Q1.(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.



© 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*.

.....

.....

.....

.....

.....

.....

.....

.....

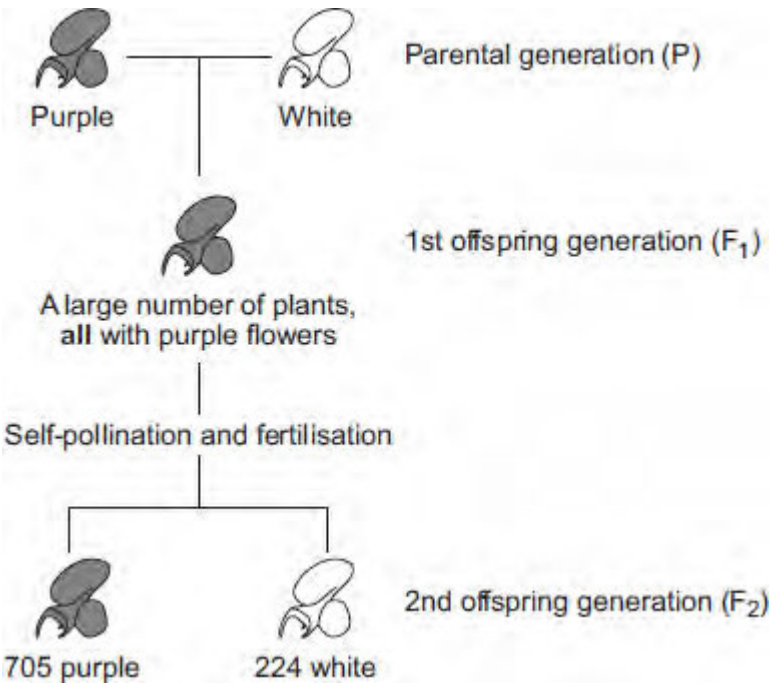
.....

.....

(4)
(Total 8 marks)

Q2. 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.....

.....

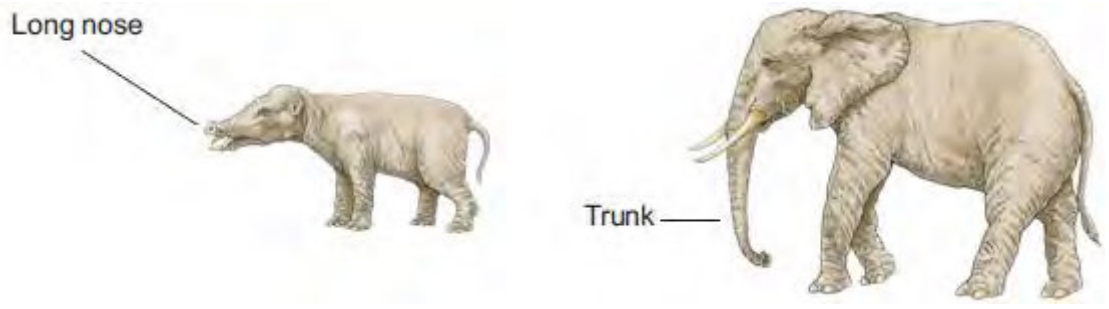
(2)
(Total 10 marks)

Q3. The image below shows:

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

Phiomia lived about 35 million years ago.

Phiomia **African elephant**



© 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 .....

.....

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)

Q4.(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.

.....

.....

.....

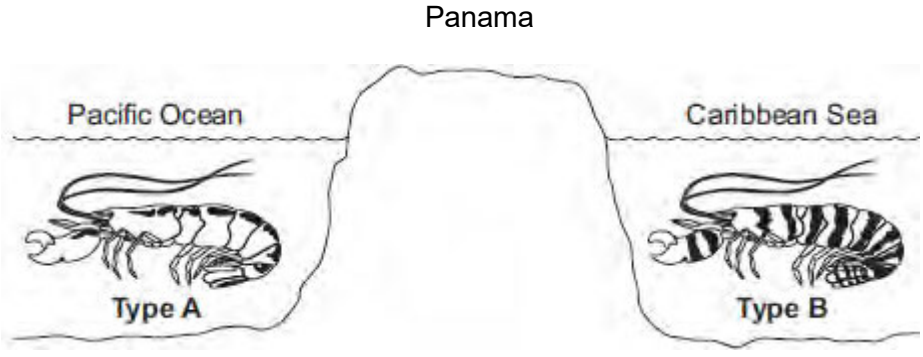
.....

.....

(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)

Q5. 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)

Q6.*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)

Q7. 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)