DEV. UNDERSTANDING GENETICS AND EVOLUTION PART 1

Q1.

Our understanding of genetics and inheritance has improved due to the work of many scientists.

(a) Draw **one** line from each scientist to the description of their significant work.

Scientist	Description of significant work
	Carried out breeding experiments on pea plants.
Charles Darwin	
	Wrote 'On the origin of species'.
Alfred Russel Wallance	
	Worked on plant defence systems.
Gregor Mendel	
	Worked on warning colouration in animals.

(3)

(b) In the mid-20th century the structure of DNA was discovered.

What is a section of DNA which codes for one specific protein called?

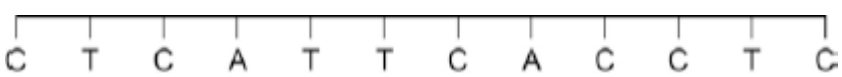
_____

(1)

(c) **Figure 1** shows one strand of DNA.

The strand has a sequence of bases (A, C, G and T).

Figure 1



How many amino acids does the strand of DNA in **Figure 1** code for?

Tick **one** box.

2 ☐

3 ☐

4 ☐

6 ☐

(1)

(d) Mutations of DNA cause some inherited disorders.

One inherited disorder is cystic fibrosis (CF).

A recessive allele causes CF.

Complete the genetic diagram in **Figure 2**.

- Identify any children with CF.
- Give the probability of any children having CF.

Each parent does not have CF.

The following symbols have been used:

D = dominant allele for **not** having CF

d = recessive allele for having CF

Figure 2

		Mother	
		D	d
Father	D	DD	
	d		

Probability of a child with CF = _____

(3)

(e) What is the genotype of the mother shown in **Figure 2**?

Tick **one** box.

Heterozygous ☐

Homozygous dominant ☐

Homozygous recessive ☐

(1)

(Total 9 marks)

Q2.

Charles Darwin proposed the theory of natural selection.

Many people at the time did not accept his theory.

(a) There was a different theory at the same time as Darwin's theory.

The different theory said that changes in an organism during its life could be inherited.

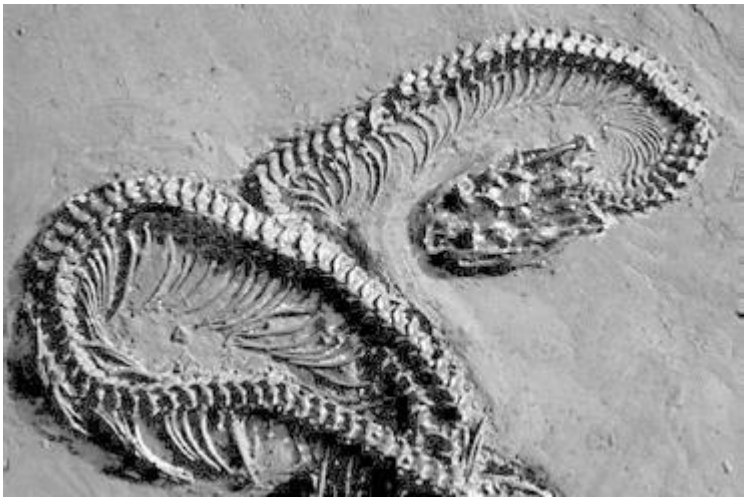
Who proposed this theory?

_____

(1)

(b) Studying fossils helps scientists understand how living things have evolved.

The diagram below shows a fossilised snake.



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Explain how the fossil in the diagram above may have formed.

_____

_____

_____

_____

_____

_____

(3)

(c) There are many types of rat snake in the world.

The table below shows two types of rat snake.

	 © Kazzpix/iStock/Thinkstock	 © Talkir/iStock/Thinkstock
Type of snake	Japanese rat snake	Texas rat snake
Colour of snake	Green	Pale brown
Type of environment	Grass	Dry and dusty

The different types of rat snake have evolved from similar ancestors.

The rat snakes have evolved to to suit their environments.

Explain how the Japanese rat snake evolved to be different from the Texas rat snake.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(d) Many species of snake have become extinct.

Give **one** reason why a species might become extinct.

_____

_____

(1)

(Total 9 marks)

Q3.

Darwin's theory of natural selection states that all living things have evolved from simple life forms.

(a) Use the correct answer from the box to complete the sentence.

three billion	three million	three thousand

Darwin's theory states that life began on Earth _____ years ago.

(1)

(b) Life evolved due to changes in genes. Changes in genes cause variation.

Complete the sentences.

Changes in genes are called _____ .

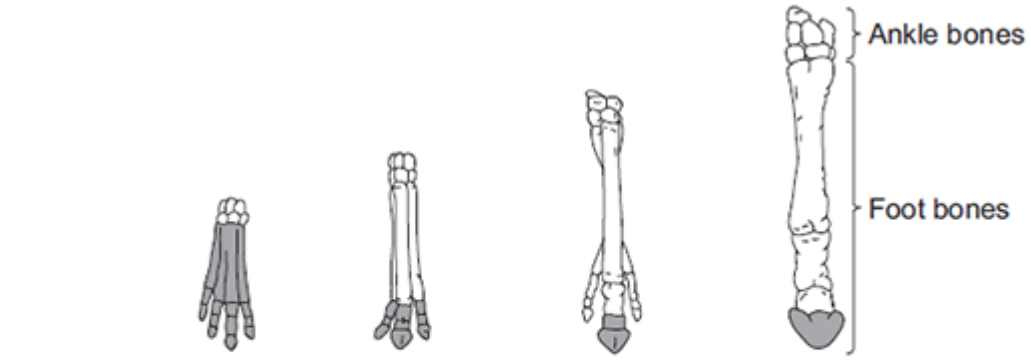
Individuals with characteristics most suited to the environment are more likely to survive and _____ .

(2)

(Total 3 marks)

Q4.

The diagram below shows changes in the foot bones of four ancestors of modern horses over the past 50 million years.



Key: The shaded bones are the bones which touched the ground.

(a) Describe **two** changes to the bones in the feet of horses that have taken place over the past 50 million years.

_____

_____

_____

_____

(2)

(b) *Eohippus* lived in swampy areas with soft mud.

Since this time the ground in the habitat has become drier and harder.

All of the horse ancestors were preyed upon by other animals.

(i) Explain **one** advantage to *Eohippus* of the arrangement of bones in its feet.

_____

_____

_____

_____

(2)

(ii) The changes in the arrangement of the foot bones of horses support Darwin's theory of evolution by natural selection.

Explain how the arrangement of the foot bones of *Eohippus* could have evolved into the arrangement of the foot bones of *Equus.*

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q5.

Over millions of years:

- new groups of organisms have evolved
- other groups of organisms have become extinct.

(a) If an asteroid collided with the Earth, large amounts of dust and water vapour would be thrown up into the air. This would mean less light and heat would reach the Earth's surface from the Sun.

(i) A reduced amount of light and heat could have caused the extinction of plants.

Suggest how.

_____

_____

(1)

(ii) How could the extinction of plants have caused the extinction of some animals?

_____

_____

(1)

(iii) Give **two** reasons, other than collision with an asteroid, why groups of animals may become extinct.

1. _____

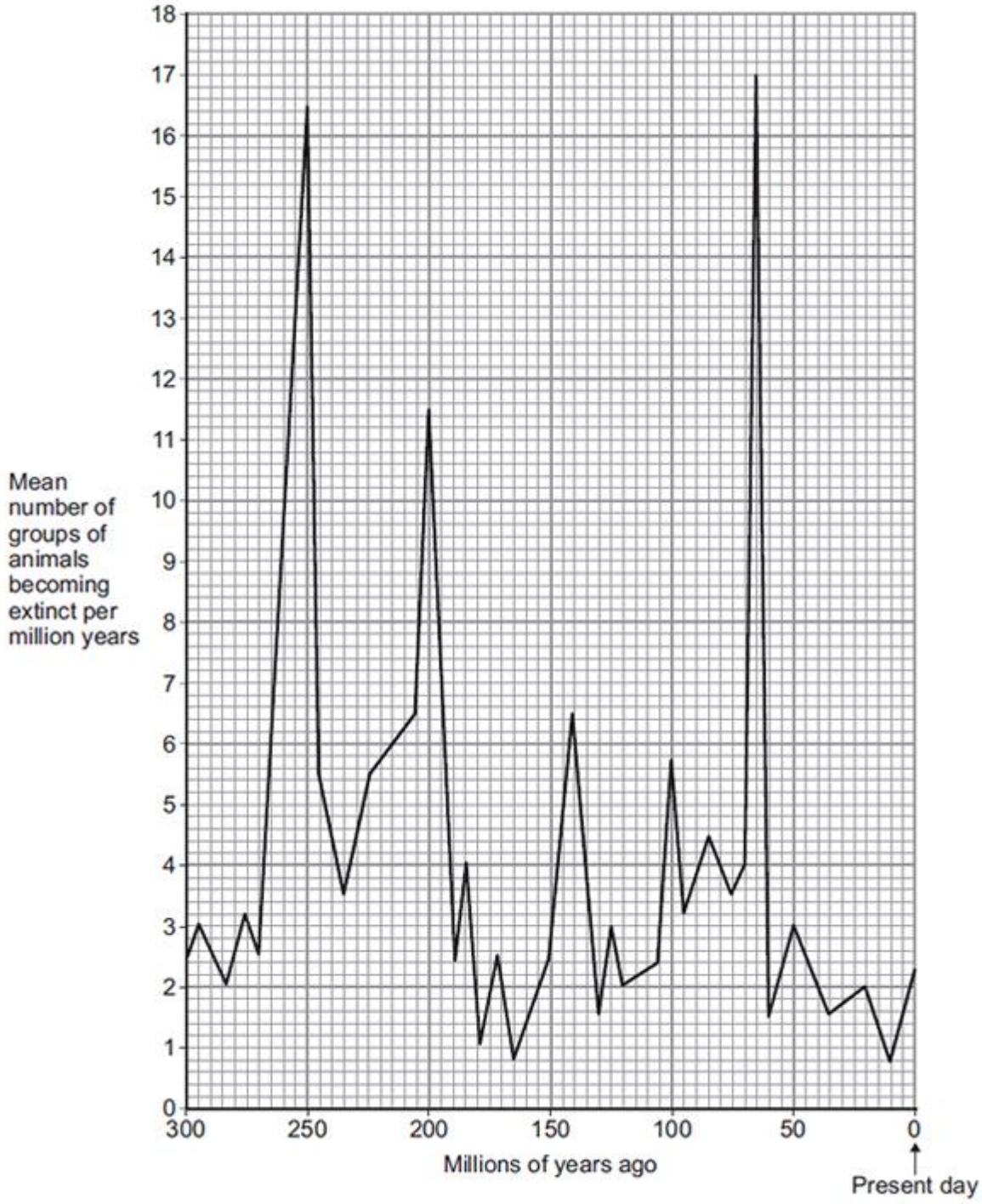
_____

2. _____

_____

(2)

(b) The graph shows how the rate of extinction of groups of animals has varied over the past 300 million years.



(i) If more than 10 groups of animals become extinct in a 1 million year period, scientists call this a 'mass extinction'.

How many mass extinctions occurred over the past 300 million years?

_____

(1)

(ii) How do we know what types of animals lived hundreds of millions of years ago?

_____

_____

(1)

(c) Use information from the graph to answer part (i) and (ii).

(i) How many years ago did the most recent mass extinction of animals occur?

Tick (✔) **one** box.

50 million years ago ☐

65 million years ago ☐

250 million years ago ☐

(1)

(ii) What was the mean number of groups of animals becoming extinct per million years in the most recent mass extinction?

_____ groups per million years

(1)

(iii) Why are scientists not sure how many groups of animals became extinct in the most recent mass extinction?

_____

_____

(1)

(Total 9 marks)

Q6.

Figure 1 is a map showing a group of islands in the Pacific Ocean, near the coast of California, USA.

Figure 1

A species of fox, called the Island Fox, lives on each of the six islands shown in **Figure 1**.

Figure 2 shows an Island Fox.

Figure 2

The foxes on each island are slightly different from those on the other islands.

The Island Foxes are similar to another species of fox, called the Grey Fox.

The Grey Fox lives in mainland California.

(a) Suggest how scientists could prove that the six types of Island Fox belong to the same species.

_____

_____

_____

_____

(2)

(b) Scientists believe that ancestors of the modern Island Fox first colonised what is now Santa Cruz Island during the last Ice Age, approximately 16 000 years ago. At that time, lowered sea levels made the three northernmost islands into a single island and the distance between this island and the mainland was reduced to about 8 km.

(i) How could the Island Fox have developed into a completely different species from the mainland Grey Fox?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)

(ii) Suggest why the Island Foxes have developed into different varieties of the same species instead of six different species.

_____

_____

_____

(1)

(Total 8 marks)

Q7.

(a) Which of the following is the **best** definition of a species?

Tick (✓) **one** box.

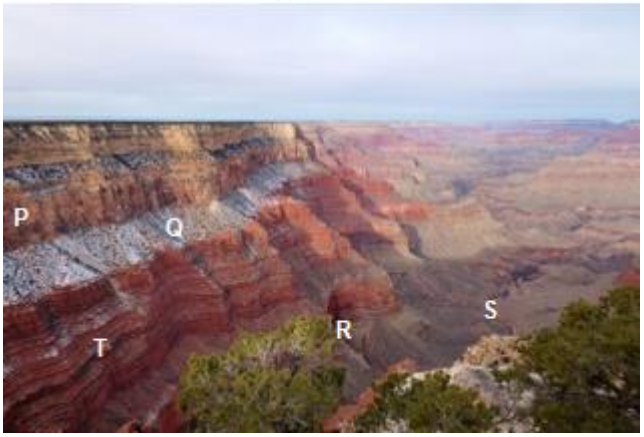
Organisms with many features in common	☐
Organisms that live in the same habitat and eat the same food	☐
Organisms that reproduce together to form fertile offspring	☐

(1)

(b) **Figure 1** is a photograph of the Grand Canyon.

The layers of rock contain fossils.

Figure 1



Scientists found five fossils of different species of animal, **P**, **Q**, **R**, **S** and **T**, at the positions shown in **Figure 1.**

(i) What is the evidence in **Figure 1** that animals **P** and **Q** were alive at the same time?

_____

_____

(1)

(ii) Was animal **R** alive at an earlier time or at a later time than animals **P** and **Q**?

Give the reason for your answer.

_____

_____

(1)

(iii) Which **two** of the following would be evidence that animal **T** may have evolved from animal **S**?

Tick (✓) **two** boxes.

The fossils of animals **S** and **T** have many features in common, but **T** is more complex than **S**. ☐

The fossils of animals **S** and **T** are the same size. ☐

The fossils of animals **S** and **T** have the same skin colour. ☐

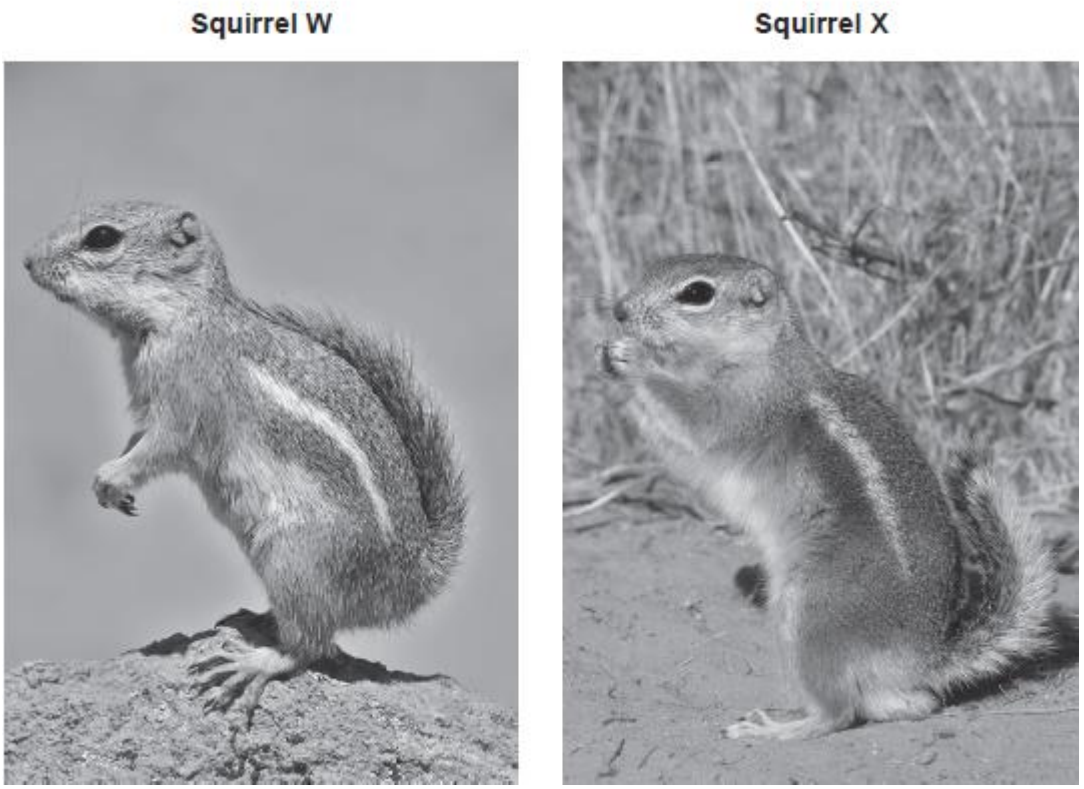
The fossil of animal **S** was found in a deeper layer of rock than the fossil of animal **T**. ☐

The fossil of animal **T** is more similar to the fossil of animal **R** than to the fossil of animal **S**.

(2)

(c) **Figure 2** shows two species of ground squirrel, **W** and **X**.

Figure 2



Squirrel **W** lives on the high ground to the south of the Grand Canyon.

Squirrel **X** lives on the high ground to the north of the Grand Canyon.

The land to the north of the Grand Canyon is about 300 metres higher than the land on the south side. The north side also has lower winter temperatures and has more rain and snow than the south side.

(i) The two species of squirrel are very similar.

Describe **one** way, which you can see in **Figure 2**, in which squirrel **X** is different from squirrel **W**.

_____

_____

(1)

(ii) The Grand Canyon was formed about 6 million years ago.

Explain how the two different species of squirrel could have developed from a common ancestor.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(iii) Squirrels **W** and **X** are separate species, but they are still very similar.

Suggest why the two species have **not** become more different over time.

_____

_____

_____

_____

(2)

(Total 14 marks)

Q8.

In the 1800s, Charles Darwin visited the Galapagos Islands. On the islands he found many different species of bird called finches. Darwin thought that all the different finch species had evolved from one species of finch that had reached the islands many years before.

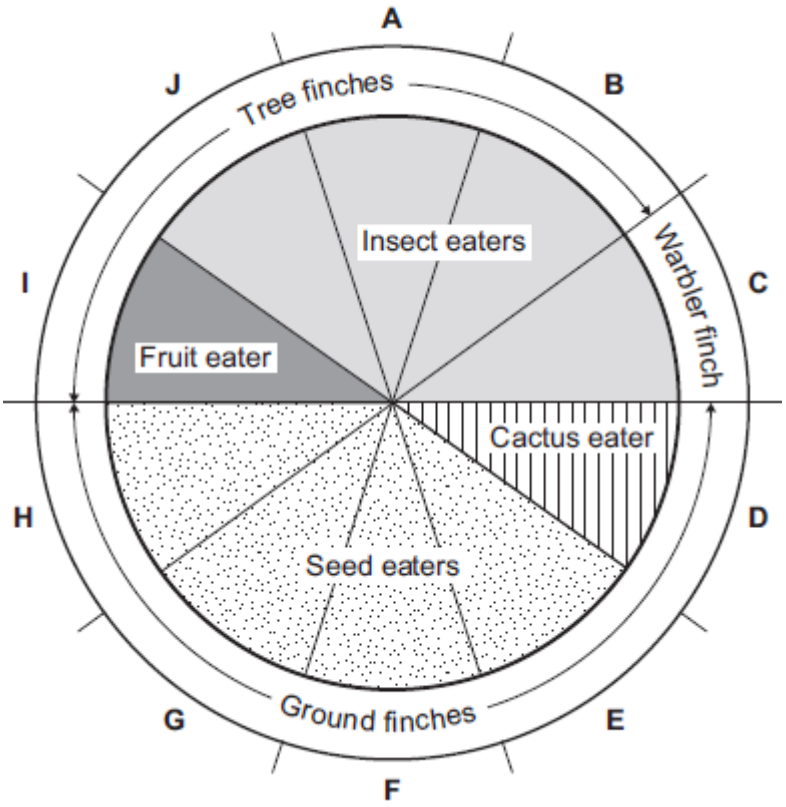
(a) Complete the following sentence.

Darwin suggested the theory of evolution by natural

_____

(1)

(b) The pie chart shows information about ten species of finch, **A − J**.



(i) How many of the species of finch eat insects?

Draw a ring around the correct answer.

4 **5** **6**

(1)

(ii) Describe finch species **G**.
Use **only** information from the pie chart.

_____

_____

_____

_____

(2)

(c) When Darwin returned to the UK very few people believed his theory of evolution.

A different scientist suggested that the changes that occur in an organism during its lifetime can be inherited by its offspring.

What was the name of this scientist?

Tick (✓) **one** box.

Lamarck ☐

Mendel ☐

Semmelweis ☐

(1)

(Total 5 marks)

Q9.

Antibiotics can be used to protect our bodies from pathogens.

(a) What is a pathogen?

_____

_____

(1)

(b) Bacteria may become resistant to antibiotics.

How can doctors reduce the number of bacteria that become resistant to antibiotics?

_____

_____

_____

_____

(2)

(c) Scientists grow microorganisms in industrial conditions at a higher temperature than is used in school laboratories.

(i) Which temperature would be most suitable for growing bacteria in industrial conditions?

Draw a ring around the correct answer.

25 °C **40 °C** **100 °C**

(1)

(ii) What is the advantage of using the temperature you gave in part (c)(i)?

_____

_____

(1)

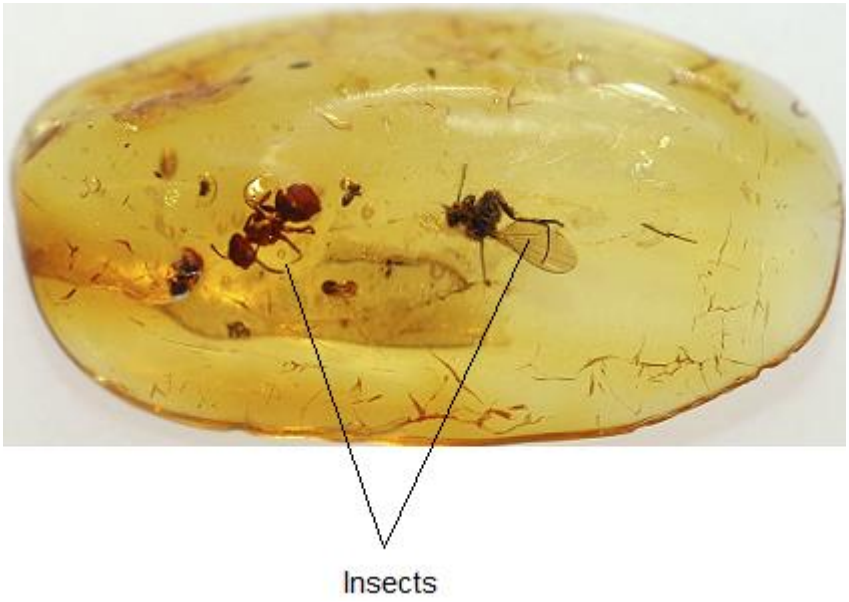
(Total 5 marks)

Q10.

Fossils give us information about organisms from a long time ago.

(a) Amber is a solid, glass-like material. Amber is formed from a thick, sticky liquid which oozes out of pine trees.

The image shows two fossil insects in amber.



(i) Suggest how the insects came to be preserved in the amber.

_____

_____

_____

_____

(2)

(ii) Give **two** other ways fossils are formed.

1. _____

_____

2. _____

_____

(2)

(b) The fossil record shows that many organisms, including the dinosaurs, became extinct 65 million years ago.

One theory was that volcanic activity might have caused this mass extinction. Many scientists believe that this extinction was caused when an asteroid collided with the Earth.

(i) A new scientific theory may replace an old theory.

Why might this happen?

Tick (✓) **one** box.

Evidence from amber is unreliable. ☐

Internet evidence is more reliable than fossil evidence. ☐

New technology provides more valid evidence. ☐

(1)

(ii) Give **three** reasons, other than volcanic activity and collision with an asteroid, why a species may become extinct.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(Total 8 marks)

Q11.

(a) Evidence about extinct species of animals and plants comes from fossils.

Below is a photograph of a fossil of a bird-like animal called *Archaeopteryx.* *Archaeopteryx* lived about 150 million years ago.

(i) Suggest how the fossil of *Archaeopteryx* was formed.

_____

_____

_____

_____

(2)

(ii) Scientists have found other fossils of the ancestors of modern birds, but the fossil record is very incomplete.

Suggest **two** reasons why there are gaps in the fossil record.

1. _____

_____

2. _____

_____

(2)

(b) There are many different species of bird on the Earth today.

Describe how these different species may have evolved from an ancestor such as *Archaeopteryx*.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

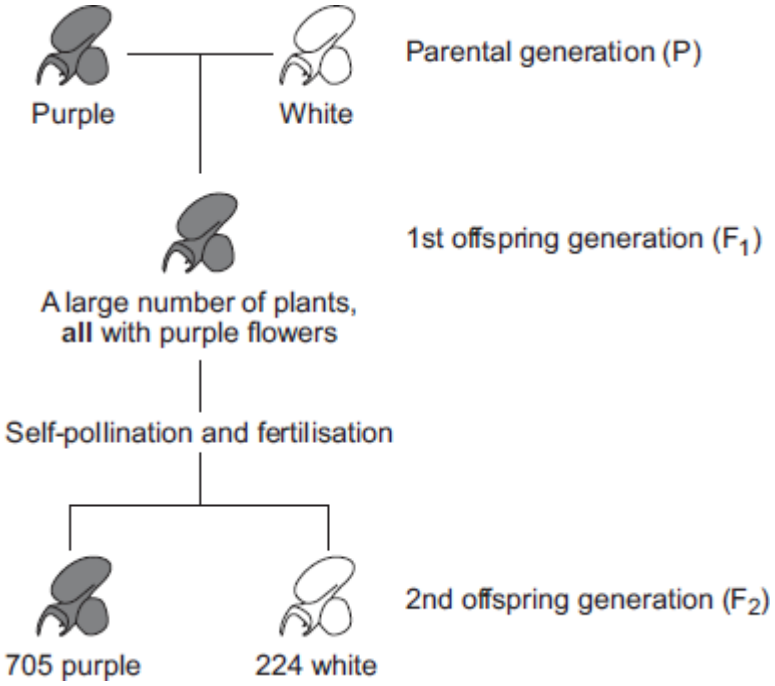
(4)

(Total 8 marks)

Q12.

In 1866, Gregor Mendel published the results of his investigations into inheritance in garden pea plants.

The diagram below shows the results Mendel obtained in one investigation with purple-flowered and white-flowered pea plants.



(a) (i) Calculate the ratio of purple-flowered plants to white-flowered plants in the F_2 generation.

Ratio of purple : white = _____

(1)

(ii) There was a total of 929 plants in the F_2 generation.

Mendel thought that the production of a large number of offspring plants improved the investigation.

Explain why.

_____

_____

_____

_____

(2)

(b) (i) Some of the plants in the diagram are homozygous for flower colour and some are heterozygous.

Complete the table to show whether each of the plants is homozygous or heterozygous. For each plant, tick (✓) **one** box.

	Homozygous	**Heterozygous**
Purple-flowered plant in the P generation		
White-flowered plant in the P generation		
Purple-flowered plant in the F_1 generation		

(2)

(ii) Draw a genetic diagram to show how self-pollination of the F_1 purple-flowered plants produced mainly purple-flowered offspring in the F_2 generation together with some white-flowered offspring.

Use the following symbols:

N = allele for purple flower colour
n = allele for white flower colour

(3)

(c) When Mendel published his work on genetics, other scientists at the time did not realise how important it was.

Suggest **two** reasons why.

1. _____

_____

2. _____

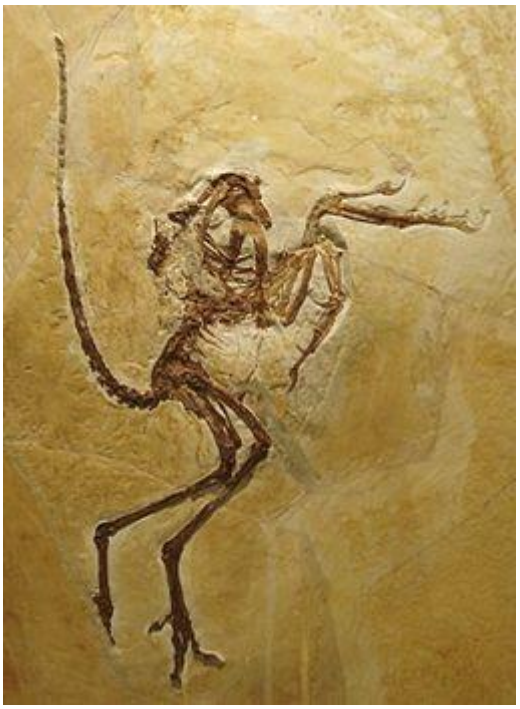
_____

(2)

(Total 10 marks)

Q13.

The photograph shows a fossil of a prehistoric bird called *Archaeopteryx*.



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(a) Describe **three** ways fossils can be made.

_____

_____

_____

_____

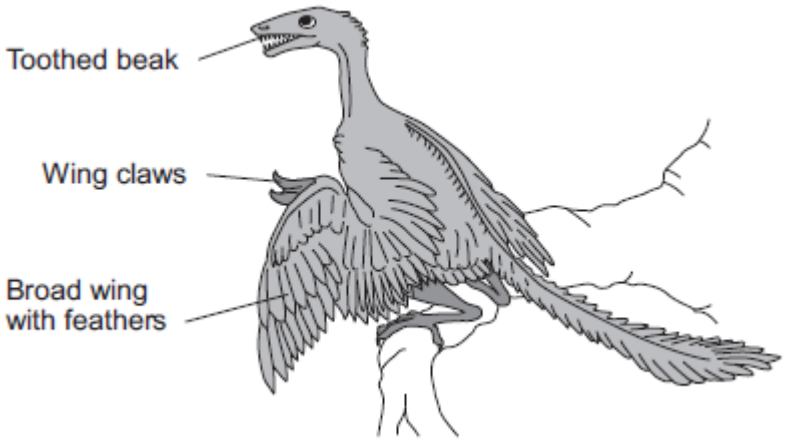
_____

_____

(3)

(b) The drawing shows what an *Archaeopteryx* might have looked like when it was alive.

Scientists think that *Archaeopteryx* was a predator.



(i) Look at the drawing.

Write down **three** adaptations that might have helped *Archaeopteryx* to catch prey.

How would **each** adaptation have helped *Archaeopteryx* to catch prey?

Adaptation 1 _____

How it helps _____

_____

Adaptation 2 _____

How it helps _____

_____

Adaptation 3 _____

How it helps _____

_____

(3)

(ii) *Archaeopteryx* is now extinct.

Give **two** reasons why animals may become extinct.

1. _____

_____

2. _____

_____

(2)

(Total 8 marks)

Q14.

Darwin's theory of evolution states that all species of living things have evolved from simple life forms.

Darwin's theory was published in 1859.

(a) Give **two** reasons why Darwin's theory was only slowly accepted.

_____

_____

_____

_____

(2)

(b) Darwin observed birds called finches on the Galapagos Islands, 1000 km from the coast of South America.

He saw that the birds were similar to, but not the same as, birds he had seen on the mainland of South America.

Recent evidence suggests that 13 different species of finch on the islands evolved from 1 species of finch that arrived from the mainland about 1 million years ago.

Describe how a new finch species may have evolved from the original species of finch that arrived from the mainland.

_____

_____

_____

_____

_____

_____

_____

_____

_____

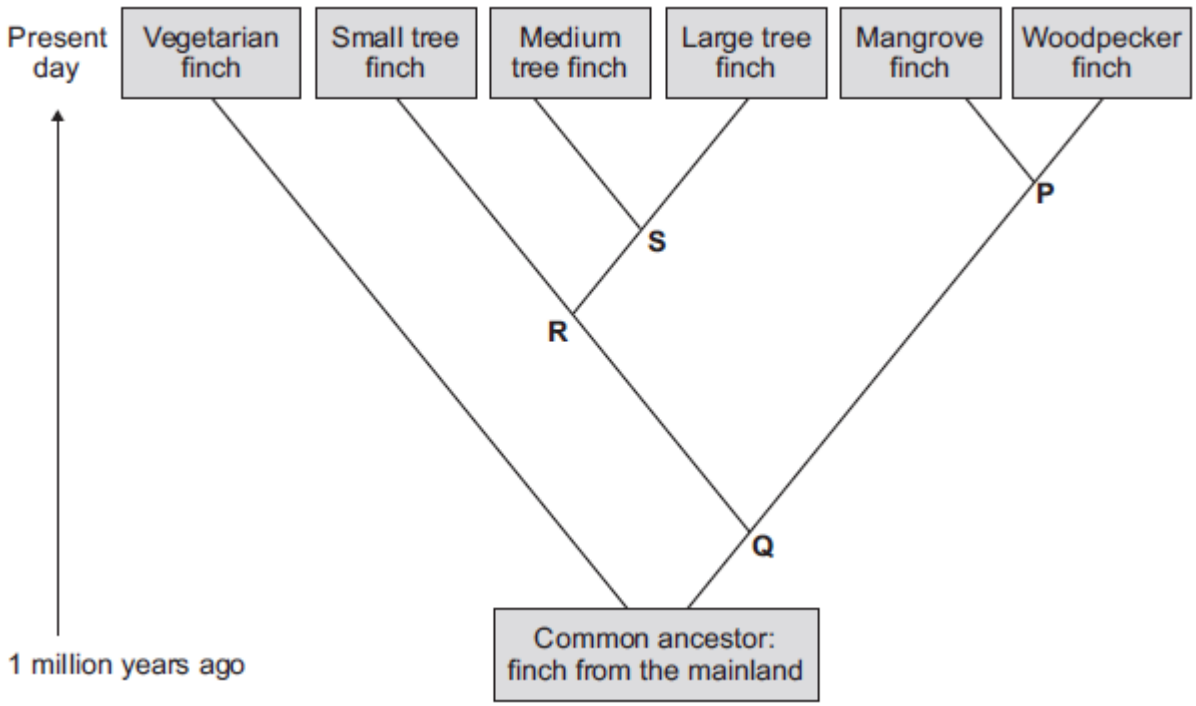
_____

_____

_____

(4)

(c) The diagram below shows the evolutionary tree for some Galapagos finches.



(i) Which type of present-day finch is **least** closely related to all the others?

_____

(1)

(ii) Which branching point, **P, Q, R** or **S**, on the diagram above shows the most recent common ancestor of all the **tree finches**?

Write the correct answer in the box. ☐

(1)

(iii) Which **two** finches have the most recent common ancestor?

1. _____

2. _____

(1)

(Total 9 marks)

Q15.

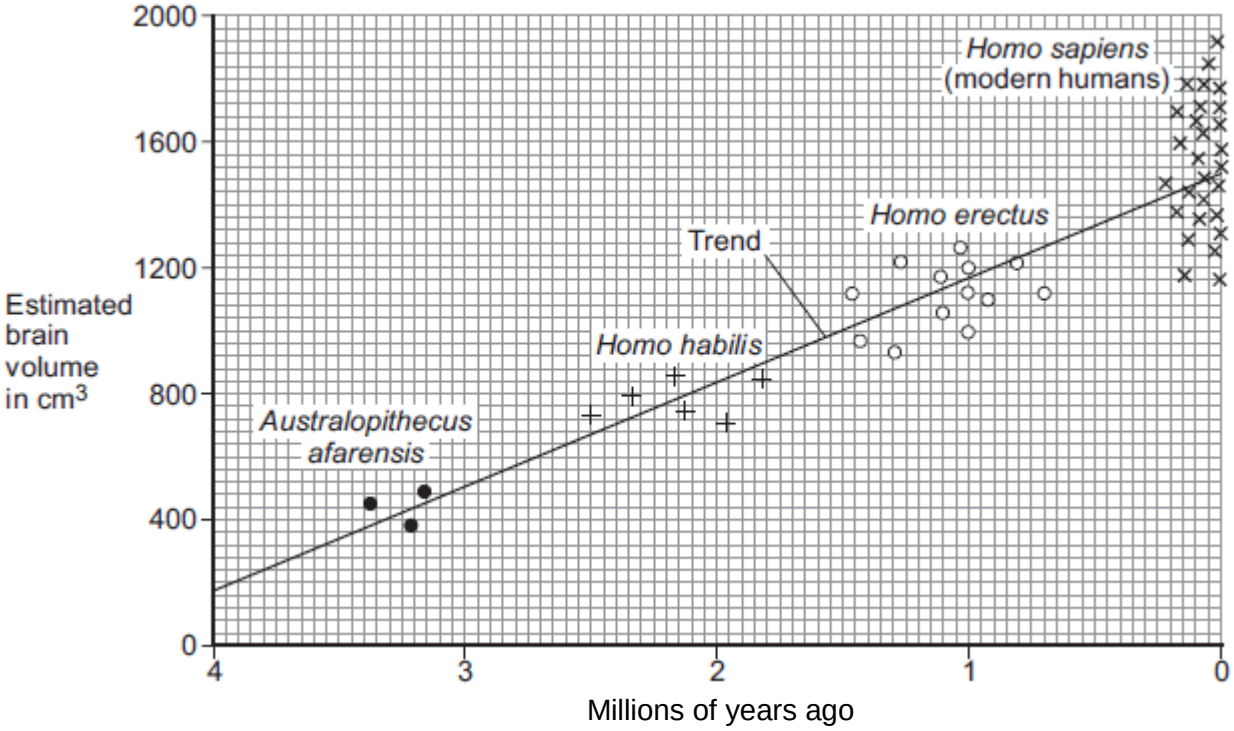
This question is about evolution in humans.

The graph shows:

- the estimated brain volume of different species of humans
- the time when the different species existed on Earth.

The data is plotted for modern humans (Homo sapiens) and for three types of extinct

ancestors of humans.



Key
Each point plotted on the graph shows the estimate for one human.

(a) (i) As humans evolved, their brain volume changed.

What has happened to human brain volume over the past 4 million years?

_____

_____

(1)

(ii) Why is the evidence for estimated brain volume for *Homo sapiens* stronger than the evidence for *Australopithecus afarensis*?

_____

_____

(1)

(b) In a book, the brain volume of a different species, *Australopithecus africanus*, is stated to be about 600 cm^3.

Use evidence from the graphic above to estimate when *Australopithecus africanus* lived on Earth.

Estimate = _____ million years ago

(1)

(c) Scientists believe that modern humans evolved by natural selection from *Australopithecus afarensis.*

(i) Complete the following sentence.

In the nineteenth century, the scientist who suggested the theory of evolution

by natural selection was Charles _____ .

(1)

(ii) In the nineteenth century, many people did not accept this scientist's theory.

Give **one** reason why.

_____

_____

(1)

(Total 5 marks)

Q16.

The MMR vaccine is used to protect against measles.

(a) Apart from measles, which **two** other diseases does the MMR vaccine protect against?

_____ and _____

(1)

(b) Read the information.

> Measles is a dangerous disease caused by a virus.
> Normally, MMR vaccinations are given at 1 year old and again at 4 years old.
> Each vaccination is 90% effective in protecting against the measles virus.
>
> In April 2013, there were 630 cases of measles in children aged 4 and over in a small area of the UK. Of these cases, 504 children had not been vaccinated against MMR at all and only a few had been given a second vaccination.

(i) Calculate the percentage of the children who caught measles in April 2013 who had **not** been vaccinated against MMR.

_____

_____

_____

Percentage = _____

(2)

(ii) Suggest **one** advantage to the population as a whole of children having the second MMR vaccination.

_____

(1)

(c) (i) What does a vaccine contain?

_____

_____

(1)

(ii) Explain how a vaccination prevents infection.

_____

_____

_____

_____

_____

_____

_____

(3)

(d) (i) Antibiotics can only be used to treat some infections.

Explain why antibiotics **cannot** be used to treat measles.

_____

_____

_____

_____

(2)

(ii) Why do antibiotics become less useful at treating an infection if the antibiotic is overused?

_____

_____

(1)

(Total 11 marks)

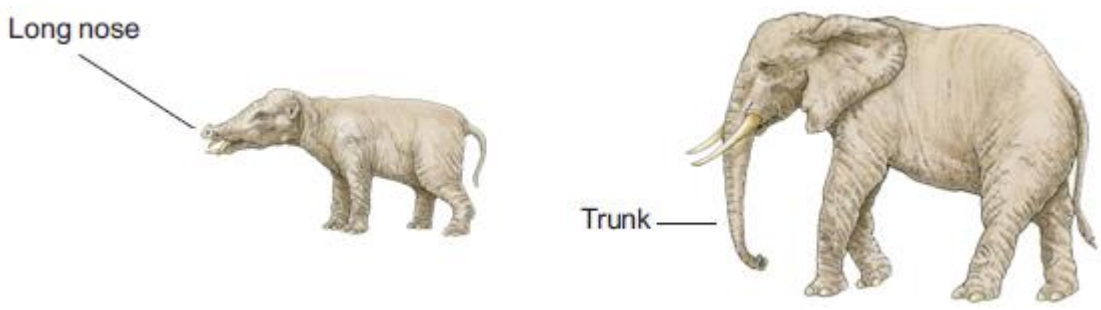
Q17.

The image below shows:

- *Phiomia*, an ancestor of elephants
- a modern African elephant.

Phiomia lived about 35 million years ago.

Phiomia **African elephant**



Both *Phiomia* and the African elephant reach up into trees to get leaves.

In the 1800s, Darwin and Lamarck had different theories about how the long nose of *Phiomia* evolved into the trunk of the African elephant.

(a) (i) Use Darwin's theory of natural selection to explain how the elephant's trunk evolved.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(ii) Lamarck's theory is different from Darwin's theory.

Use Lamarck's theory to explain how the elephant's trunk evolved.

_____

_____

_____

_____

(2)

(b) (i) In the 1800s, many scientists could **not** decide whether Lamarck's theory or Darwin's theory was the right one.

Give **two** reasons why.

1. _____

_____

2. _____

_____

(2)

(ii) Before the 1800s, many people had a different idea to explain where all the living things on Earth came from.

What idea was this?

_____

_____

(1)

(Total 9 marks)

Q18.

Figure 1 shows a fossil of a sea animal called a Plesiosaur.
The Plesiosaur was alive about 135 million years ago.

Figure 1

By Andy Dingley (Own work) [CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

(a) How can fossils give evidence for evolution?

Tick (✓) **one** box.

Newer fossils are simpler than older fossils. ☐

Fossils show change over time. ☐

All fossils show the bones of animals. ☐

(1)

(b) Plesiosaurs lived in the sea. There was mud at the bottom of the sea.

Suggest how the fossil shown in **Figure 1** may have been formed after the animal died.

_____

_____

_____

_____

_____

_____

(3)

(c) **Figure 2** shows what scientists think a living Plesiosaur may have looked like.

Figure 2

Scientists think that the Plesiosaur had smooth skin, with no scales.

The scientists **cannot** be certain what the skin of a Plesiosaur was like.
Suggest why.

_____

_____

(1)

(d) Plesiosaurs are now extinct.

Give **two** possible reasons why.

1. _____

_____

2. _____

_____

(2)

(Total 7 marks)

Q19.

(a) Fossils provide evidence for what early life forms were like. From the evidence, scientists think that life began on Earth more than 3 billion years ago.

Many early life forms were soft-bodied.
Explain why this makes it difficult for scientists to be certain about what these early life forms were like.

_____

_____

_____

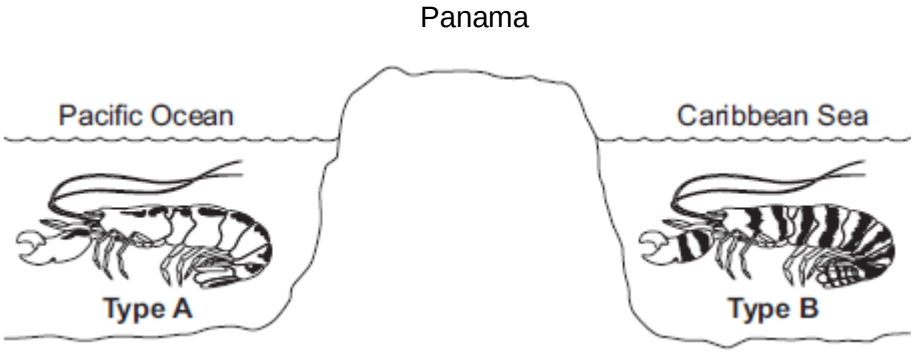
_____

_____

(2)

(b) The illustration below shows two types of pistol shrimp.

The shrimps live in shallow, tropical seas on opposite sides of Panama.



Not to scale

Scientists put one **Type A** shrimp and one **Type B** shrimp together in a tank of seawater.
The two types of shrimp snapped their claws aggressively at each other.
They did not mate.

The scientists said that this was evidence for the **Type A** and **Type B** shrimps being classified as two different species.

(i) Give **one** reason why the scientists' opinion may be correct.

_____

_____

(1)

(ii) Suggest **two** reasons why the scientists' opinion may **not** be correct.

1. _____

_____

2. _____

_____

(2)

(c) Panama is a narrow strip of land which today joins North America and South America.
It was formed by land moving up from beneath the sea. Panama has separated the Pacific Ocean and the Caribbean Sea for the past 3 million years.

Explain how two different species of pistol shrimp could have developed from an ancestral species of shrimp.

_____

_____

_____

_____

_____

_____

(6)

(Total 11 marks)

Q20.

Viruses and bacteria cause diseases in humans.

(a) Draw a ring around the correct word to complete the sentence.

Organisms that cause disease are called	algae. pathogens. vaccines.

(1)

(b) In August 2011 the United Nations gave a warning that there was a new strain of the bird flu virus in China.

Bird flu may kill humans. The new strain of the bird flu virus could cause a *pandemic* very quickly.

(i) What is a *pandemic*?

Tick (✓) **one** box.

A disease affecting the people all over one country.	☐
A disease affecting hundreds of people	☐
A disease affecting people in many countries.	☐

(1)

(ii) The swine flu virus is carried by pigs.

The bird flu virus is likely to spread much more quickly than the swine flu virus.

Suggest **one** reason why.

_____

_____

(1)

This notice is from a doctor's surgery.

Unfortunately, antibiotics will NOT get rid of your flu.

(c) (i) Why will antibiotics **not** get rid of flu?

_____

_____

(1)

(ii) The symptoms of flu include a sore throat and aching muscles.

What would a doctor give to a patient to relieve the symptoms of flu?

_____

(1)

(iii) It is important that antibiotics are **not** overused.

Explain why.

Use words from the box to complete the sentence.

antibody	**bacteria**	**immune**	**resistant**	**viruses**

Overuse of antibiotics might speed up the development

of _____ strains of _____ .

(2)

(Total 7 marks)

Q21.

(a) Complete the sentences about evolution.

Draw a ring around the correct answer to complete each sentence.

(i) Darwin suggested the theory of evolution by

artificial
natural
asexual

selection.

(1)

(ii) Darwin's theory of evolution says that all species of living things have

evolved from | artificial / complex / simple | life forms.

(1)

(iii) Most scientists believe that life first developed about | three billion / three million / three thousand | years ago.

(1)

(b) Darwin's theory of evolution was only slowly accepted by other people.

Give **two** reasons why.

1 _____

_____

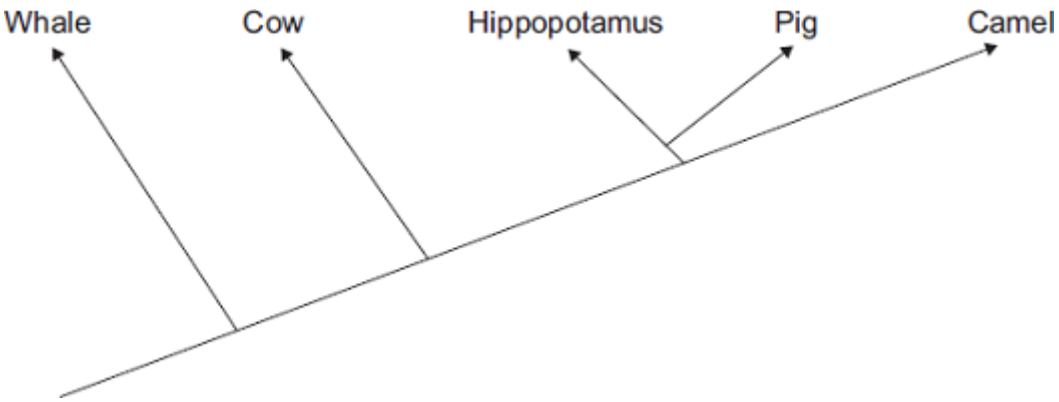
2 _____

_____

(2)

(c) **Diagram 1** shows one model of the relationship between some animals.

Diagram 1



(i) Complete the sentence.

The model shown in **Diagram 1** is an evolutionary _____ .

(1)

(ii) Which **two** of the animals in **Diagram 1** are most closely related?

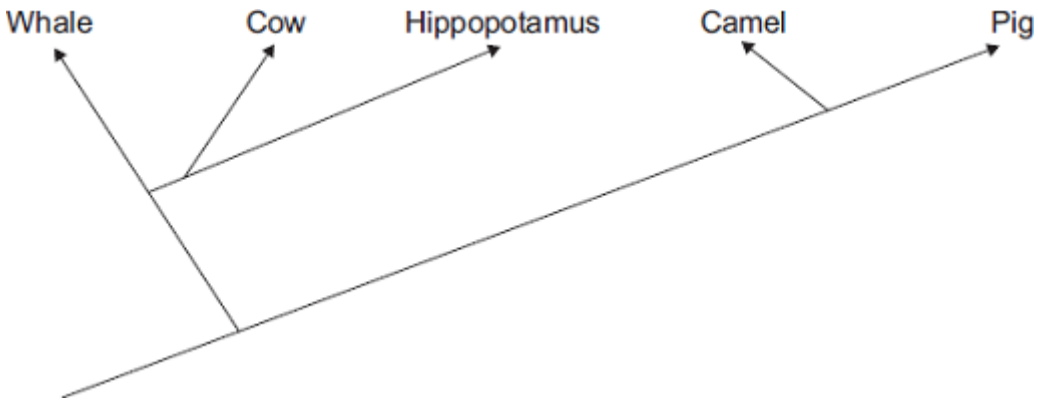
_____ and _____

(1)

(iii) Diagram **2** shows a more recent model of the relationship between the

animals.

Diagram 2



Suggest **one** reason why scientists have changed the model of the relationships between the animals shown in the diagram.

Draw a ring around the correct answer.

more powerful computers	**new evidence from fossils**	**new species discovered**

(1)

(Total 8 marks)

Q22.

Darwin suggested the theory of natural selection.

(a) Explain how natural selection occurs.

_____

_____

_____

_____

_____

_____

_____

(3)

(b) Latitude is a measure of distance from the Earth's equator.

Scientists investigated the effect of latitude on:

- the time taken for new species to evolve
- the number of living species.

The table shows the scientists' results.

Latitude in degrees North of equator	Time taken for new species to evolve in millions of years	Relative number of living species
0 (at the equator)	3–4	100
25	2	80
50	1	30
75 (in the Arctic)	0.5	20

As latitude increases environmental conditions become more severe.

(i) Describe the patterns shown by the data.

_____

_____

_____

_____

_____

_____

(2)

(ii) Suggest explanations for the patterns you have described in part (b)(i).

_____

_____

_____

_____

_____

_____

(2)

(Total 7 marks)

Q23.

The photograph shows a fossil footprint. The fossil was found in a rock at the bottom of a shallow river.

Scientists believe this is the footprint of a dinosaur. The dinosaur was alive 110 million years ago.

(a) (i) Suggest how the fossil shown in the photograph was formed.

_____

_____

(1)

(ii) Fossils may also be formed by other methods.

Describe **one** other method of forming a fossil.

_____

_____

(1)

(b) Dinosaurs are now extinct.

Give **two** factors that can cause extinction.

1. _____

_____

2. _____

_____

(2)

(c) How can fossils give evidence for evolution?

_____

_____

(1)

(d) Scientists are uncertain about how life began on Earth.

Why?

_____

_____

(1)

(Total 6 marks)

Q24.

Howea forsteriana and *Howea belmoreana* are two species of palm tree.

The two *species* grow together on a small island in the South Pacific.

(a) What is meant by the term *species* ?

_____

_____

_____

_____

(2)

(b) The table gives some information about these two species of palm tree.

	Howea forsteriana	***Howea belmoreana***
Optimum pH of the soil for growth of the palm tree	pH 8	pH 6
Height above sea level of most common habitat	30 to 60 metres	above 120 metres
Month when most palm trees flower	October	December
Method of pollination	Wind carries pollen	Wind carries pollen

Scientists believe that these two species of palm tree began to evolve from a single species over 2 million years ago.

Suggest how these two different species developed.

In your answer you should use information from the table and your own knowledge.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)

(Total 7 marks)

Q25.

Darwin was the first scientist to state that humans and other primates had common ancestors.

Many people were against Darwin's ideas at that time.

Give **two** reasons why they were against his ideas.

1. _____

_____

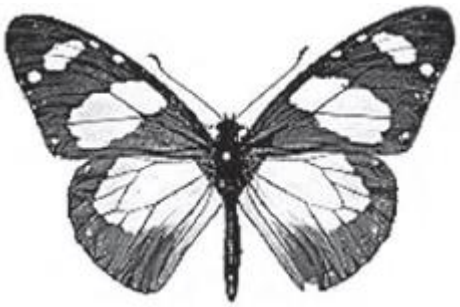
2. _____

_____

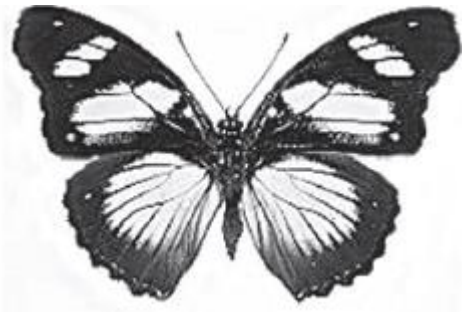
(Total 2 marks)

Q26.

The drawings show two different species of butterfly.



Amauris



Hypolimnas

- Both species can be eaten by most birds.
- *Amauris* has an unpleasant taste which birds do **not** like, so birds have learned **not** to prey on it.
- *Hypolimnas* does **not** have an unpleasant taste but most birds do **not** prey on it.

(a) Suggest why most birds do **not** prey on *Hypolimnas*.

_____

_____

_____

_____

(2)

(b) Suggest an explanation, in terms of natural selection, for the markings on the wings

of *Hypolimnas*.

_____

_____

_____

_____

_____

_____

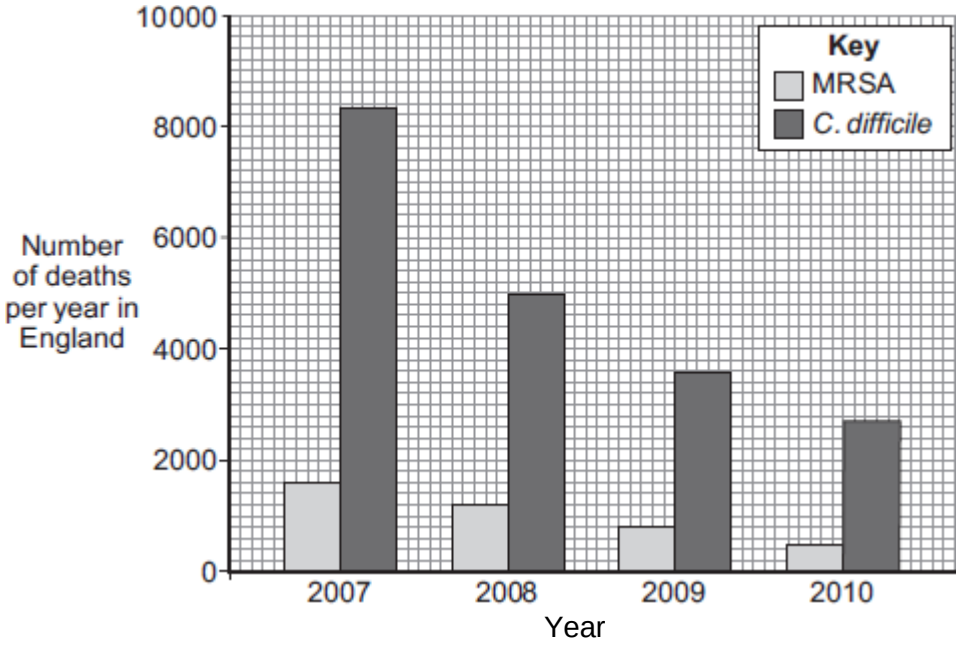
(3)

(Total 5 marks)

Q27.

Infections by antibiotic resistant bacteria cause many deaths.

The bar chart below shows information about the number of deaths per year in England from *Methicillin-resistant Staphylococcus aureus* (MRSA) and from *Clostridium difficile* (*C.difficile*) over 4 years.



(a) (i) Describe the trend for deaths caused by *C.difficile*.

_____

_____

_____

_____

(2)

(ii) Suggest a reason for the trend you have described in part **(a)(i)**.

Explain your answer.

_____

_____

_____

_____

(2)

(iii) Calculate the percentage change in deaths caused by MRSA from 2009 to 2010.

_____

_____

_____

Percentage change in deaths caused by MRSA = _____ %

(2)

(iv) Numbers have not yet been published for 2011.

When the numbers are published, scientists do **not** expect to see such a large percentage change from 2010 to 2011 as the one you have calculated for 2009 to 2010.

Suggest **one** reason why.

_____

_____

(1)

(b) Before 2007 there was a rapid increase in the number of deaths caused by MRSA.

Describe how the overuse of the antibiotic methicillin led to this increase.

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

Q28.

There are two forms of peppered moth, dark and pale.
Birds eat the moths when the moths are resting on tree bark.

Pollution in the atmosphere may:

- kill lichens living on tree bark
- make the bark of trees go black.

(a) Draw a ring around the correct answer to complete the sentence.

Lichens are very sensitive to air pollution caused by

carbon dioxide.
nitrogen.
sulfur dioxide.

(1)

(b) The photographs show the two forms of peppered moth, on tree bark.

Tree bark covered with lichens Tree bark made black by pollution

(i) The dark form of the peppered moth was produced by a change in the genetic material of a pale moth.

Use **one** word from the box to complete the sentence.

characteristic	**clone**	**mutation**

A change in genetic material is called a _____

(1)

(ii) In the 19th century, pollution made the bark of many trees go black.

Explain why:

- the population of the pale form of the moth in forests decreased
- the population of the dark form of the moth in forests increased.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(c) (i) The larvae (young) of the peppered moths eat the leaves of birch trees.

The diagram shows the food chain:

birch trees → peppered moth larvae → birds

Draw a pyramid of biomass for this food chain.

Label the pyramid.

(2)

(ii) Which **two** reasons explain the shape of the pyramid you drew in part (c)(i)?

Tick (✓) **two** boxes.

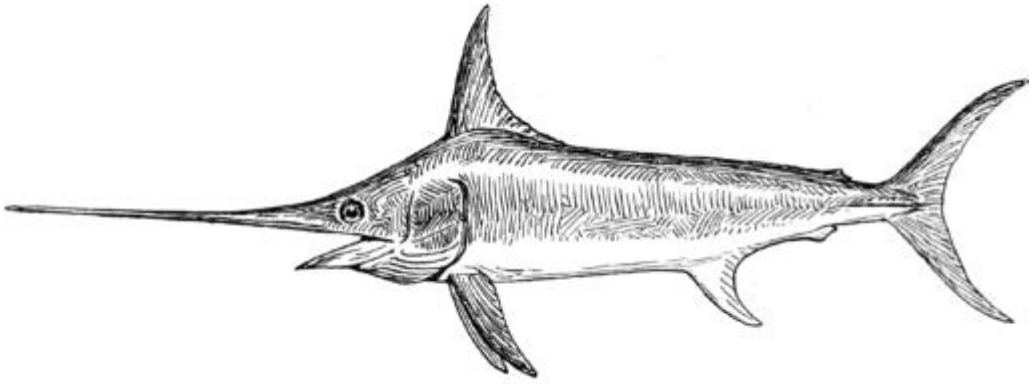
Some material is lost in waste from the birds	☐
The trees are much larger than peppered moth larvae	☐
Peppered moth larvae do not eat all the leaves from the trees	☐
The trees do not use all of the Sun's energy	☐

(2)

(Total 9 marks)

Q29.

The picture shows a modern swordfish.

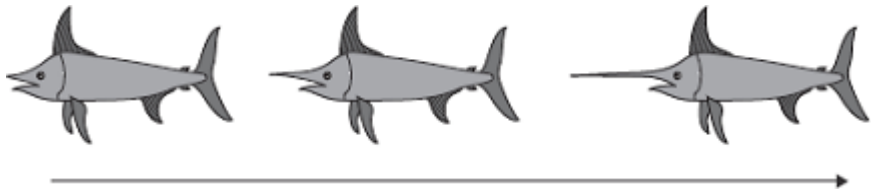


By Pearson Scott Foresman [Public domain], via Wikimedia Commons

Ancestors of swordfish had short swords. Modern swordfish have long swords. Swordfish use their swords to injure prey. The injured prey are easier to catch.

The information in the box shows one theory of how the length of the sword of swordfish changed.

The sword grew longer as each swordfish used its sword more and more.
Each time a swordfish reproduced, the longer sword was passed on to its offspring.



Many generations

(a) Which scientist suggested the theory shown in the box?

_____

(1)

(b) (i) Darwin suggested that evolution is a result of natural selection.

Describe how natural selection could result in modern swordfish with long swords
developing from ancestors with short swords.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(ii) Scientists in the 1800s accepted both the theory shown in the box, and Darwin's theory.

Now most scientists only accept Darwin's theory.

Give **one** reason why.

_____

_____

_____

(1)

(Total 6 marks)

Q30.

Evolution is the development of new species over time.
Evidence for evolution comes from *fossils*.

(a) (i) What is a *fossil*?

_____

_____

_____

_____

(2)

(ii) How can fossils give evidence for evolution?

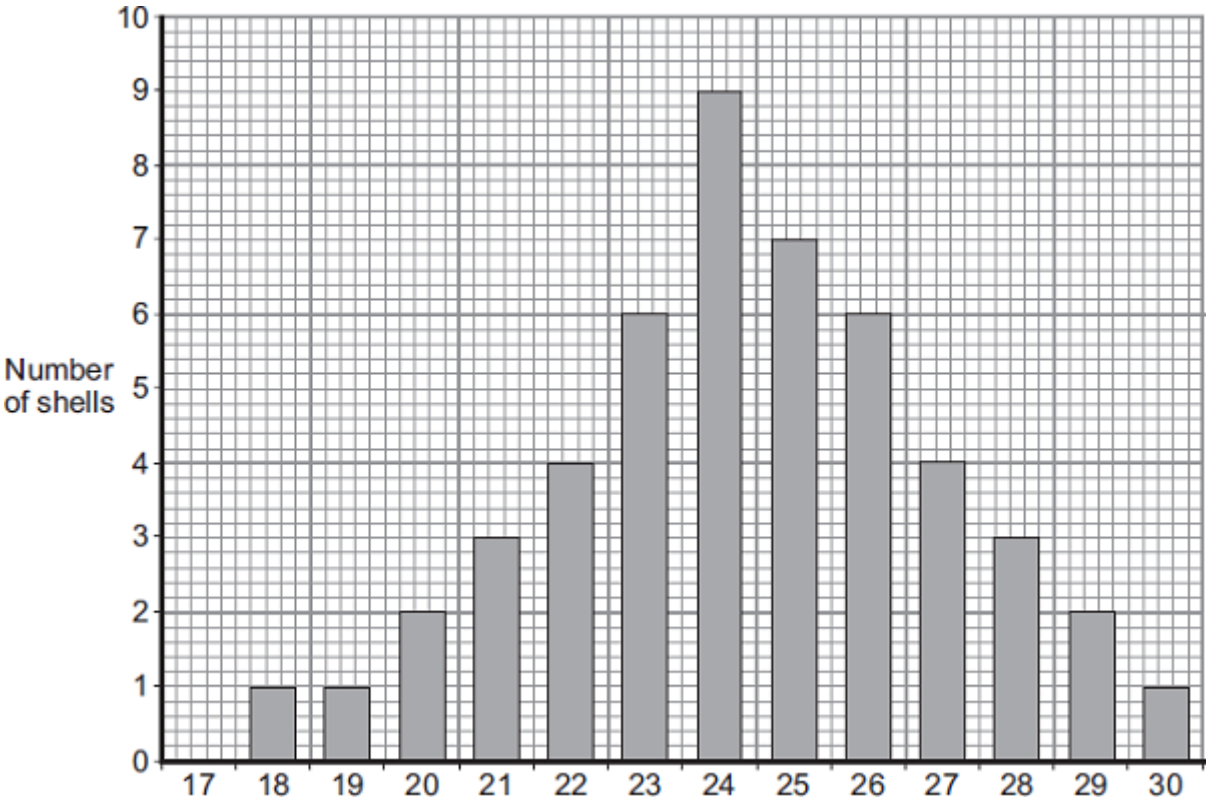
_____

_____

(1)

(b) A species of snail lived 400 million years ago.
Scientists measured the width of 49 fossil shells of this snail.

The bar chart shows the scientists' results.



(i) What is the range of the values for the width of the fossil shells for this species?

From _____ to _____

(1)

(ii) The scientists **cannot** be sure that this is the full range of fossil shell widths for this species.

Why?

_____

_____

(1)

(c) This species of snail became extinct 380 million years ago.

Give **one** possible reason why species become extinct.

_____

_____

(1)

(Total 6 marks)

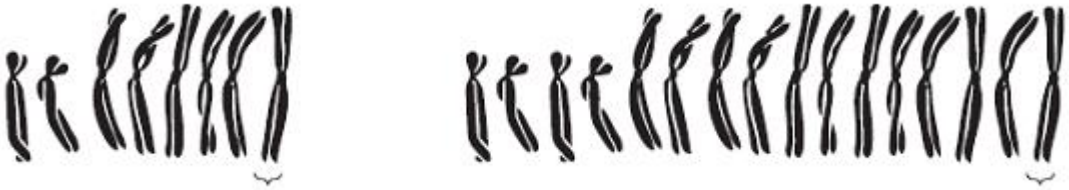
Q31.

The photographs show the flowers of two closely-related species of plant.

Species A Species B

The drawings show chromosomes from one cell in the root of each plant during cell division.

Species A **Species B**



One chromosome **One chromosome**

(a) The drawings show that each chromosome has two strands of genetic material.

(i) How does a chromosome become two strands?

_____

_____

(1)

(ii) Explain why each chromosome must become two strands before the cell divides.

_____

_____

_____

_____

(2)

(b) For sexual reproduction, the plants produce gametes.

(i) Name the type of cell division that produces gametes. _____

(1)

(ii) How many chromosomes would there be in a gamete from each of these two plant species?

Species A ☐ **Species B** ☐

(1)

(iii) It is possible for gametes from **Species A** to combine with gametes from **Species B** to produce healthy offspring plants.
How many chromosomes would there be in each cell of one of the offspring plants? ☐

(1)

(c) (i) Look back at the information at the start of the question and the information from part (b).

What evidence from these two pieces of information supports the belief that **Species A** and **Species B** evolved from a common ancestor?

_____

_____

_____

_____

(2)

(ii) For successful gamete production to take place, chromosomes that contain the same genes must pair up.

The drawings showing the chromosomes of **Species A** and of **Species B** are repeated below.

Species A Species B

The offspring plants cannot reproduce sexually.

Suggest an explanation for this.

_____

_____

_____

_____

_____

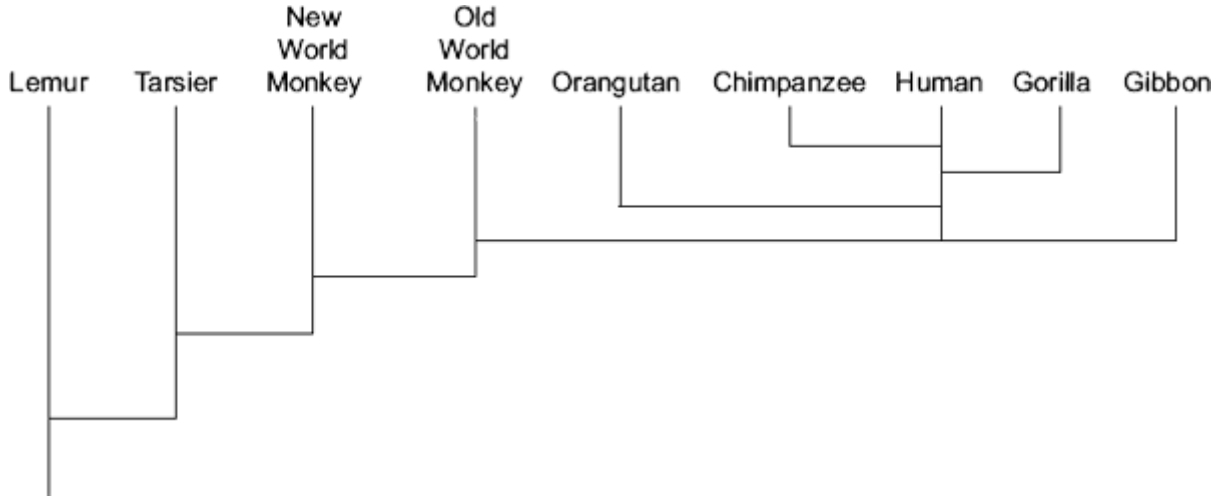
_____

(2)

(Total 10 marks)

Q32.

The diagram shows the evolution of a group called the primates.



(a) Which primate evolved first?

_____

(1)

(b) Name **two** primates that developed most recently from the same common ancestor as humans.

1. _____

2. _____

(2)

(c) (i) The theory of evolution by natural selection was suggested in the 1800s.

Which scientist suggested this theory?

_____

(1)

(ii) Use words from the box to complete the passage about natural selection.

evolution	**environment**	**generation**
mutate	**survive**	**variation**

Individual organisms of a species may show a wide range of

_____ because of differences in their genes.

Individuals with characteristics most suited to the _____

are more likely to _____ and breed successfully.

The genes that have helped these individuals to survive are then passed on to

the next _____

(4)

(Total 8 marks)

Q33.

The Blue-moon butterfly lives on a small island called Samoa, in the Pacific Ocean.

By Emoke Dénes [CC-BY-SA-2.5], via Wikimedia Commons

In 2006 Blue-moon butterflies almost became extinct.

Wolbachia bacteria killed males before they could hatch from eggs. Only females were resistant to the bacteria.

In 2006 the number of male Blue-moon butterflies had decreased to only 1 per cent of the population. Two years later, the number of males was equal to the number of females.

(a) Scientists believe that a change in a gene suddenly occurred to make some males resistant to the bacteria.

What scientific term describes a change in a gene?

_____

(1)

(b) The numbers of male Blue-moon butterflies in the population increased quickly after the new form of the gene had appeared.

Suggest why.

_____

_____

_____

_____

_____

_____

(4)
(Total 5 marks)

Q34.

An animal called *Tiktaalik* became extinct about 360 million years ago.

The photograph shows the fossilised skeleton of *Tiktaalik* and a model of what scientists think *Tiktaalik* looked like.

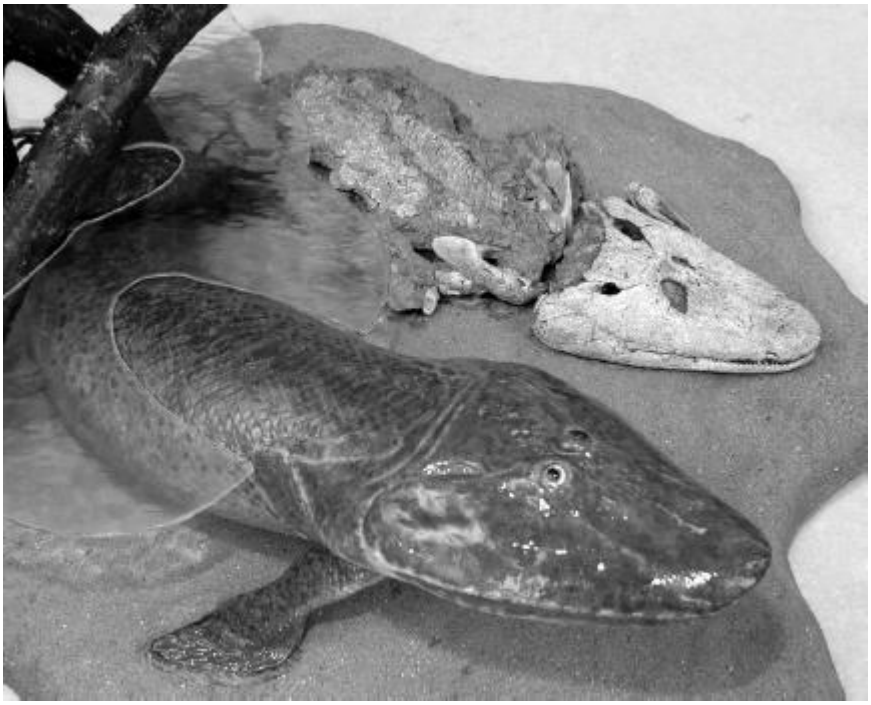


Image © University of Chicago, Shubin Lab. Model by Tyler Keillor

(a) Scientists found only the fossilised skeleton of *Tiktaalik*.

Explain why.

(2)

(b) Scientists think that *Tiktaalik* lived mostly in water, but that it was one of the first animals to be able to move onto land.

Use evidence from the photograph to suggest why.

_____

(2)

(Total 4 marks)

Q35.

When animals die, they usually fall to the ground and decay.
In 1977 the body of a baby mammoth was discovered.
The baby mammoth died 40 000 years ago and its body froze in ice.

The picture shows the mammoth.

By Thomas Quine [CC BY-SA 2.0], via Wikimedia Commons

(a) Explain why the body of the baby mammoth did **not** decay.

_____

_____

_____

_____

(2)

(b) Mammoths are closely related to modern elephants.
The pictures show these two animals.

What scientists think a mammoth looked like

Modern elephant

By WolfmanSF (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

By Caitlin from Hertfordshire, UK [CC-BY-2.0], via Wikimedia Commons

Mammoths are *extinct*. What does *extinct* mean?

_____

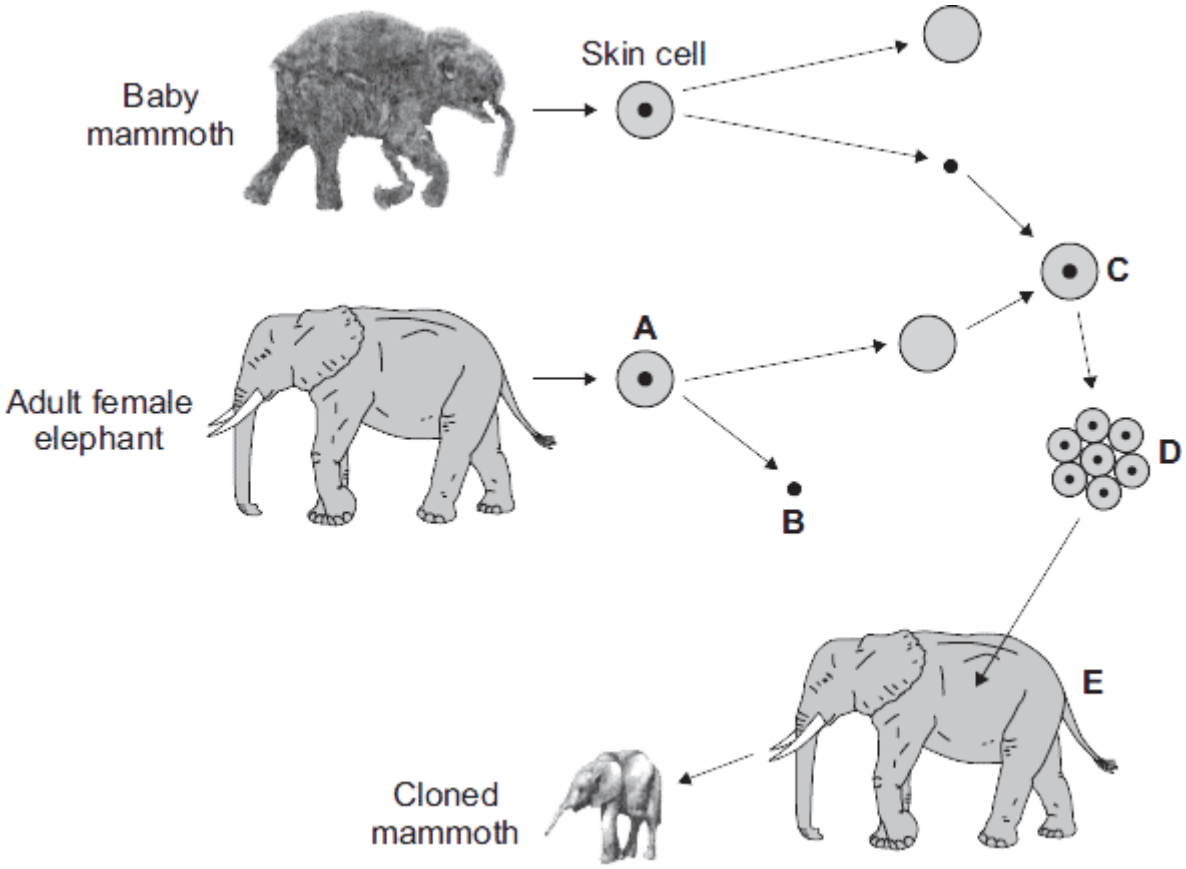
_____

(1)

(c) Scientists believe they may be able to use adult cell cloning to recreate a living mammoth.

The scientists will use a skin cell from the baby mammoth.

The diagrams show how the skin cell will be used.



In each question, draw a ring around the correct answer.

(i) What type of cell is cell **A**?

skin cell **egg cell** **sperm cell**

(1)

(ii) Part **B** is removed from cell **A**.

What part of the cell is part **B**?

nucleus **cytoplasm** **cell membrane**

(1)

(iii) After cell **C** is formed, it divides into embryo cells.

What is done to cell **C** to make it divide?

Cell **C** is

treated with enzymes.
mixed with sperm cells.
given an electric shock.

(1)

(iv) The embryo cells form a ball of cells. The ball of cells will be put into female elephant, **E**.

Which part of elephant **E** is the ball of cells put into?

womb **stomach** **ovary**

(1)

(d) The scientists expect any offspring of the adult cell cloning to look like a mammoth and **not** like an elephant.

Why?

_____

_____

(1)

(Total 8 marks)

Q36.

People may be immunised against diseases using vaccines.

(a) (i) Which part of the vaccine stimulates the body's defence system?

_____

_____

_____

_____

(2)

(ii) A person has been vaccinated against measles. The person comes in contact with the measles pathogen. The person does **not** catch measles.

Explain why.

_____

_____

_____

_____

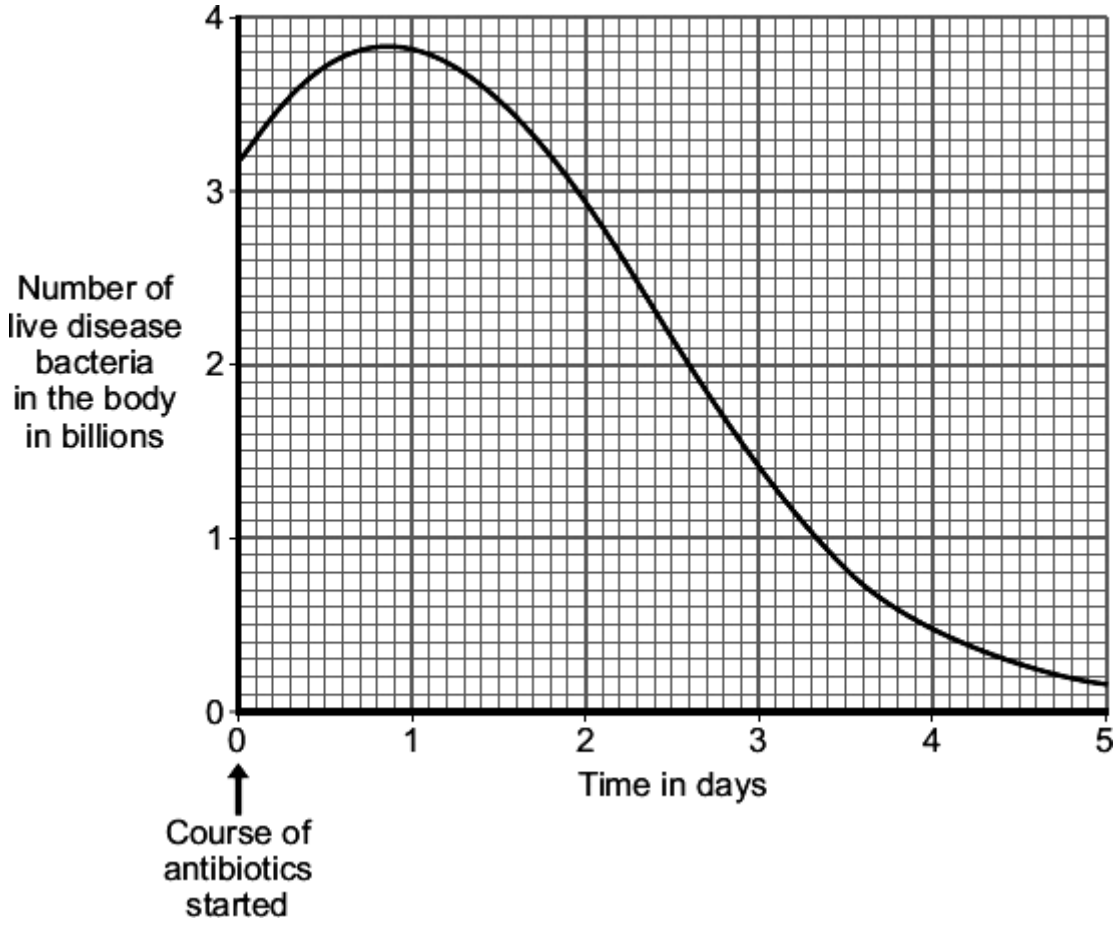
_____

_____

(3)

(b) A man catches a disease. The man has **not** been immunised against this disease. A doctor gives the man a course of antibiotics.

The graph shows how the number of live disease bacteria in the body changes when the man is taking the antibiotics.



(i) Four days after starting the course of antibiotics the man feels well again. It is important that the man does **not** stop taking the antibiotics.

Explain why.

Use information from the graph.

_____

_____

_____

_____

(2)

(ii) Occasionally a new, resistant strain of a pathogen appears.

The new strain may spread rapidly.

Explain why.

_____

_____

_____

_____

_____

_____

(3)

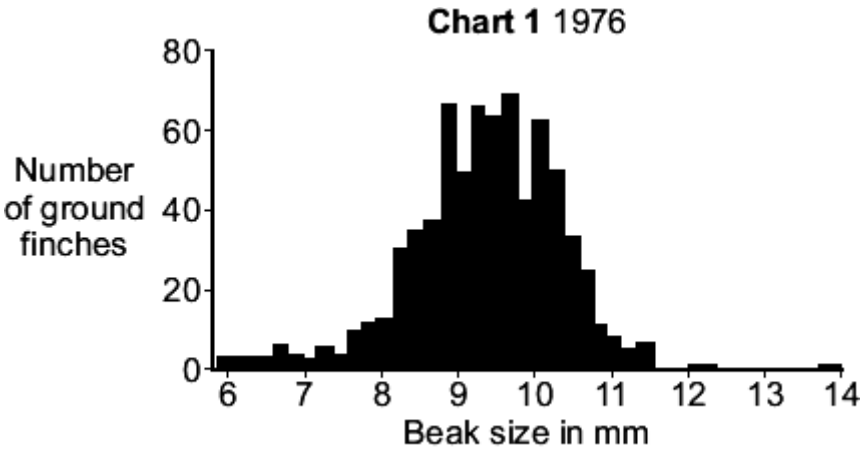
(Total 10 marks)

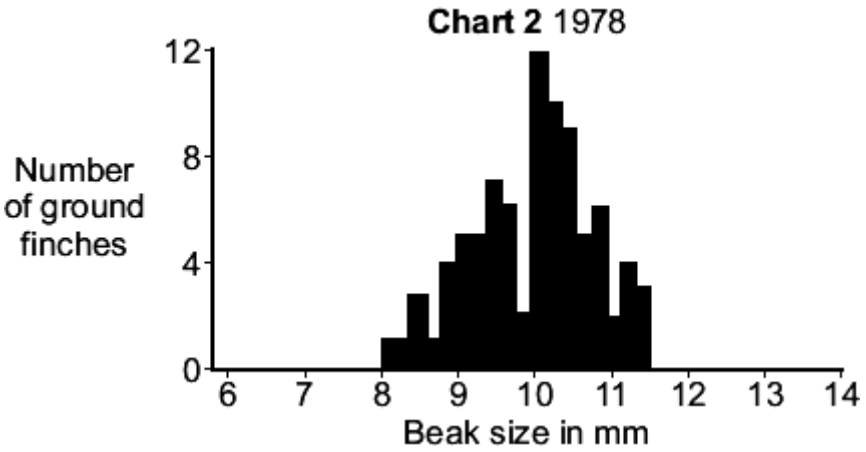
Q37.

The Galapagos Islands are in the Pacific Ocean, 1400 km from South America.
A type of bird called a ground finch lives on the islands.
The picture shows a ground finch.

By Charlesjsharp (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

The size of the seeds the ground finch can eat depends upon the size of the beak.
To eat large seeds, a large beak is needed.
The bar charts show the sizes of the beaks of ground finches on **one** island, in 1976 and in 1978.





(a) The population of the ground finches and their beak sizes changed between 1976 and 1978.

Describe these changes.

_____

_____

_____

_____

_____

_____

(3)

(b) In 1977 there was very little rain on the island. The lack of rain affected the seeds that the finches ate.
The table shows how the seeds were affected.

Year	Mean number of seeds per m^2	Mean mass of each seed in mg
1976	8.5	3.5
1978	2.8	4.2

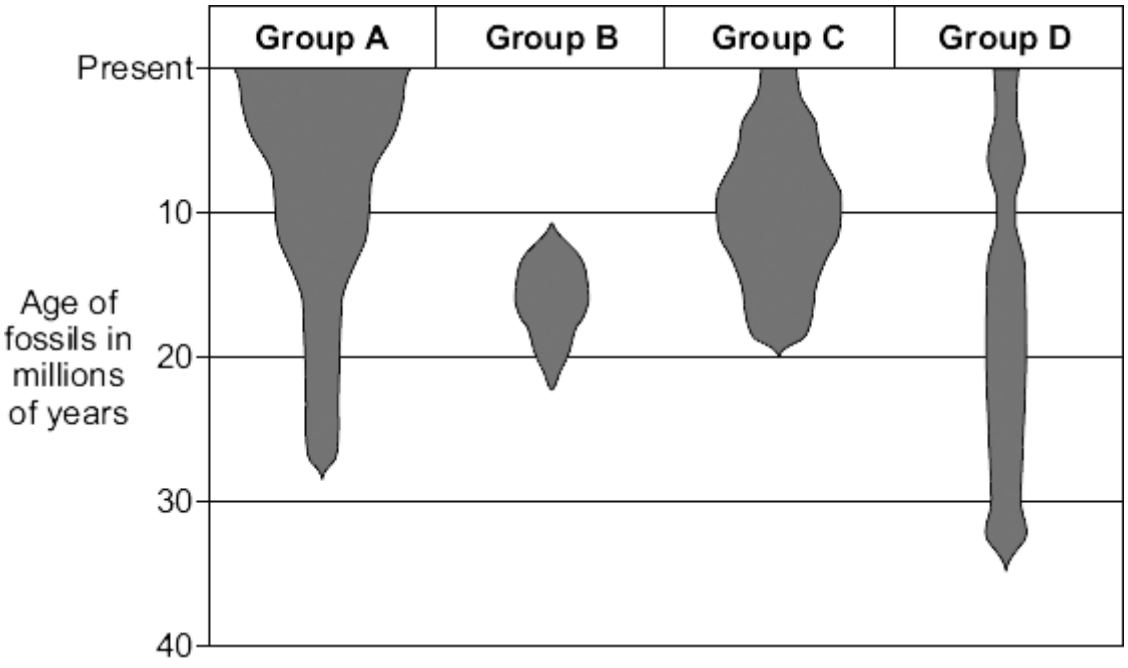
Suggest an explanation for the changes in beak sizes between 1976 and 1978.

(4)

(Total 7 marks)

Q38.

In the Grand Canyon, scientists have found fossils of several different groups of organisms.
The diagram shows the number and age of the fossils that the scientists found.
The width of each shaded area shows the number of fossils found.



(a) What is a fossil?

(2)

(b) (i) Which group of organisms, **A**, **B**, **C** or **D**, was the first to evolve?

(1)

(ii) Which group of organisms, **A**, **B**, **C** or **D**, is now extinct?

(1)

(iii) Give **one** environmental factor that might have caused this group of organisms to become extinct.

_____

_____

(1)

(c) Scientists suggested that, 10 million years ago, organisms of **Group C** were more common than organisms from any of the other groups.

What is the evidence for this in the diagram?

_____

_____

(1)

(d) The scientists suggested that the four groups of fossilised organisms evolved from a common ancestor.

Which of the following would provide the best evidence that their suggestion is correct?

Tick (✓) **one** box.

Statement	**Tick (✓)**
All the groups lived in the same area.	
Fossils from each group were found in the same rock layer.	
Members of the groups have similar physical structures.	

(1)

(Total 7 marks)

Q39.

(a) How do fossils provide evidence that species alive today have evolved from simpler organisms?

_____

(3)

(b) The photographs show two species of gull.

Herring gull (*Larus argentatus*)

By Ken Billington (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

Lesser black-backed gull (*Larus fuscus*)

By Andreas Trepte (Own work) [CC-BY-SA-2.5], via Wikimedia Commons

Both species are now found in the UK but the two species cannot interbreed with each other. Scientists believe that these two species have evolved from a common ancestor.

The map on the next page shows a view of the Earth from above the North Pole. The map also shows where these two species are found.

Suggest an explanation for the development of these different species.

_____

_____

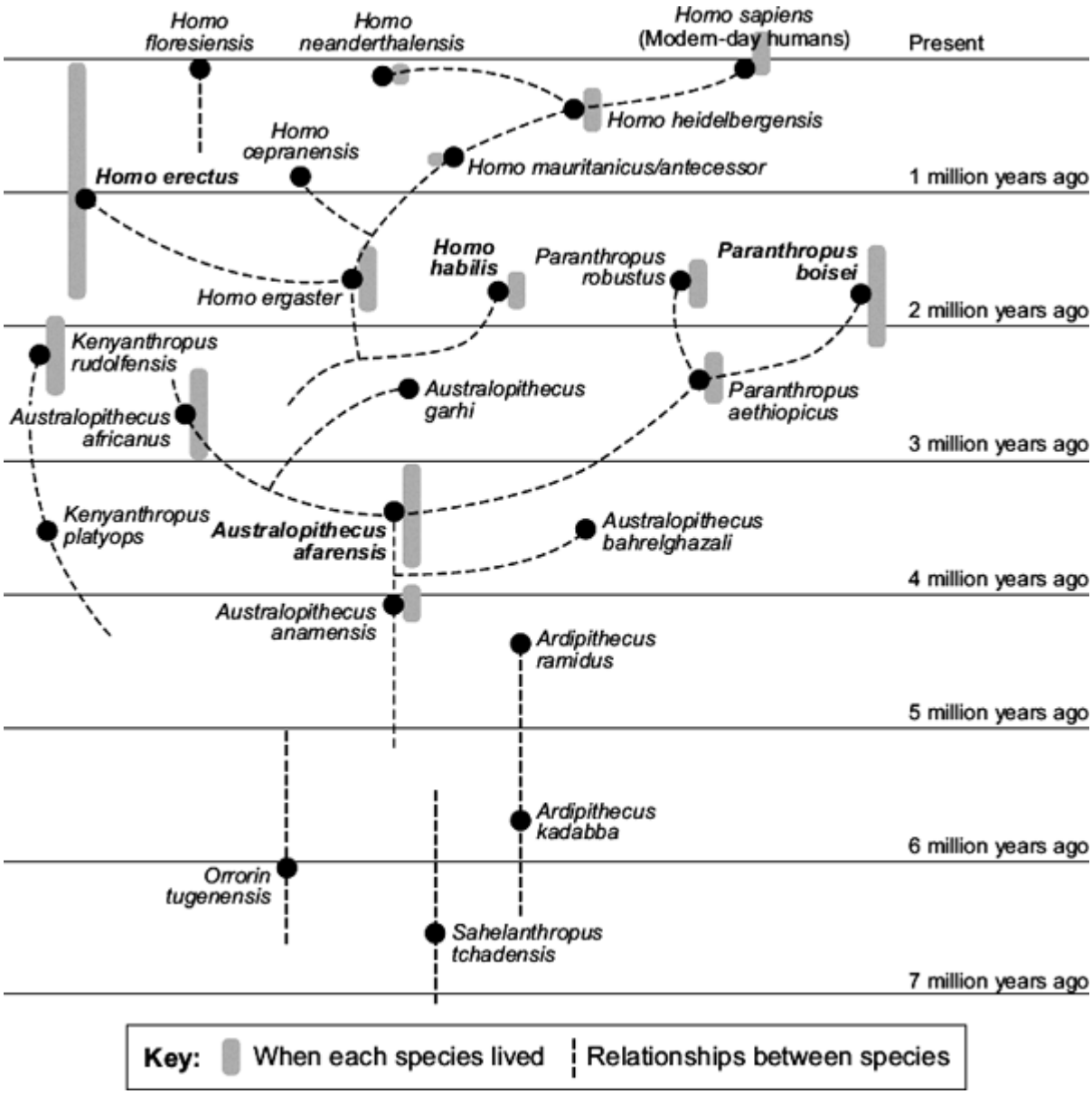
(6)

(Total 9 marks)

Q40.

The diagram shows an evolutionary tree for humans.

The diagram is based on a study of fossils.



(a) When did *Australopithecus afarensis* first appear?

_____ million years ago.

(1)

(b) Which species was the direct ancestor of *Paranthropus boisei*?

_____

(1)

(c) Which species is most closely related to *Homo habilis?*

_____

(1)

(d) About 250 fossils of *Homo erectus* have been found. About 50 of these fossils have been found in China.

A Chinese scientist has suggested the hypothesis that Chinese people evolved from *Homo erectus*.

Most scientists do **not** agree with this hypothesis.

Use the information above and information from the diagram to suggest **two** reasons why.

1. _____

_____

2. _____

_____

(2)

(e) Darwin suggested the theory of natural selection. It was a long time before this theory was accepted by most scientists.

Give **two** reasons why it took a long time.

1. _____

_____

2. _____

_____

(2)

(Total 7 marks)

Q41.

Many strains of bacteria have developed resistance to antibiotics.

The table shows the number of people infected with a resistant strain of one species of bacterium in the UK.

Year	2004	2005	2006	2007	2008
Number of people infected with the resistant strain	3499	3553	3767	3809	4131

(a) Calculate the percentage increase in the number of people infected with the resistant strain between 2004 and 2008.

Show clearly how you work out your answer.

_____

_____

Percentage increase = _____

(2)

(b) Explain, in terms of natural selection, why the number of people infected with the resistant strain of the bacterium is increasing.

_____

_____

_____

_____

_____

_____

_____

_____

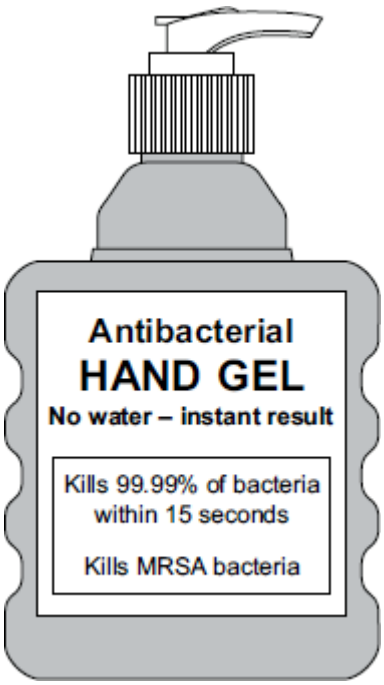
(3)

(Total 5 marks)

Q42.

MRSA strains of bacteria are causing problems in many hospitals.

(a) The diagram shows a hand-gel dispenser.



Hand-gel dispensers are now placed at the entrance of most hospital wards.

Explain why.

_____

_____

_____

_____

(2)

(b) Explain, as fully as you can, how MRSA strains of bacteria became difficult to treat.

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

Q43.

Soay sheep live wild on an island off the north coast of Scotland. No people live on the island.

By Owen Jones = Jonesor [CC-BY-SA-2.5], via Wikimedia Commons

Over the last 25 years, the average height and mass of the wild Soay sheep have decreased.

The scientists think that climate change might have affected the size of the sheep.

Suggest an explanation for the evolution of the wild Soay sheep over the last 25 years.

_____

_____

_____

_____

_____

_____

_____

_____

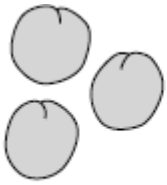
_____

_____

(Total 4 marks)

Q44.

In the 1860s, Gregor Mendel studied inheritance in nearly 30 000 pea plants. Pea plants can produce either round seeds or wrinkled seeds.



Round pea seeds

Wrinkled pea seeds

(a) Mendel crossed plants that always produced round seeds with plants that always produced wrinkled seeds.

He found that all the seeds produced from the cross were round.

Use the symbol **A** to represent the dominant allele and **a** to represent the recessive allele.

Which alleles did the seeds from the cross have?

_____

(1)

(b) Mendel grew hundreds of plants from the seeds of the offspring.
He crossed these plants with each other.

(i) Mendel's crosses produced 5496 round pea seeds and 1832 wrinkled pea seeds.

Explain why Mendel's crosses gave him these results.

In your answer you should use:

- a genetic diagram
- the symbols **A** and **a**.

(3)

(ii) One of Mendel's crosses produced 19 round seeds and 16 wrinkled seeds.

These numbers do **not** match the expected ratio of round and wrinkled seeds.

Suggest why.

_____

_____

(1)

(c) The importance of Mendel's discovery was not recognised until many years after his death.

Give **one** reason why.

_____

_____

(1)

(Total 6 marks)

Q45.

Charles Darwin proposed the theory of natural selection.

(a) What is meant by natural selection?

_____

_____

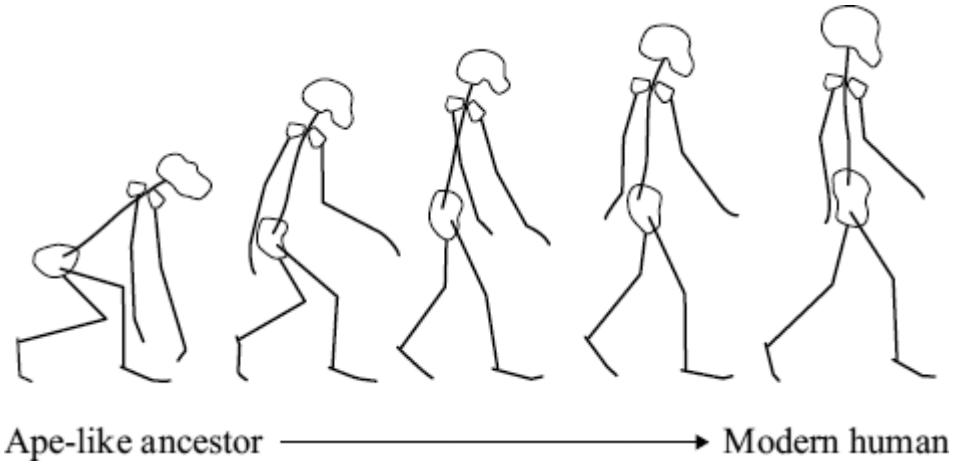
_____

_____

(2)

(b) The drawings show stages in the evolution of the human skeleton.

All the drawings are to the same scale.



Use information from the drawings to describe **two** trends in the evolution of the human skeleton.

1. _____

_____

2. _____

_____

(2)

(c) Darwin said that humans had evolved from ape-like ancestors.

Many people disagreed with him at the time.

Give **two** reasons why.

1. _____

_____

2. _____

_____

(2)

(d) Lamarck's theory of evolution stated that useful changes which occur in an organism during its lifetime will be inherited by its offspring.

Give **one** way in which Darwin's theory differs from Lamarck's.

_____

_____

(1)

(Total 7 marks)

Q46.

The photograph shows an *Anolis* lizard. This lizard lives on a tiny island.

By Paul Hirst (Phirst) (Own work) [CC-BY-SA-2.5], via Wikimedia Commons

Scientists investigated how the leg length of the *Anolis* lizards affected their survival. At the start of the investigation the *Anolis* lizards had a large range of leg lengths.

- The scientists placed six *Curly-tailed* lizards onto the island.
- The *Curly-tail* lizard is a predator of the *Anolis* lizard.
- After one year the population of *Anolis* lizards had halved.
- Nearly all the remaining *Anolis* lizards had long legs.

(a) Why did the population of *Anolis* lizards halve?

_____

_____

(1)

(b) The remaining *Anolis* lizards had long legs.

Suggest an explanation for this.

_____

_____

_____

_____

_____

(2)

(c) Answer each of these questions by placing a tick (✓) in the correct box.

(i) Which theory is supported by evidence from this investigation?

Global warming ☐

Natural selection ☐

Sustainability ☐

(1)

(ii) Which scientist proposed this theory?

Darwin ☐

Lamarck ☐

Semmelweiss ☐

(1)
(Total 5 marks)

Q47.

The photograph shows some flamingos.

By Charles J Sharp (Own work) [GFDL, CC-BY-SA-3.0 or CC-BY-2.5], via Wikimedia Commons

- Flamingos feed on organisms that live in mud at the bottom of lakes.
- Leopards prey on flamingos.
- Flamingos find it difficult to fly if their feathers get wet.

Flamingos have evolved very long legs.

How would each of the following theories explain the evolution of these long legs?

(a) Darwin's theory

_____

_____

_____

(3)

(b) Lamarck's theory.

(2)

(Total 5 marks)

Q48.

Animals have adaptations that enable them to survive.

(a) The photograph shows an echidna.

The echidna has pointed spines on its back.

Explain how these spines might help the echidna to survive.

_____

_____

_____

_____

_____

(2)

(b) The photograph shows a caterpillar.

Explain how the caterpillar's appearance might help it to survive.

_____

_____

_____

_____

_____

(2)

(c) Draw a ring around the correct answer to complete each sentence.

(i) Evolution can be explained by a theory called

genetic engineering
mutation
natural selection

.

(1)

(ii) This theory was suggested by a scientist called Charles

Darwin
Lamarck
Semmelweiss

.

(1)

(iii) This scientist said that all living things have evolved from

monkeys
dinosaurs
simple life forms

.

(1)

(d) Many religious people oppose the theory of evolution.

Give **one** reason why.

_____

_____

(1)

(Total 8 marks)

Q49.

Some organisms are in danger of extinction.
The photograph shows an African elephant feeding on tree leaves.

(a) Read the information about elephants and humans in Africa.

- The African elephant is the largest land animal.
- The African elephant feeds on lots of leaves.
- Adult African elephants have no natural predators.
- Elephants are killed by poachers for their ivory tusks.
- African elephants live for about 70 years.
- Most African elephants live in large herds.
- Land available to elephants is disappearing rapidly.

The African elephant is now extinct in many parts of Africa.

Use information from the list to give **three** reasons why.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(b) Organisms that are in danger of extinction can be cloned.

List A gives the names of three different cloning techniques.

List B gives information about these techniques.

Draw a line from each technique in **List A** to the correct information about it in **List B**.

List A Technique	List B Information
	Small groups of cells from parts of a plant are grown on a special jelly.
Adult cell cloning	
	Cells from a developing animal are separated before they become specialised and then placed into host mothers.
Embryo transplanting	
	Genes are cut out from chromosomes and inserted into other organisms.
Tissue culture	
	A nucleus is removed from an unfertilised egg cell. The nucleus from a body cell is inserted into the egg cell. An electric shock causes the egg to start to divide.

(3)

(Total 6 marks)

Q50.

The dodo is an extinct bird. The drawing shows an artist's impression of the bird.

The dodo lived on a small island in the middle of the Indian Ocean. Its ancestors were pigeon-like birds which flew to the island millions of years ago. There were no predators on the island. There was a lot of fruit on the ground. This fruit became the main diet of the

birds. Gradually, the birds became much heavier, lost their ability to fly and evolved into the dodo.

(a) Suggest an explanation for the evolution of the pigeon-like ancestor into the flightless dodo.

(4)

(b) The dodo became extinct about 80 years after Dutch sailors first discovered the island in the eighteenth century.

Scientists are uncertain about the reasons for the dodo's extinction.

Suggest an explanation for this uncertainty.

(1)

(Total 5 marks)

Q51.

In the 1850s, Gregor Mendel carried out breeding experiments using peas.

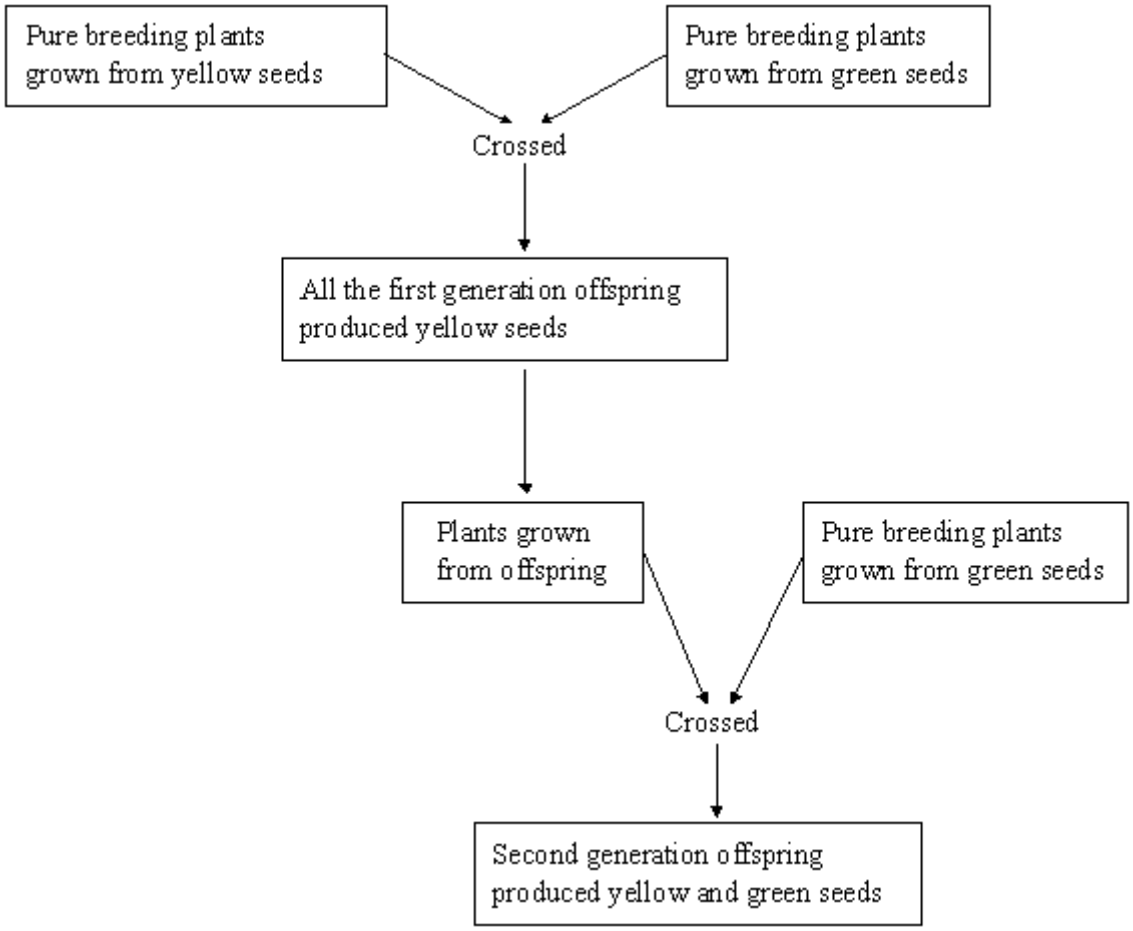
(a) The importance of Mendel's work was not recognised until the early 1900s.

Explain why.

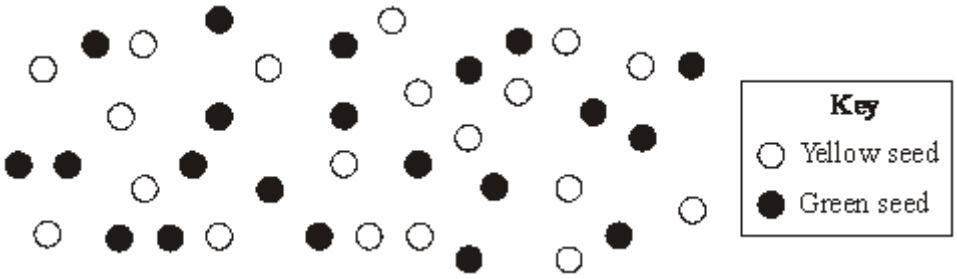
(2)

(b) A student repeated one of Mendel's experiments.

The flow chart shows her procedure.



The diagram shows a representative sample of seeds produced by second generation plants.



(i) Describe how the student could obtain a sample that is representative of seeds produced by the second generation.

_____

_____

(1)

(ii) What was the approximate ratio of yellow seeds to green seeds in the seeds produced by the second generation?

_____

(1)

(iii) Seed colour in peas is controlled by a single gene which has two alleles.

Use a genetic diagram to show why this ratio of yellow seeds to green seeds was produced by the second generation.

Use the symbol **A** to represent the dominant allele, and **a** to represent the recessive allele.

(4)

(Total 8 marks)

Q52.

The diagram shows an evolutionary tree for a group of animals called primates.

The names of extinct animals are printed in italics *e.g. Nycticeboides*.

The drawings show animals that are alive today.

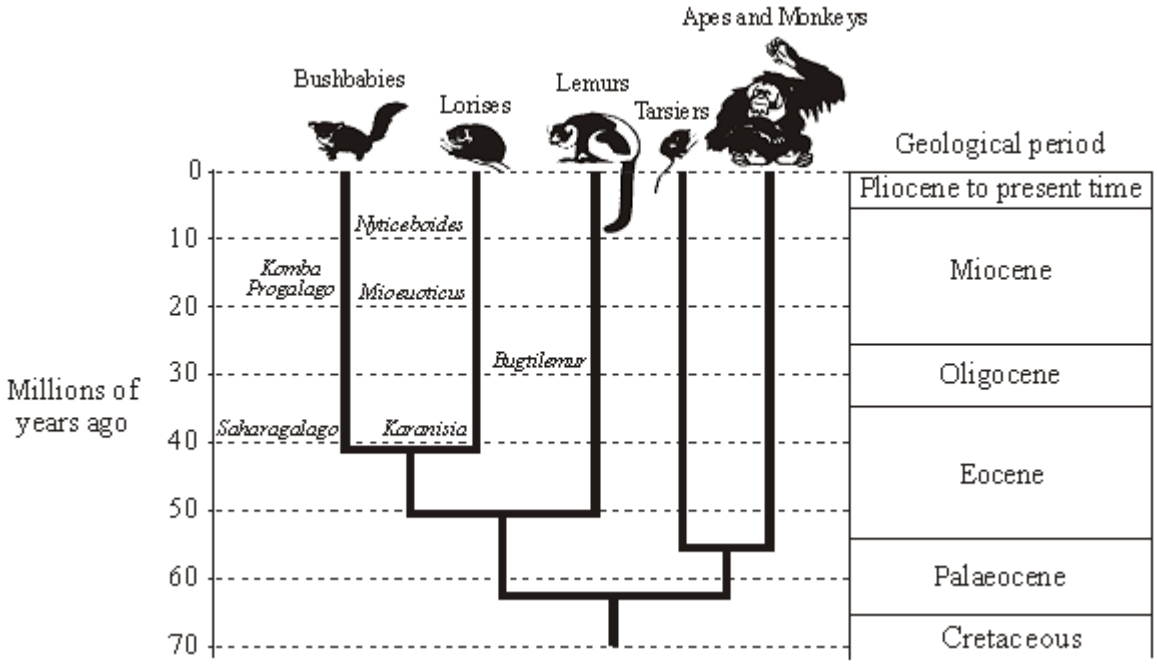


Illustration by Lucrezia Beerli-Bieler

(a) (i) How many million years ago did *Karanisia* first appear?

_____ millions of years ago.

(1)

(ii) During which geological period did the Apes and Monkeys begin to evolve?

_____

(1)

(iii) Which group of primates alive today are the closest relatives of the Lorises?

_____

(1)

(b) Darwin was the first scientist to state that humans and other primates had common ancestors.

Many people were against Darwin's ideas at that time.

Give **two** reasons why they were against his ideas.

1. _____

_____

2. _____

_____

(2)

(Total 5 marks)

Q53.

Pathogenic bacteria and viruses may make us feel ill if they enter our bodies.

(a) Why do bacteria and viruses make us feel ill?

Bacteria _____

_____

Viruses _____

_____

(2)

(b) Most drugs that kill bacteria cannot be used to treat viral infections.

Explain why.

_____

_____

_____

_____

_____

_____

(2)

(c) Antibiotic-resistant strains of bacteria are causing problems in most hospitals.

Explain, as fully as you can, why there has been a large increase in the number of antibiotic-resistant strains of bacteria.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q54.

The photograph shows a Crossbill.

A Crossbill feeds by using its bill (beak) to force apart the scales on conifer cones. It then uses its tongue to extract the seeds. If the bill is clipped it grows back again.

Scientists were interested in the evolution of the bill of the Crossbill.

In an investigation, they clipped the bills of several Crossbills so that their bills no longer crossed.

They observed that Crossbills with clipped bills took much longer to get seeds.

Use information from the investigation to suggest an explanation for the evolution of the bill in the Crossbill.

In your explanation, use the ideas of *selection*, *competition* and *mutation*.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)