

Understanding Genetics And Evolution

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science – Trilogy - Biology
Exam Board	AQA
Topic	4.6 Inheritance Variation and Evolution
Sub-Topic	Dev. Understanding Genetics + Evolution
Difficulty Level	Gold Level
Booklet	Question Paper 1

Time Allowed: 60 minutes

Score: / 58

Percentage: /100

Grade Boundaries:

Q1. Different antibiotics destroy bacteria in different ways.

- Some antibiotics disrupt the bacterial cell membrane.
 - Some antibiotics disrupt the bacterial cell wall.
- (a) Antibiotics that disrupt the bacterial cell membrane often cause more side effects in humans compared with antibiotics that disrupt bacterial cell walls.

Suggest why.

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(1)

- (b) Some antibiotics prevent ribosomes functioning.

Suggest how this damages the bacterium.

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(1)

- (c) Drug manufacturers are spending less on research into new antibiotics.

One reason why is because new antibiotics are rarely prescribed.

Some people think that governments should pay drug manufacturers to develop new antibiotics.

Suggest why.

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(3)

(Total 5 marks)

Q2. Humans can use different methods to produce animals and plants with desired characteristics.

The figure below shows some different breeds of horse.



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(a) All breeds of horse are of the same species.

Suggest what you could do to show this.

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(2)

(b) Horse racing is an ancient sport.

Selective breeding has been used for centuries to produce racehorses.

Describe the steps involved in selective breeding to produce a racehorse.

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(3)

- (c) Another way of producing organisms with desired characteristics is genetic engineering.

Bt cotton is a variety of cotton that has been genetically engineered to produce a poison.

The poison kills several different species of insect that feed on cotton plants.

The poison is naturally produced by a soil bacterium called *Bacillus thuringiensis*.

Describe how cotton plants can be genetically engineered to produce the Bt poison.

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(3)

- (d) Describe the advantages and disadvantages of growing Bt cotton.

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(4)
(Total 12 marks)

Q3. Huntington's disease is an inherited disorder that affects the nervous system.

It is caused by a dominant allele.

A man is heterozygous for Huntington's disease.

His partner is healthy and does not have the allele that causes Huntington's disease.

(a) What are the genotypes of the man and the woman?

Use:

- **H** for the allele that causes Huntington's disease
- **h** for the healthy allele.

Man's genotype

Woman's genotype

(1)

(b) The couple want to have a child.

Use a Punnett square to determine the probability of the child having Huntington's disease.

Circle the genotypes of any children that will have Huntington's disease.

Probability of child having Huntington's disease =

(4)

- (c) The couple visit a genetic counsellor, who gives them the following options.
1. Adopt a child.
 2. Gamete donation – uses sperm from another man to fertilise the woman's eggs by in vitro fertilisation (IVF).
 3. Conceive naturally.
 4. Use pre-implantation genetic diagnosis (PGD).
 - Many embryos are produced by IVF using gametes from the man and woman.
 - Embryos are tested for Huntington's disease and a healthy embryo is implanted into the woman's uterus.
 - The risk of implanting an embryo with the allele for Huntington's disease is 0.2%.
 - Costs the NHS about £11 000.
 5. Conceive naturally and use prenatal diagnosis (PND) once the woman becomes pregnant.
 - A sample of the placenta is taken at 10 weeks of pregnancy or a sample of fluid is taken from around the developing baby at 16 weeks of pregnancy.
 - The sample is tested for the Huntington's allele.
 - A 0.5–1.0% risk of miscarriage.
 - About 1% of samples collected are unsuitable for testing.
 - Costs the NHS about £600.

The couple decide they want to have a healthy baby that is their own biological offspring.

Evaluate the options.

Suggest which option would be best for the couple.

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(6)
(Total 11 marks)

Q4.(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.

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(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.

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(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)

Q5. Darwin suggested the theory of natural selection.

- (a) Explain how natural selection occurs.

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(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).

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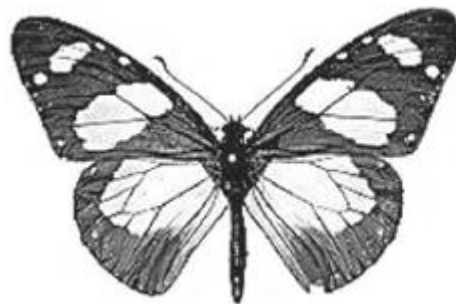
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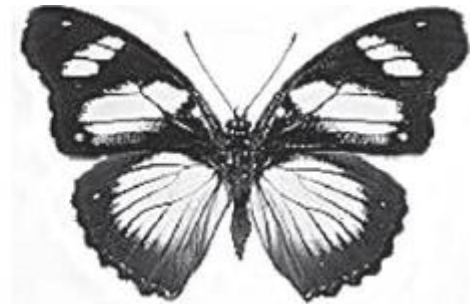
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(2)
(Total 7 marks)

Q6. 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*.

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(2)

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

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(3)
(Total 5 marks)

Q7. The photographs show the flowers of two closely-related species of plant.

Species A Species B



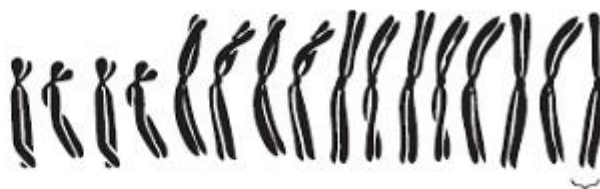
Images: © iStock/Thinkstock

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?

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(1)

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

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(2)

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

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

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(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?

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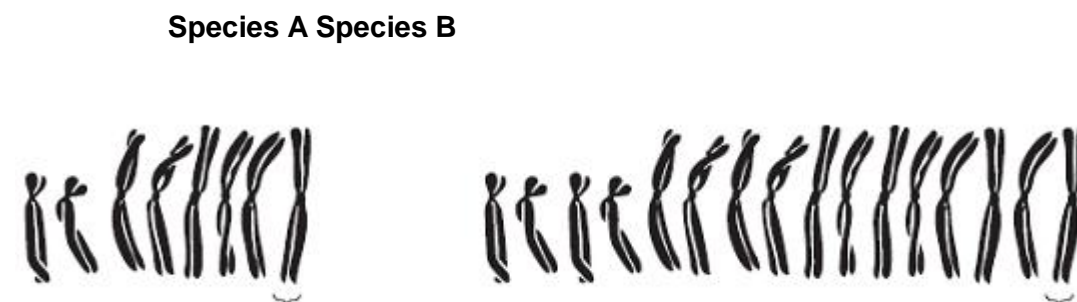
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(2)

- (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.



The offspring plants cannot reproduce sexually.

Suggest an explanation for this.

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(2)

(Total 10 marks)