have become less effective.

The graph shows the number of males infected with MRSA during their stay in hospital.



A programme of intensive use of antiseptics in hospitals has been used since 2005.

Use the information given and your own scientific knowledge to explain the trends shown in the graph.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 12 marks)

Q35.

The dodo was a flightless bird which is now extinct.

The photograph shows the skeleton of a dodo.



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

(2)

.....

.....

.....

.....

(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)

.....

.....

(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

Q36.

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)

.....

.....

.....

.....

(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)

.....

.....

(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)

.....

.....

.....

.....

.....

.....

(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)

.....

.....

.....

.....

(Total for Question = 10 marks)