

AQA – Genetic information, variation and relationships between organisms – AS Biology P2

1. May/2020/Paper_2/No.1

| | | | |
|---|---|---|---|
| 0 | 1 | . | 1 |
|---|---|---|---|

Littorina littorea is a species of snail found on rocky sea shores.

A student investigated variation in snail shell height in two populations of snails.

Give **two** ways in which the student could ensure his samples would provide a reliable measure of the variation between individuals in each population.**[2 marks]**

1 _____

2 _____

| | | | |
|---|---|---|---|
| 0 | 1 | . | 2 |
|---|---|---|---|

 The student could determine the median, mode and range from his measurement of shell heights in these populations.Give **two** other statistical values the student could calculate from his measurement of shell heights in these populations.**[1 mark]**

1 _____

2 _____

| | | | |
|---|---|---|---|
| 0 | 1 | . | 3 |
|---|---|---|---|

 Name the taxon in the hierarchy of classification represented by:**[1 mark]**1 *Littorina* _____2 *littorea* _____

0 1 . 4

The student noticed there was a difference in shell height between these populations of snails. He wanted to investigate if the difference was significant.

Give a suitable null hypothesis to use in his investigation and name the statistical test to use with these data.

[2 marks]

Null hypothesis _____

Statistical test _____

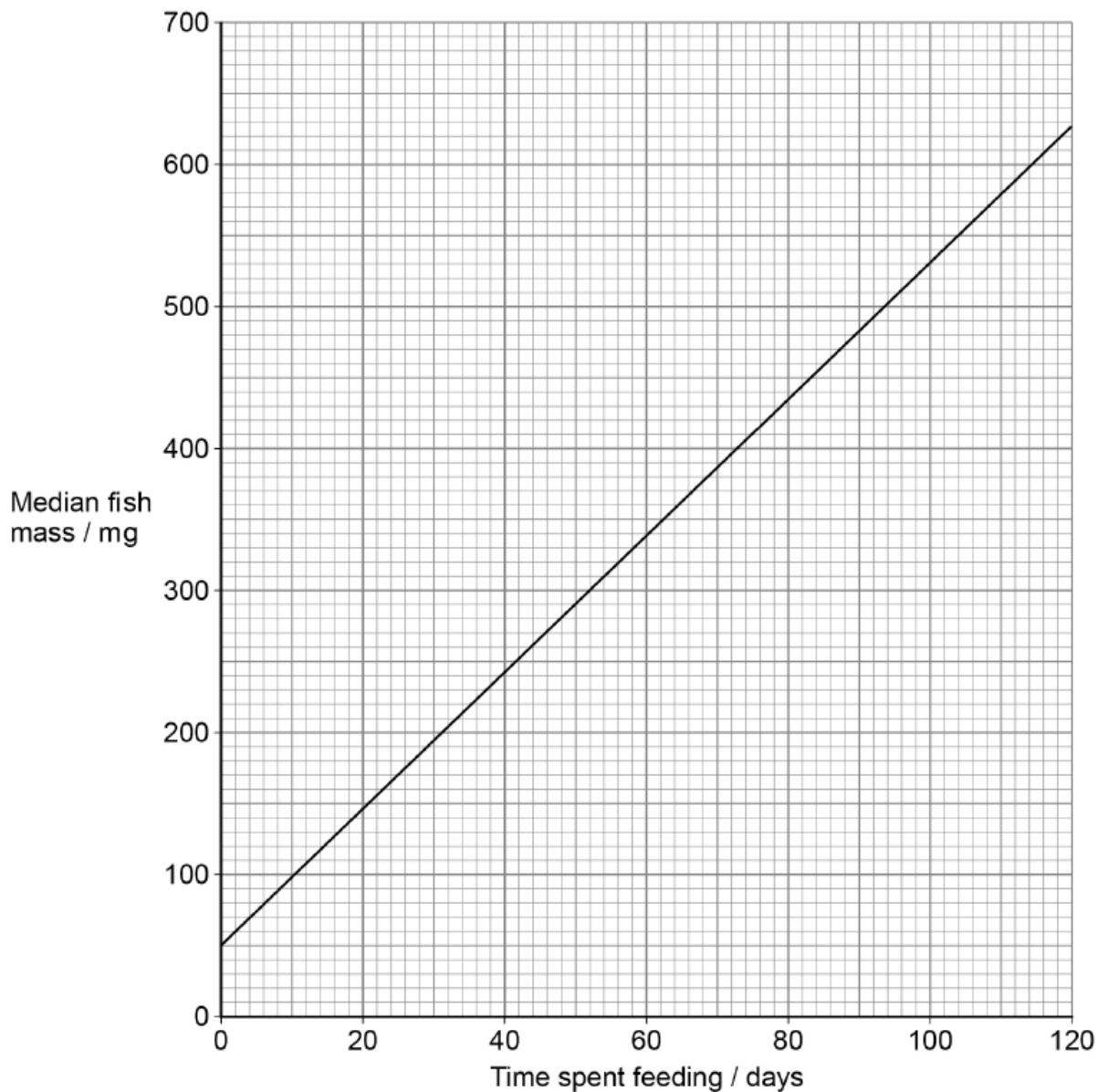
2. May/2020/Paper_2/No.6

0 6

Trout is a type of fish, often produced commercially in trout farms.

A scientist investigated the growth of farmed trout. She determined the median mass of a large population of trout at intervals. She started measuring on the day the newly hatched fish began feeding. Her results are shown in **Figure 4**.

Figure 4



The best fit line shown in **Figure 4** is represented using this equation.

$$\text{median fish mass} = (m \times \text{days feeding}) + 50$$

where m is the gradient of the best fit line.

- 0 6 . 1 Use **Figure 4** and the equation to calculate the median mass of fish after 195 days' feeding.

Show your working.

[2 marks]

Answer _____ mg

- 0 6 . 2 A trout body cell contains 80 chromosomes.

Table 2 shows the number of chromosomes and the mass of DNA in different nuclei. All the nuclei are from the same trout.

Complete **Table 2**.

[2 marks]

Table 2

| Nucleus | Number of chromosomes | Mass of DNA / arbitrary units |
|-------------------------|-----------------------|-------------------------------|
| At prophase of mitosis | 80 | |
| At telophase of mitosis | | 25 |
| From an egg cell | | |

- 0 6 . 3 Give **one** reason why trout eggs produced by meiosis are genetically different.

[1 mark]

3. May/2019/Paper_2/No.3

0 3 . 1

Name the **two** scientists who proposed models of the chemical structure of DNA and of DNA replication.

[1 mark]

A scientist replicated DNA in a test tube. To do this, he mixed an enzyme with identical single-stranded DNA fragments and a solution containing DNA nucleotides.

0 3 . 2

Name the enzyme used in this DNA replication.

[1 mark]

0 3 . 3

Use your knowledge of semi-conservative replication of DNA to suggest:

[3 marks]

1. the role of the single-stranded DNA fragments _____

2. the role of the DNA nucleotides. _____

4. May/2019/Paper_2/No.6

0 6

A scientist crossed a strain of the fungus *Neurospora* producing pink spores with a strain of *Neurospora* producing white spores.

To cross these strains, he used aseptic techniques. He moved a small agar cube containing one strain of the fungus onto a new agar plate. Then he placed a second agar cube containing the other strain of fungus next to the first agar cube.

0 6 . 1

Describe and explain **three** ways in which the scientist would ensure he used aseptic techniques to move each cube of agar onto a new agar plate.

[3 marks]

1 _____

2 _____

3 _____

In the life cycle of *Neurospora* most stages are haploid. Fusion of two haploid strains of this fungus produces diploid zygotes. Nuclear division in these zygotes occurs by meiosis.

0 6 . 2

Give **two** differences between mitosis and meiosis.

[2 marks]

1 _____

2 _____

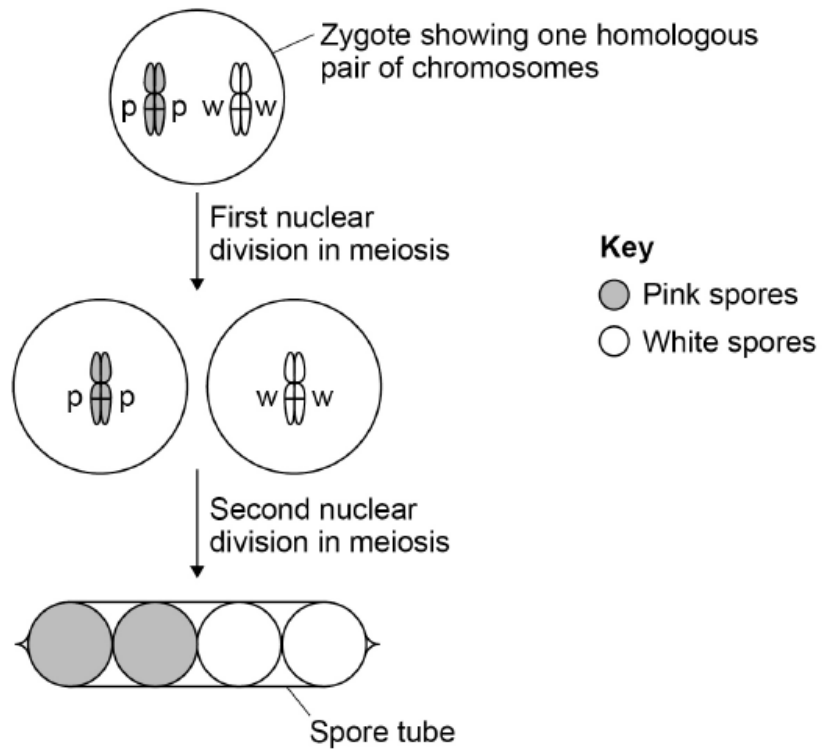
At the end of meiosis, this fungus produces cells called spores.

The spores are produced in narrow tubes that restrict their movement. As a result, each tube contains a single line of spores. The spores are coloured either pink or white.

The spore colour gene is located on a pair of homologous chromosomes. Each zygote produced in this cross has one chromosome with a pink allele (p) and one chromosome with a white allele (w).

This is shown in **Figure 7**.

Figure 7



0 6 . 3 There are seven chromosomes in a spore nucleus.

Place a tick (✓) in the box next to the number that represents the number of **chromatids** present in the zygote shown in **Figure 7**.

[1 mark]

7

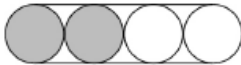


14

21

28

The scientist recorded the arrangement of coloured spores inside many narrow tubes. His results are shown in **Table 2**.

Table 2

| Type of spore tube | Arrangement of coloured spores | Number of narrow tubes |
|--------------------|--|------------------------|
| 1 |  | 81 |
| 2 |  | 78 |
| 3 |  | 10 |

0 6 . 4

Using all the information in this question, what can you conclude from the scientist's results about the movement of chromosomes in meiosis in this fungus?

[3 marks]

5. May/2019/Paper_2/No.7

0 7

Scientists investigated changes in the mass of fish from three populations of the same species. The fish they used had a life cycle of one year.

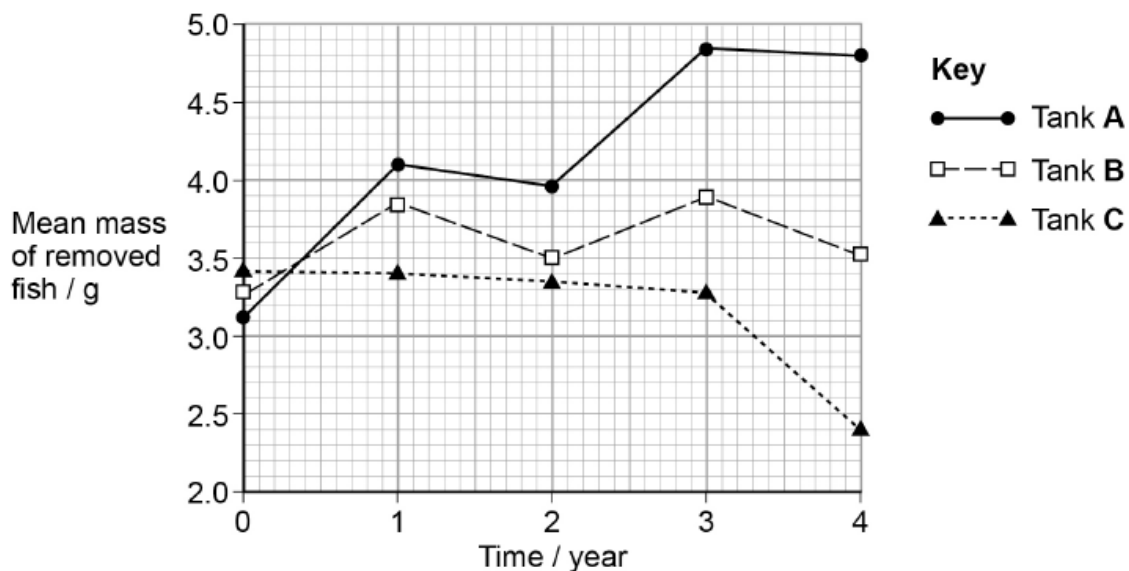
The scientists set up three fish tanks, each containing a separate population. Each year the scientists removed all the fish from each tank and determined the mean mass of the fish removed. They then put back 10% of each population in the following way.

- Tank A – put back only the largest fish.
- Tank B – put back fish at random.
- Tank C – put back only the smallest fish.

During each year the fish were left to grow and reproduce.

The scientists' results are shown in Figure 8.

Figure 8



0 7 . 1

What type of selection were the scientists modelling in this investigation by putting back only the largest or only the smallest fish in Tank A and Tank C? Give a reason why.

[2 marks]

Type of selection _____

Reason _____

0 7 . 2 Explain the purpose of Tank **B** (on page 21).

[2 marks]

0 7 . 3 Calculate the ratio of the mean mass of fish removed from Tank **A** (on page 21) to the mean mass of fish removed from Tank **C** (on page 21) at 1 year and at 4 years.

How much greater is the ratio at 4 years compared with the ratio at 1 year?

[2 marks]

Ratio at 1 year = _____

Ratio at 4 years = _____

How much greater at 4 years = _____

0 7 . 4

Sea fishing is regulated in law. The size of the mesh used in some fishing nets is controlled so that small fish can escape but large fish are captured. This regulation is designed to protect populations of wild fish.

Using all the information in this question, evaluate whether the scientists' investigation supports the use of these types of nets in sea fishing.

[3 marks]

[Extra space]

6. May/2019/Paper_2/No.8

0 8 . 1

The genetic diversity of species is measured by comparing differences in the base sequence of DNA or differences in the base sequence of mRNA.

Give **two** other ways in which genetic diversity between species is measured.

[2 marks]

1 _____

2 _____

Scientists investigated differences between 260 North American bird species by comparing the base sequence of a gene in mitochondrial DNA. They compared the gene base sequence of each bird with all of the other 259 species. For each comparison they calculated the percentage difference in base sequence.

0 8 . 2

Figure 9 shows the base sequence for part of the gene in two species.

Figure 9

Species 1 A G C T G C C T A G A

Species 2 A T G T G G C A A G A

Calculate the percentage difference in base sequence for these base sequences.

[1 mark]

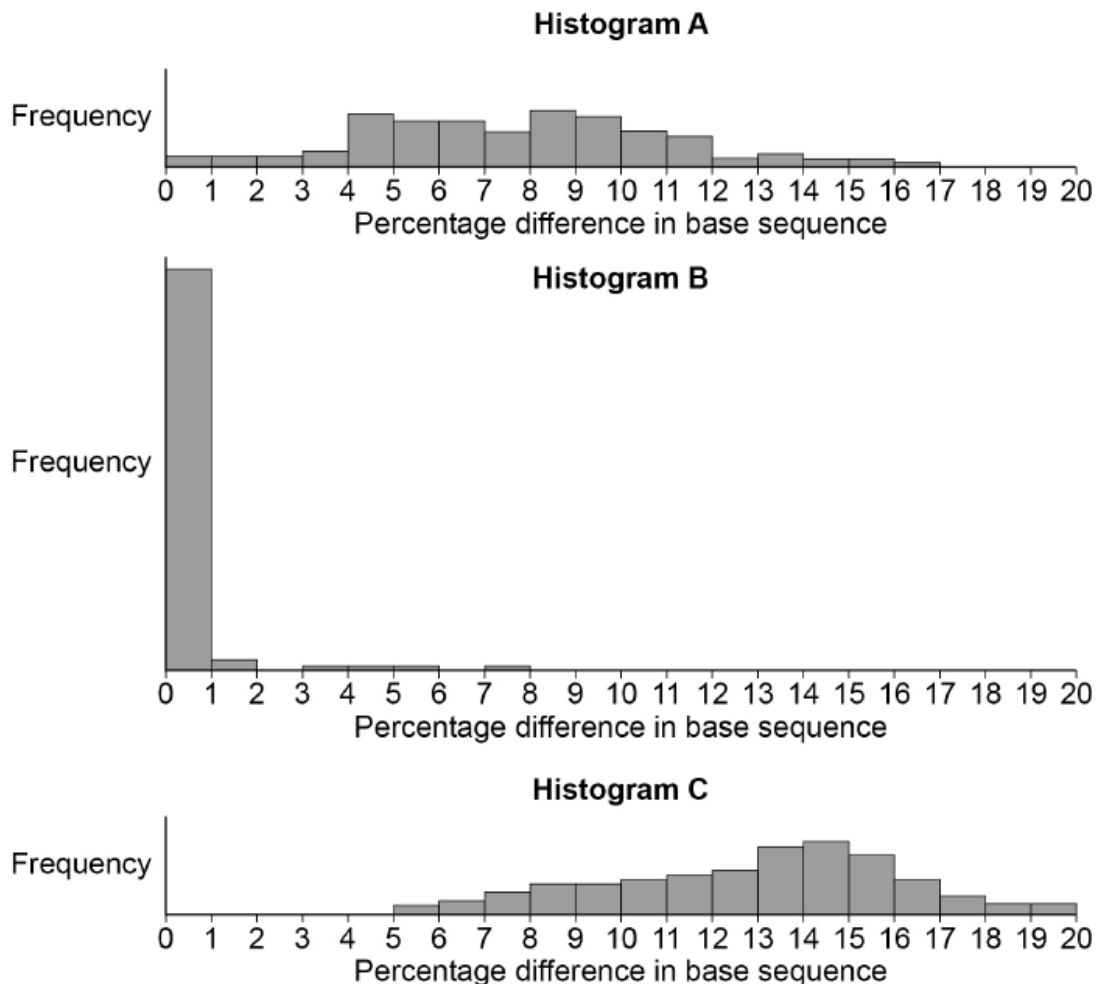
Answer = _____ %

The scientists compared base sequences in:

- birds of the same species
- birds of different species in the same genus
- birds of different species in the same family.

The scientists' results are shown in **Figure 10**.

Figure 10



0 8 . 3

Complete **Table 3** by writing **A**, **B** or **C** in the box to correctly match the statement to each histogram shown in **Figure 10**.

[1 mark]

Table 3

| Statement | Histogram |
|--|-----------|
| Base sequences of birds of the same species. | |
| Base sequences of birds of the same genus. | |
| Base sequences of birds of the same family. | |

- 0 8 . 4 To calculate the percentage difference in base sequences, the scientists first counted the number of bases and the number of base differences.

What statistical test should the scientists use to test whether the number of base differences between birds in histogram **A** (on page 25) and birds in histogram **C** (on page 25) is statistically significant?

Place a tick (✓) in the box against the statistical test you would use.

Justify your answer.

[2 marks]

Chi-squared

Correlation coefficient

Student's t-test

Justification _____

