AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.6.3 THE DEVELOPMENT OF UNDERSTANDING OF GENETICS AND EVOLUTION (PACK 1)

SCORE	PERCENTAGE
/281	%

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Q1.

Fossils give evidence about organisms that lived a long time ago.

(a) Scientists have found very few fossils of the earliest life forms.

Give **one** reason why.

_____

_____

(1)

Below is a photograph of a fossilised fish.



(b) Suggest how the fossil in the photograph above was formed.

_____

_____

_____

_____

(2)

(c) The species of fish shown in the photograph above is now extinct.

Give **two** possible causes of extinction.

1. _____

_____

2. _____

_____

(2)

Modern fish species have evolved from fish that lived a long time ago.

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Evolution is caused by mutation and natural selection.

(d) What is a mutation?

Tick **one** box.

- A change in a gene ☐
- Accidental damage to an organism ☐
- An organism with a new characteristic ☐
- The loss of a species ☐

(1)

(e) Describe the process of natural selection.

_____

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

Q2.

In the mid-19th century, a scientist studied inheritance in pea plants.

The scientist's work was the beginning of our modern understanding of genetics.

(a) What is the name of this scientist?

Tick **one** box.

- Alfred Russel Wallace ☐
- Charles Darwin ☐
- Gregor Mendel ☐

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Jean-Baptiste Lamarck ☐

(1)

(b) In the mid-20th century, other scientists identified the chemical substance that makes up genetic material.

What is the name of the chemical substance that makes up genetic material?

Tick **one** box.

Carbohydrate ☐

DNA ☐

Lipid ☐

Protein ☐

(1)

(c) A gene often has two alleles.

One allele is dominant and the other allele is recessive.

When is a recessive allele expressed as a characteristic?

Tick **one** box.

When the dominant allele is not present ☐

When the recessive allele is inherited from the female parent ☐

When the recessive allele is inherited from the male parent ☐

When the recessive allele is present on only one of the chromosomes ☐

(1)

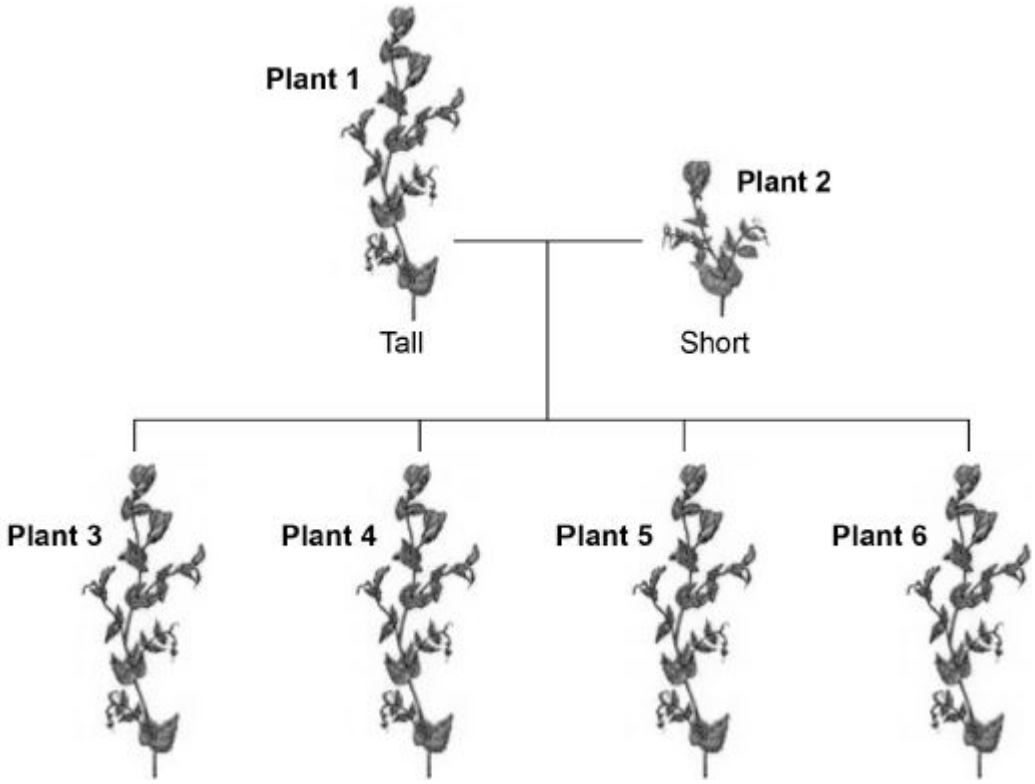
A scientist investigated the inheritance of height in pea plants.

The scientist crossed tall pea plants with short pea plants.

Figure 1 shows the scientist's results.

Figure 1

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All tall offspring

In questions **(d)** and **(e)**, use the following symbols to represent alleles:

T = the dominant allele for tall.
t = the recessive allele for short.

(d) In **Figure 1**, the genotype of plant **1** is **TT**.

Give the genotype of plant **2**.

_____

(1)

(e) The scientist crossed plant **3** with plant **4**.

Complete **Figure 2** to show the offspring produced from this cross.

Figure 2

		Male gametes: T	Male gametes: t
Female gametes	T	TT	
	t		

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(2)

(f) Draw a circle around **one** of the homozygous offspring in **Figure 2**.

(1)

(g) What is the ratio of tall plants : short plants in the offspring in **Figure 2**?

Ratio of tall plants : short plants = _____ : _____

(1)

(Total 8 marks)

Q3.

Figure 1 shows a ring-tailed lemur.

Figure 1



The table below shows part of the classification of the ring-tailed lemur.

Classification group	**Name**
Kingdom	*Animalia*
Phylum	*Chordata*
	Mammalia
	Primates
	Lemuroidea
Genus	*Lemur*
	catta

(a) Complete the table above to give the names of the missing classification groups.

(2)

(b) Give the binomial name of the ring-tailed lemur.

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Use information from the table above.

_____

(1)

Lemurs are only found on the island of Madagascar.

Madagascar is off the coast of Africa.

Scientists think that ancestors of modern lemurs evolved in Africa and reached Madagascar about 50-60 million years ago.

Today there are many species of lemur living on Madagascar.

Figure 2 shows information about water currents.

Figure 3 shows the distribution of three species of lemur on Madagascar.

Figure 2

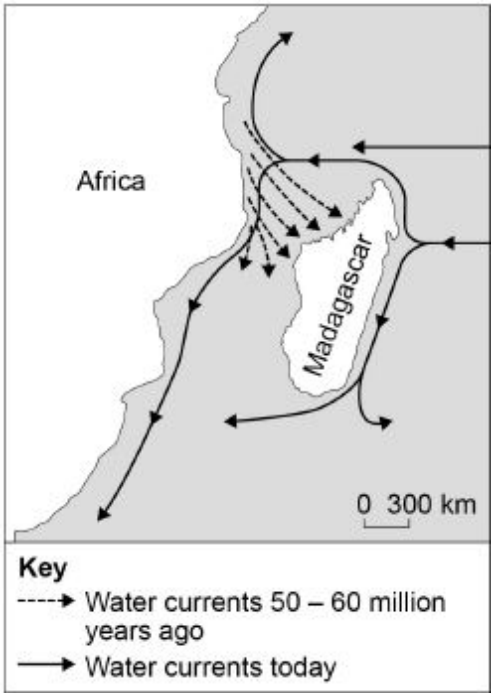
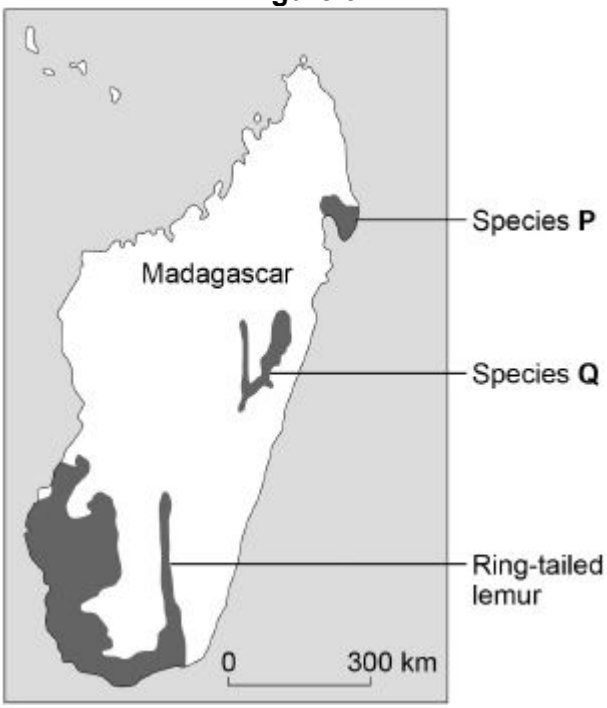


Figure 3



(c) Suggest how ancestors of modern lemurs reached Madagascar.

_____

_____

(1)

(d) Describe how the ancestors of modern lemurs may have evolved into the species shown in **Figure 3**.

_____

_____

_____

_____

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_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)

(Total 9 marks)

Q4.

Fossils provide evidence about organisms that lived a long time ago.

(a) Give **one** way a fossil may be formed.

_____

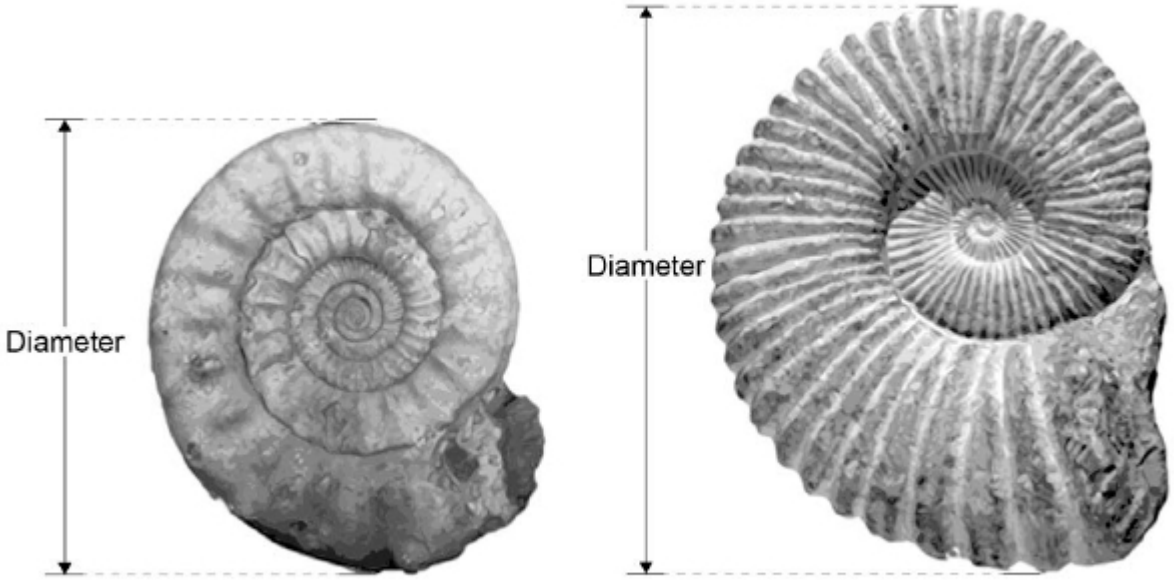
_____

(1)

Figure 1 shows the fossils of two species of ammonite.

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Figure 1



Ammonite **P** (scale: x 1)

Ammonite **Q** (scale: x ½)

(b) Use a ruler to measure the diameter of **P** and the diameter of **Q** in millimetres.

Diameter of **P** = _____ mm

Diameter of **Q** = _____ mm

(1)

(c) Calculate the diameter of the real fossil of ammonite **Q**.

Use your answer to part (b) and the scale factor given in **Figure 1**.

_____

_____

Diameter of the real fossil of ammonite **Q** = _____ mm

(1)

(d) How many times larger is ammonite **Q** compared to ammonite **P**?

Tick **one** box.

0.4 ☐ 0.8 ☐ 1.25 ☐ 2.5 ☐

(1)

(e) Describe **two** ways the fossil of ammonite **Q** is different from the fossil of ammonite **P**.

Do **not** give answers referring to size.

1. _____

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_____

2. _____

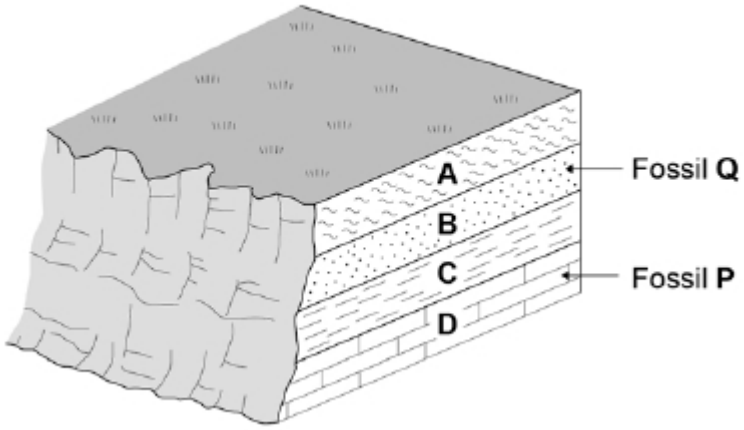
_____

(2)

(f) **Figure 2** shows:

- four layers of rock, **A**, **B**, **C** and **D**
- where the fossils of ammonites **P** and **Q** were found.

Figure 2



Which statement is evidence that ammonite **Q** may have evolved from ammonite **P**?

Tick **one** box.

P and **Q** are both found in limestone. ☐

Q was found in newer rocks than **P**. ☐

P is a darker colour than **Q**. ☐

Q has a smaller mass than **P**. ☐

(1)

(g) Suggest how long ago ammonites **P** and **Q** were alive.

Tick **one** box.

100 years ☐

1000 years ☐

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100 million years ☐

100 billion years ☐

(1)

(h) Ammonites are now extinct.

Suggest **three** possible causes of extinction.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(i) Give **one** reason why scientists cannot be sure about what caused the ammonites to become extinct.

_____

_____

(1)

(Total 12 marks)

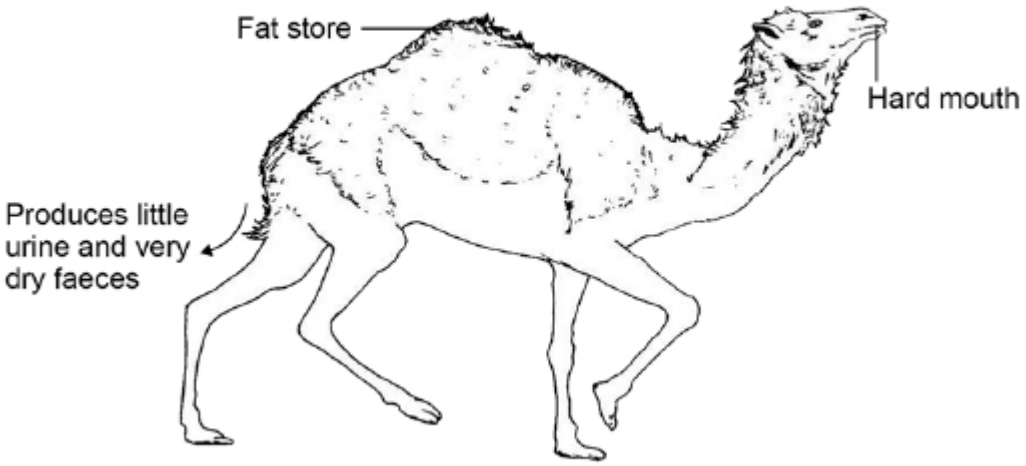
Q5.

Figure 1 shows a type of camel called a dromedary (*Camelus dromedarius*).

The dromedary lives in hot, dry deserts.

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Figure 1



(a) One adaptation of the dromedary is 'temperature tolerance'.

This means that the animal's body temperature can rise by up to 6 °C before it starts to sweat.

Explain how temperature tolerance can help the dromedary to survive in the desert.

_____

_____

_____

_____

(2)

(b) Three more adaptations of the dromedary are given in **Figure 1**.

Give a reason why each adaptation helps the animal survive in the desert.

Fat store _____

_____

Produces little urine and very dry faeces _____

_____

Hard mouth _____

_____

(3)

There are several species of the camel family alive today.

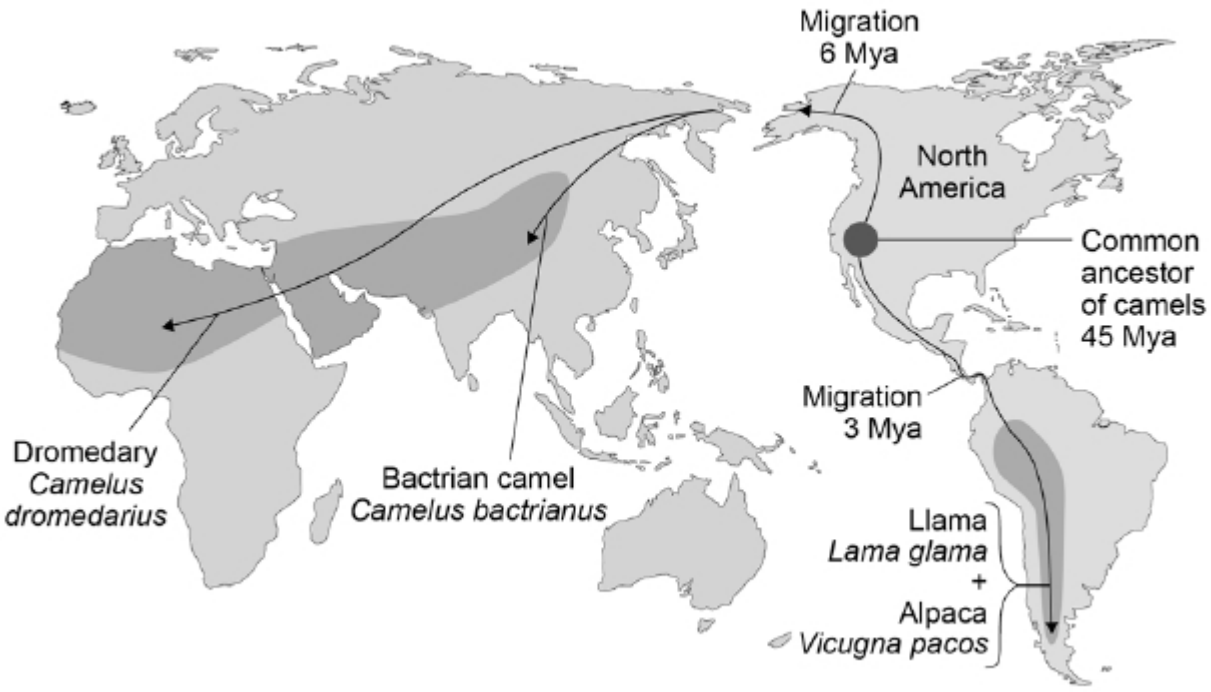
Scientists think these species evolved from a common ancestor that lived in North America about 45 million years ago (Mya).

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Figure 2 shows:

- where four modern species of the camel family live today
- how the ancestors of these camels migrated from North America.

Figure 2



(c) Which **two** of the four modern species of camel do scientists believe to be most closely related to each other?

Give the reason for your answer.

_____ and _____

Reason _____

_____

(1)

(d) Describe the type of evidence used for developing the theory of camel migration shown in **Figure 2**.

_____

_____

_____

_____

(2)

(e) Explain how several different species of camel could have evolved from a common ancestor over 45 million years.

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(6)
(Total 14 marks)

Q6.

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
Charles Darwin	Carried out breeding experiments on pea plants.
Alfred Russel Wallance	Wrote 'On the origin of species'.
Gregor Mendel	Worked on plant defence systems.
	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 ☐

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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 ☐

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Homozygous recessive ☐

(1)

(Total 9 marks)

Q7.

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.

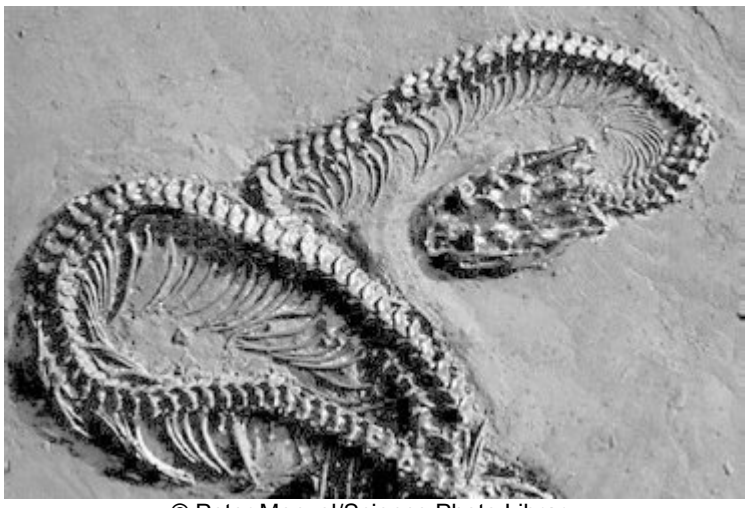
Who proposed this theory?

_____

(1)

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

The diagram below shows a fossilised snake.



© Peter Menzel/Science Photo Library

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

_____

_____

_____

_____

_____

_____

(3)

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(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)

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Q8.

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 _____ .

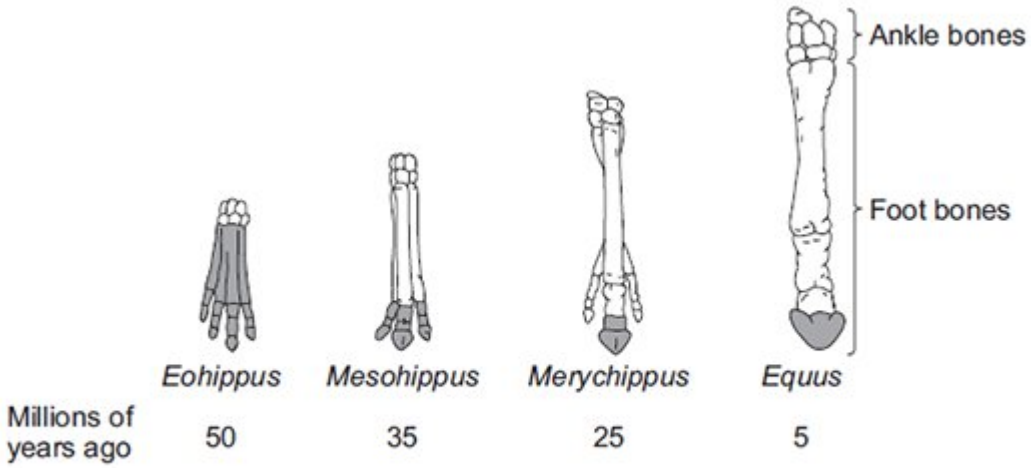
Individuals with characteristics most suited to the environment are more likely to survive and _____ .

(2)

(Total 3 marks)

Q9.

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.

_____

_____

_____

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_____

(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)

Q10.

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.

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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. _____

_____

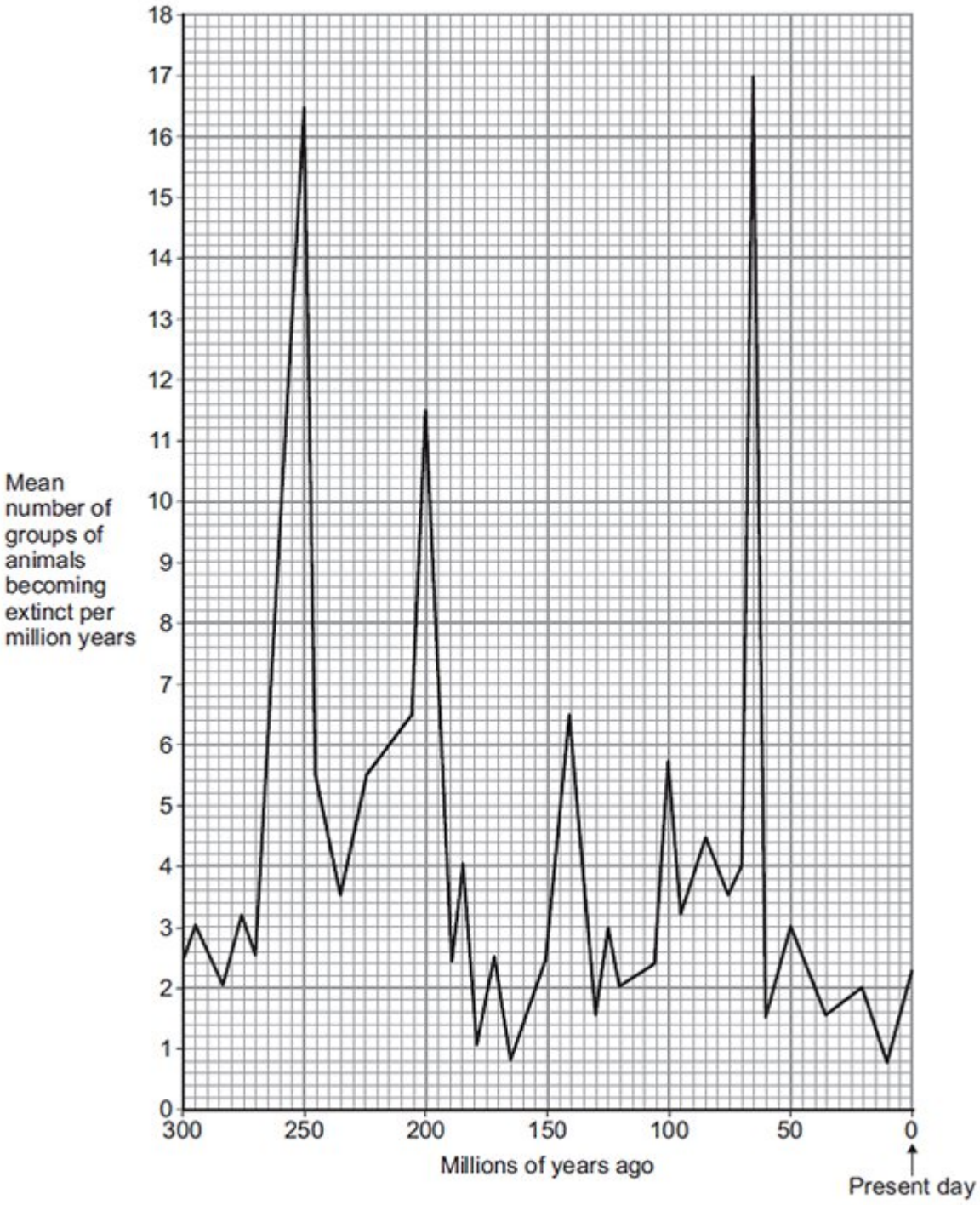
2. _____

_____

(2)

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

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(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?

_____

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_____

(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)

Q11.

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

Figure 1

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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



© GaryKavanagh/iStock

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.

_____

_____

_____

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_____

(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)

Q12.

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

Tick (✓) **one** box.

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Organisms with many features in common ☐

Organisms that live in the same habitat and eat the same food ☐

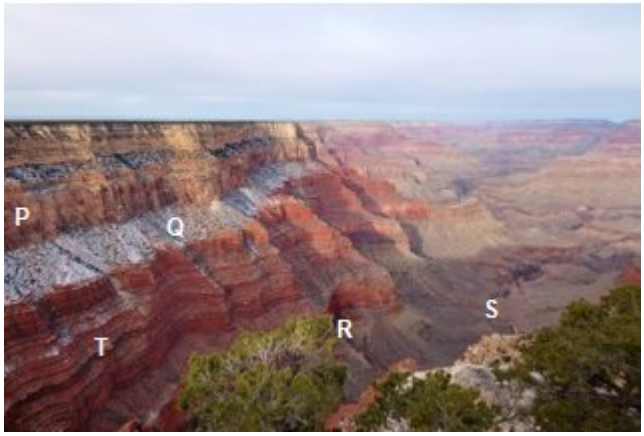
Organisms that reproduce together to form fertile offspring ☐

(1)

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

The layers of rock contain fossils.

Figure 1



© Sumikophoto/iStock/Thinkstock

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**?

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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. ☐

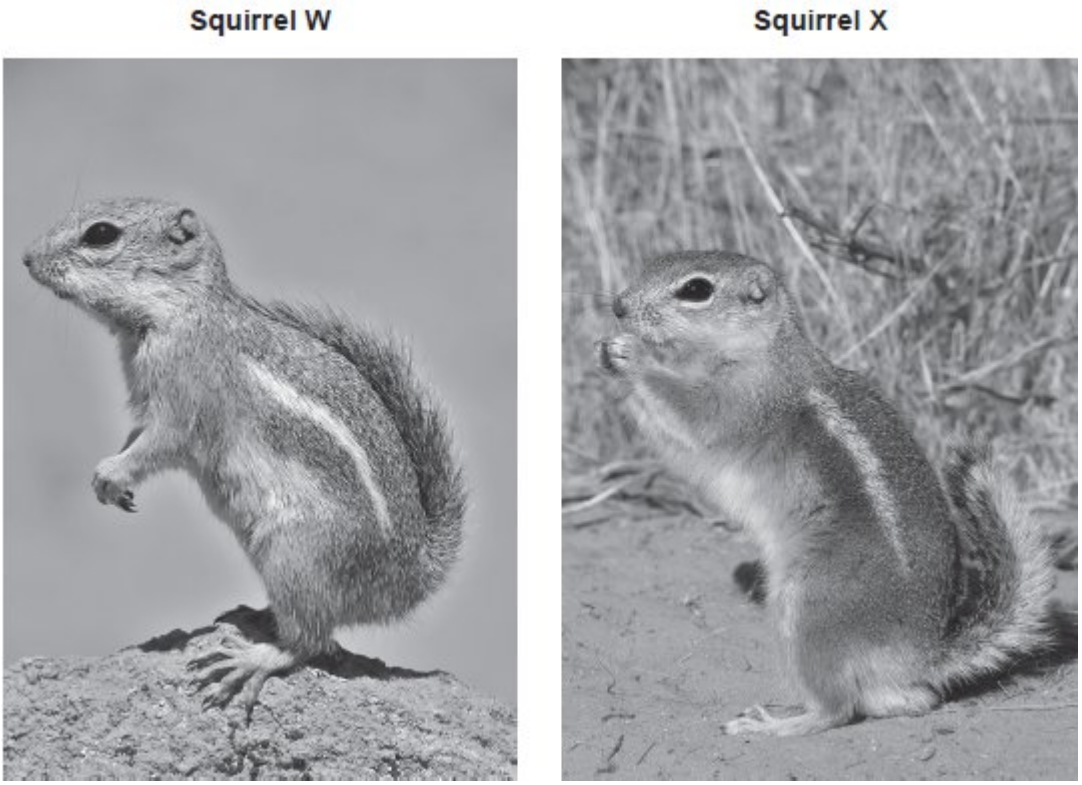
The fossil of animal **S** was found in a deeper layer of rock than the fossil of animal **T**. ☐

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.

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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)

Q13.

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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.

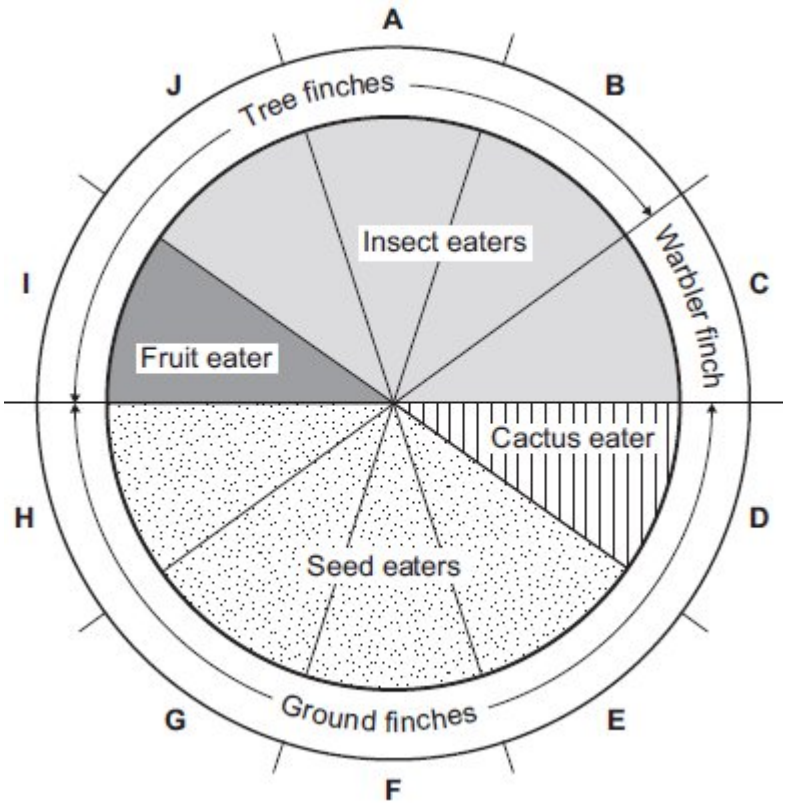
(a) Complete the following sentence.

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.

_____

_____

_____

_____

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(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)

Q14.

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.

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25 °C **40 °C** **100 °C**

(1)

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

_____

_____

(1)

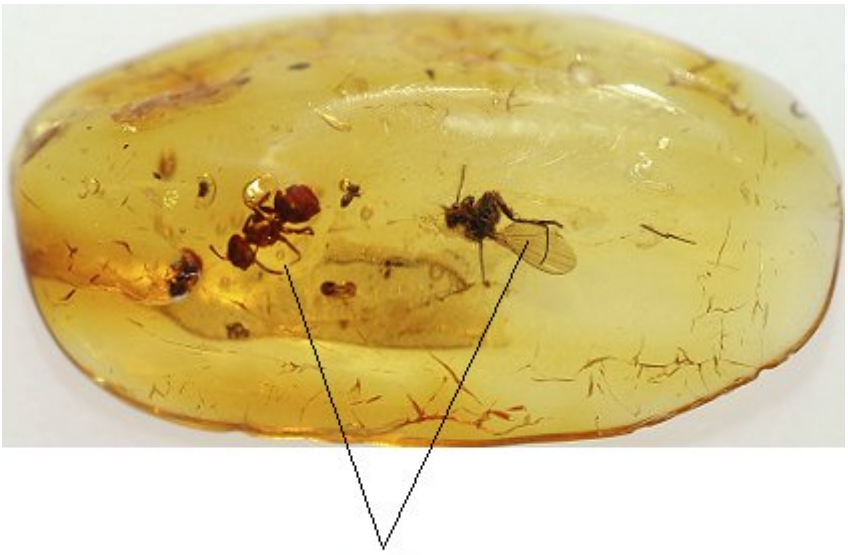
(Total 5 marks)

Q15.

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.



© fkienas/iStock/Thinkstock

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

_____

_____

_____

_____

(2)

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

1. _____

_____

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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)

Q16.

(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.

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© Wlad74/iStock/Thinkstock

(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*.

_____

_____

_____

_____

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_____

_____

_____

_____

_____

_____

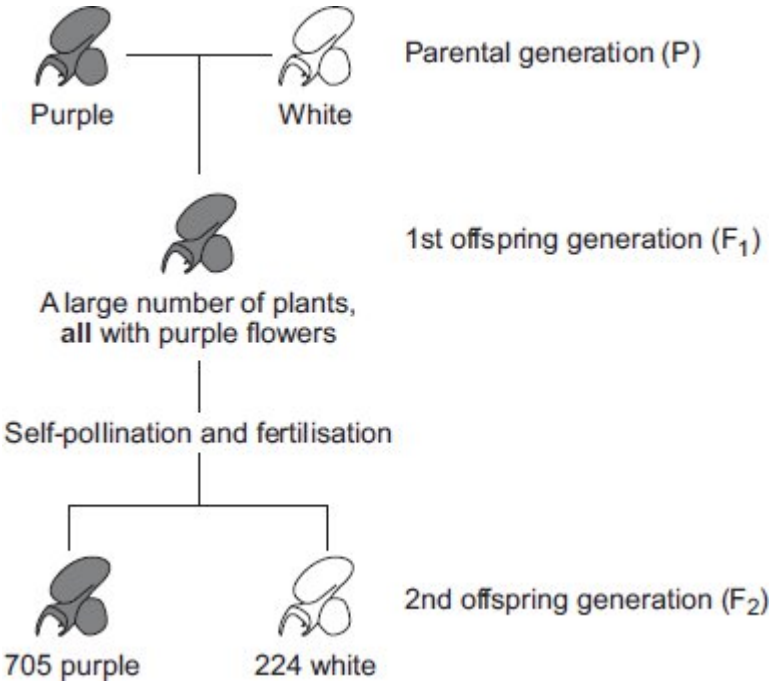
(4)

(Total 8 marks)

Q17.

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.

_____

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_____

_____

_____

(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)

Q18.

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

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By Ghedoghedo (own work) [CC-BY-SA-3.0 (http://creativecommons.org/licenses/BY-SA-3.0) or GFDL (http://www.gnu.org/copyleft/fdl.html)], via Wikimedia Commons; By Steenbergs from Ripon, United Kingdom (Small Fishing Boat In North Sea) [CC-BY-2.0 (http://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons.

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

_____

_____

_____

_____

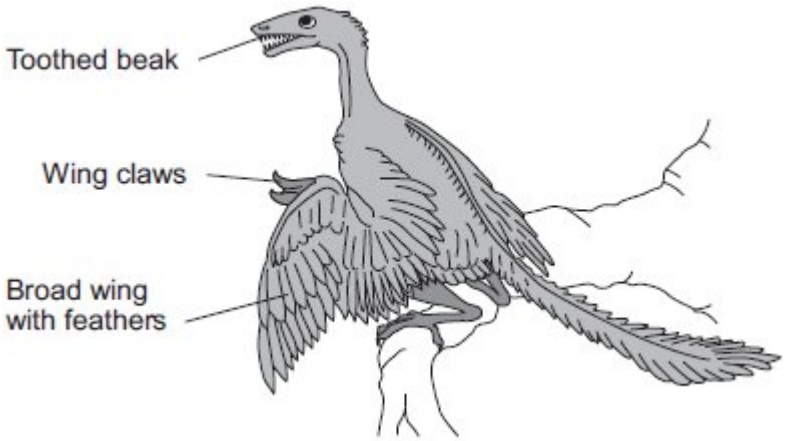
_____

_____

(3)

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

Scientists think that *Archaeopteryx* was a predator.



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(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)

Q19.

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)

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(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.

_____

_____

_____

_____

_____

_____

_____

_____

_____

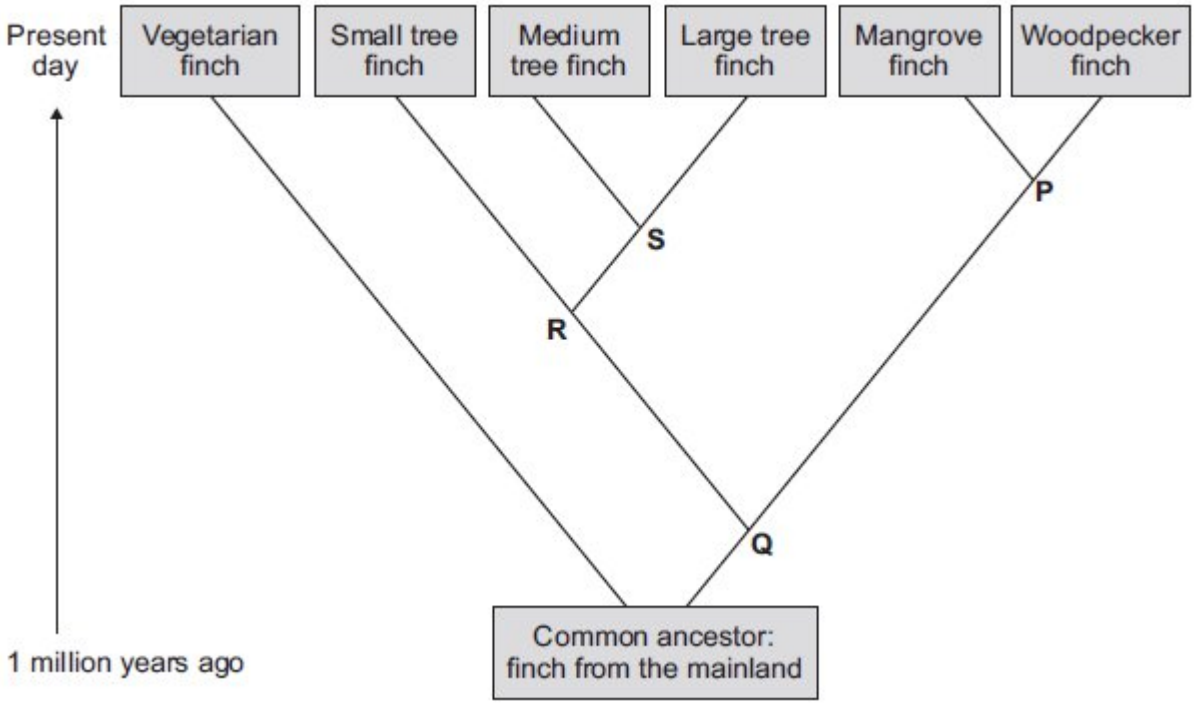
_____

_____

(4)

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

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(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)

Q20.

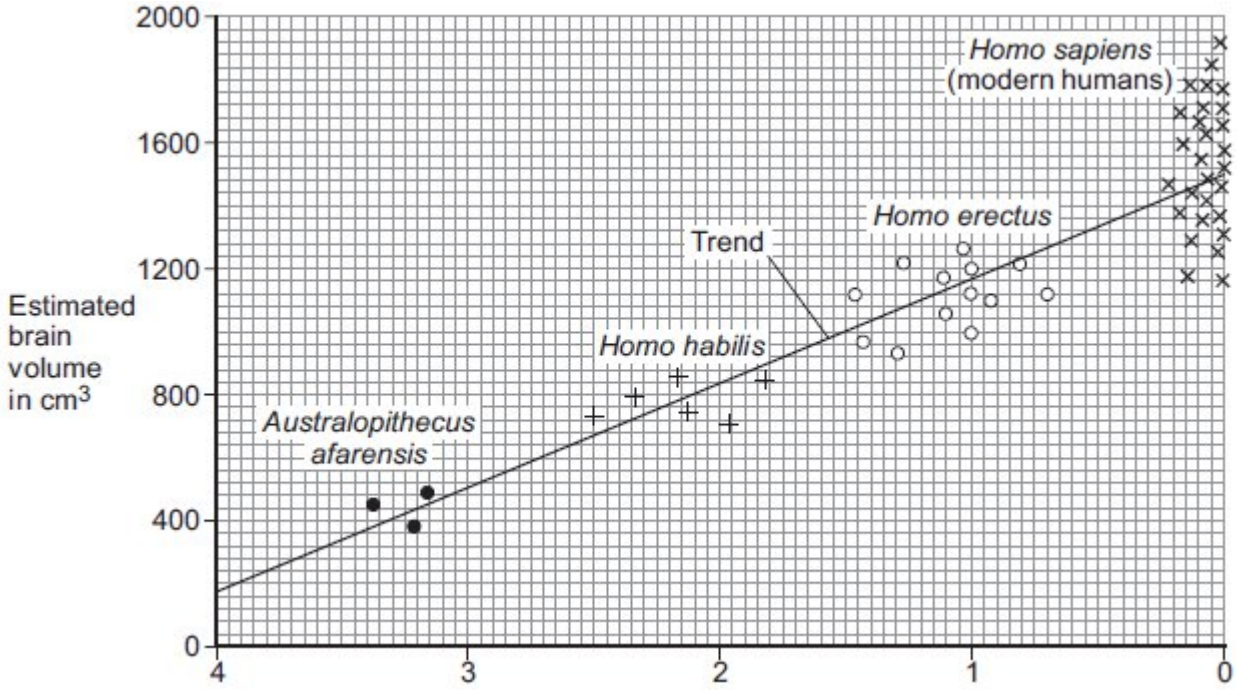
This question is about evolution in humans.

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.

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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

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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)

Q21.

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?

_____

_____

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(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)

Q22.

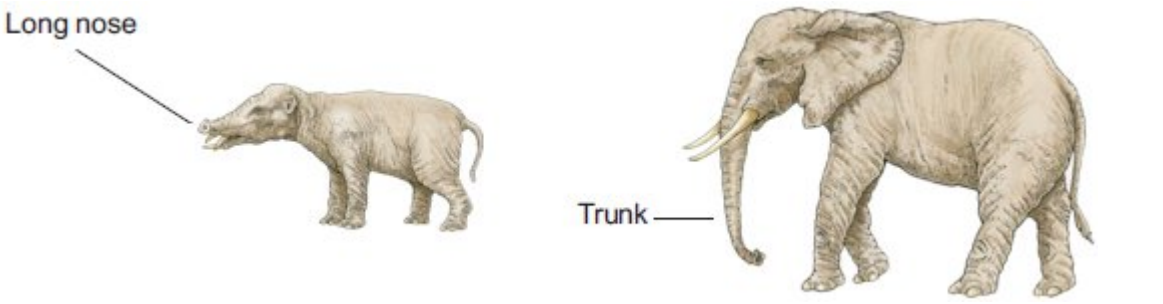
The image below shows:

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

Phiomia lived about 35 million years ago.

Phiomia **African elephant**

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© Dorling Kindersley via Thinkstock

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. _____

_____

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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)

Q23.

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.

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_____

_____

_____

_____

_____

_____

(3)

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

Figure 2



© Andreas Meyer/Hemera/Thinkstock

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)

Q24.

(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.

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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.

_____

_____

_____

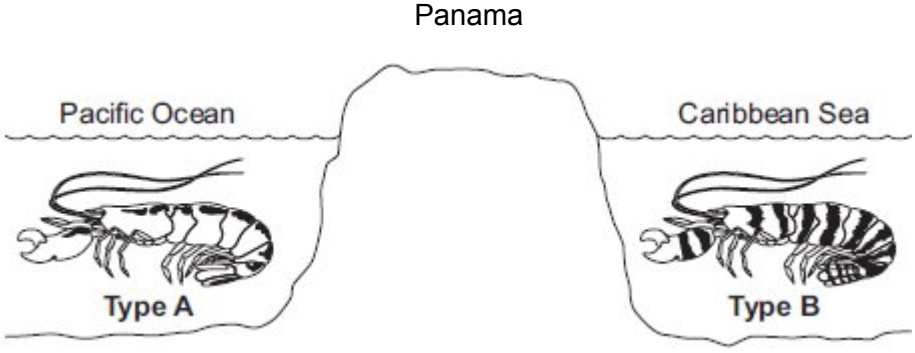
_____

_____

(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)

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(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)

Q25.

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)

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(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.

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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)

Q26.

(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 _____

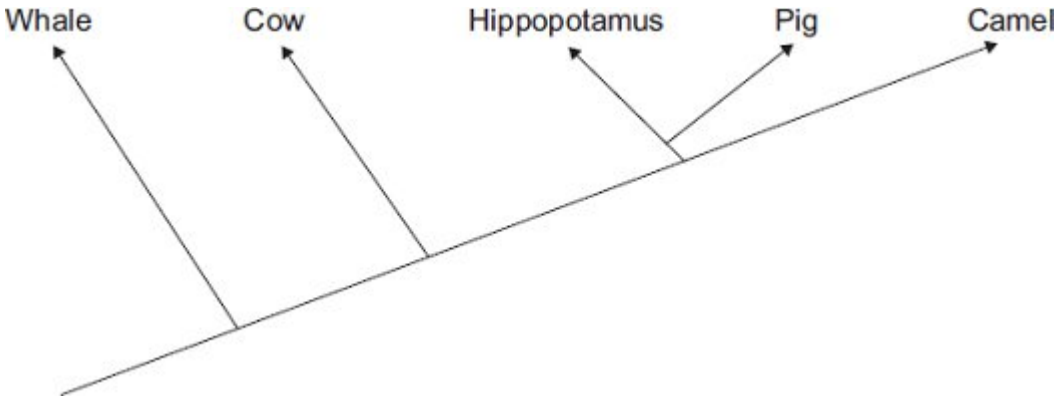
_____

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(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)

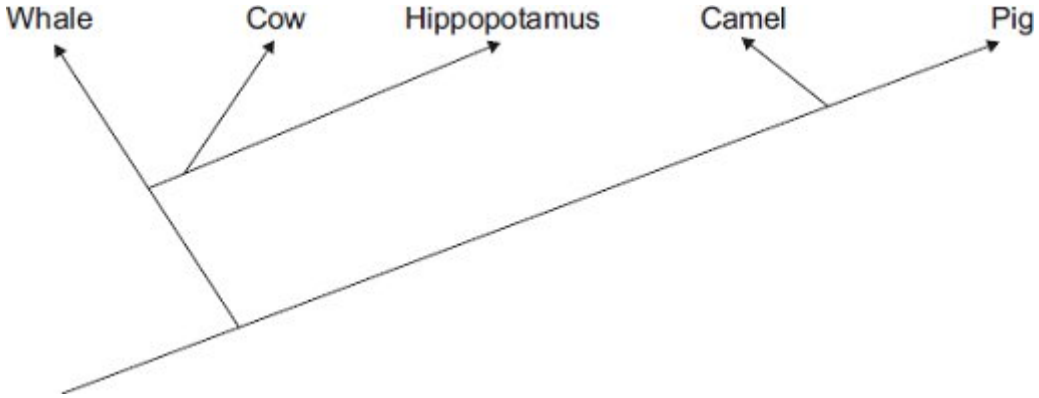
(ii) Which **two** of the animals in **Diagram 1** are most closely related?

_____ 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)

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Q27.

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.

_____

_____

_____

_____

_____

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_____

(2)

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

_____

_____

_____

_____

_____

_____

(2)

(Total 7 marks)

Q28.

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.



© Pearl Jackson/iStock

(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)

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(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)

Q29.

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

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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)

Q30.

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. _____

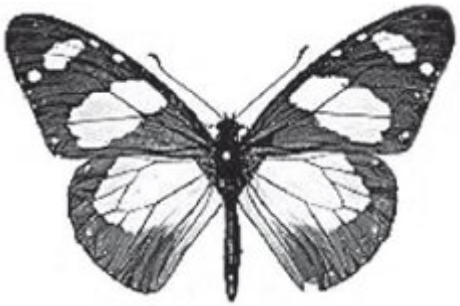
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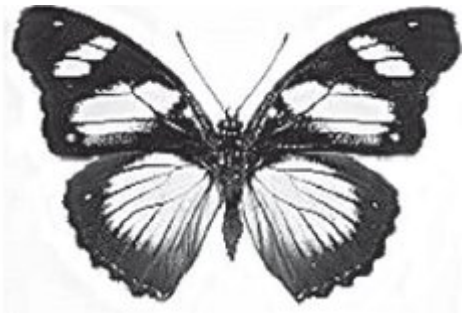
(Total 2 marks)

Q31.

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)

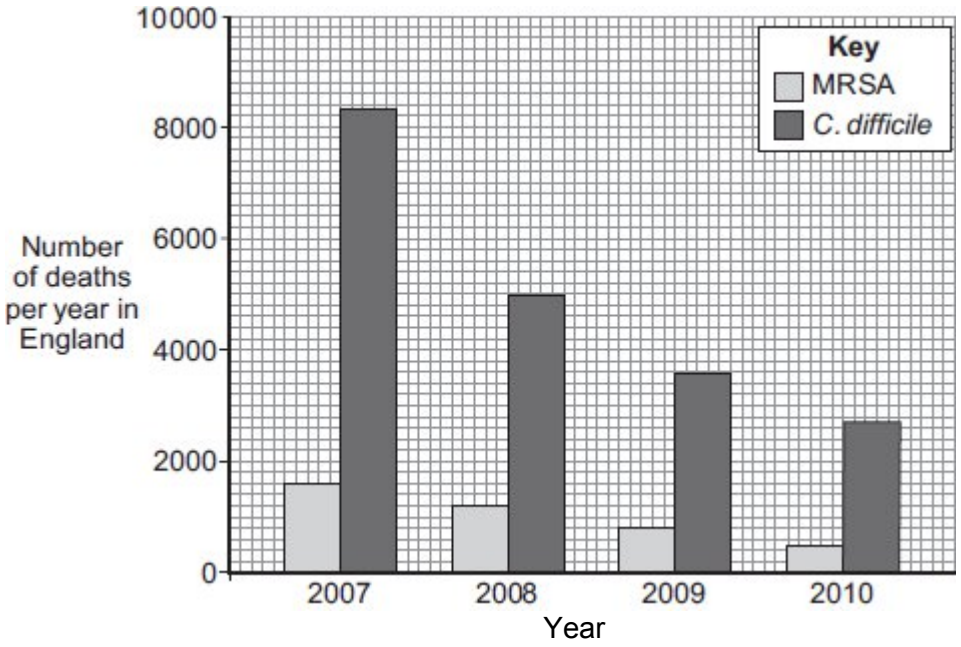
(Total 5 marks)

Q32.

Infections by antibiotic resistant bacteria cause many deaths.

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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 = _____ %

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(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)

Q33.

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.

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Tree bark covered with lichens Tree bark made black by pollution

© Kim Taylor/Warren Photographic

(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

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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)?

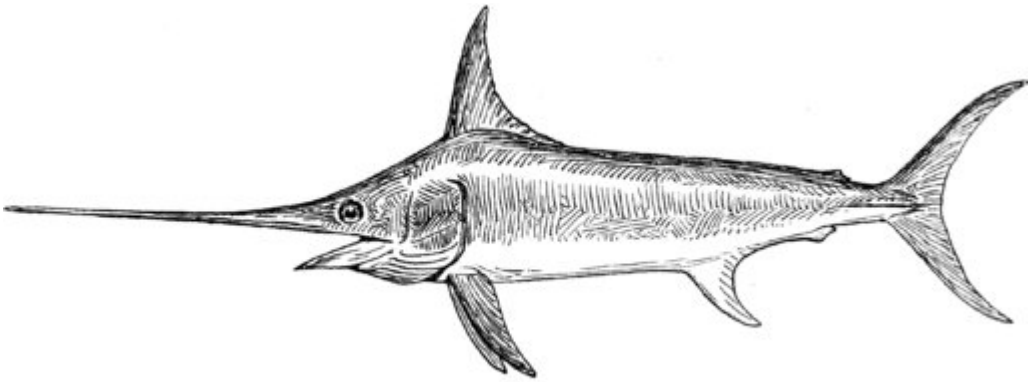
Tick (✓) **two** boxes.

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)

Q34.

The picture shows a modern swordfish.



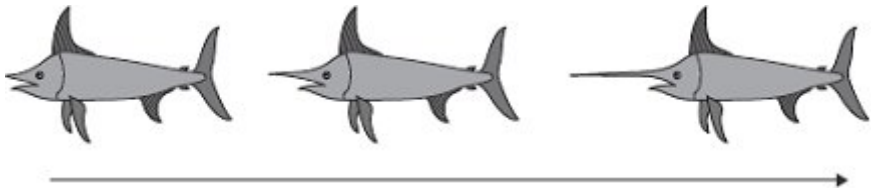
By Pearson Scott Foresman [Public domain], via Wikimedia Commons

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.

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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.

_____

_____

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_____

(1)

(Total 6 marks)

Q35.

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?

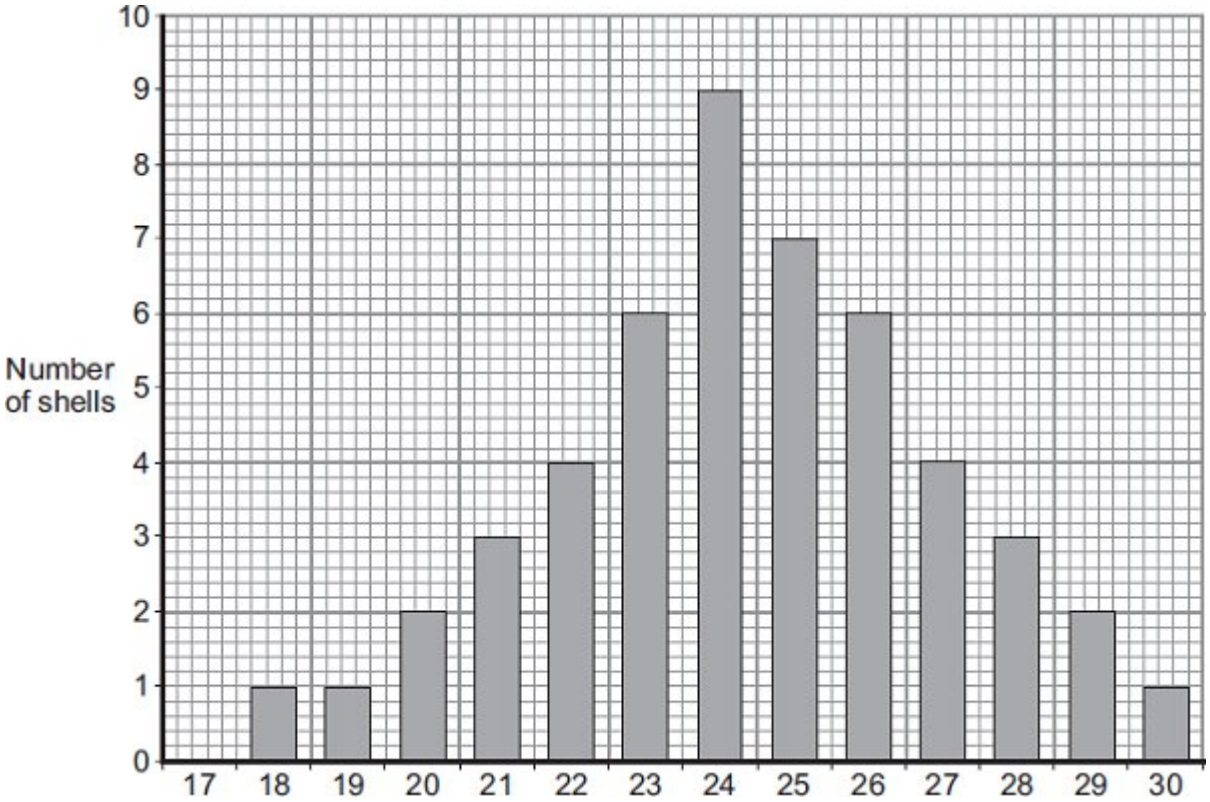
_____

_____

(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.



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Width of fossil shell in mm

(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)

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