10.2 Inheritance

Question Paper

Course	DP IB Biology
Section	10. Genetics & Evolution (HL Only)
Topic	10.2 Inheritance
Difficulty	Easy

Time allowed: 60

Score: /43

Percentage: /100

Question 1a

a)
Define the term 'genotype'.

[1 mark]

[1 mark]

Question 1b

b)
In guinea pigs, the allele for black hair (*B*) is dominant to the allele for white hair (*b*) and the allele for long hair (*L*) is dominant to the allele for short hair (*l*). A double homozygous guinea pig with long, black hair was bred with another double homozygous guinea pig with long, white hair.

State the genotypes of the two parent guinea pigs.

[2 marks]

[2 marks]

Question 1c

c)
Use a genetic diagram to show the ratio of different phenotypes which could result from the cross discussed in part (b).

[3 marks]

[3 marks]

Question 2a

a)

In 1905 a group of scientists were investigating Mendelian inheritance by carrying out experiments on sweet pea plants. They were looking at the inheritance of two traits, flower colour and pollen grain shape. Flower colour is determined by two alleles, the dominant *P* for purple and recessive *p* for red. Pollen grain shape is determined by two alleles, the dominant *L* for long and recessive *l* for round.

They started by breeding together a double homozygous dominant plant (*PPLL*) with a double homozygous recessive plant (*ppll*) to produce a generation of plants that were all double heterozygous (*PpLl*).

They then bred together several double heterozygous plants and ended up with 381 offspring.

The outcome of the crosses are as follows:

Phenotype and genotype	Observed	Expected from 9:3:3:1 ratio
Purple flower, long pollen	284	
Purple flower, round pollen	21	
Red flower, long pollen	21	
Red flower, round pollen	55	

Complete the third column of the table above with the expected number of individuals of each phenotype if the expected 9:3:3:1 ratio of offspring traits had occurred.

[3 marks]

[3 marks]

Question 2b

b)

In order to establish whether there was a significant difference between the actual results and the expected results, a statistical test is required.

Identify which statistical test the scientists should use.

[1 mark]

[1 mark]

Question 2c

c)
It was found that there was a significant difference between the expected and observed results from the genetic cross.

The genes are not located on the sex chromosomes.

Suggest a possible reason for the data that was collected in the experiment.

[1 mark]

[1 mark]

Question 2d

d)
The work of these scientists helped to establish the idea that not all dihybrid crosses produce Mendelian ratios and was later expanded on by another scientist through his work with *Drosophila*.

State the name of this scientist.

[1 mark]

[1 mark]

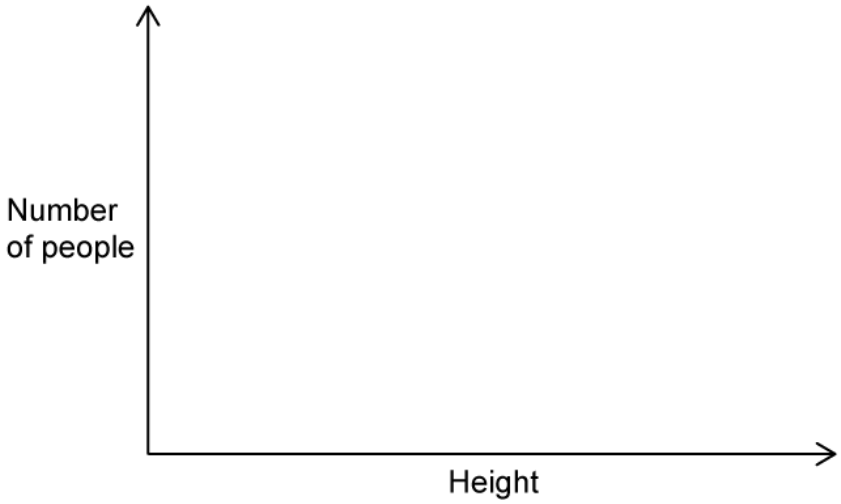
Question 3a

a)

A group of 1000 people were chosen at random and surveyed as part of a population study. The participants were asked about their characteristics.

One characteristic that was surveyed was the participant's height measurements.

Sketch a graph in the space below to predict the distribution of individuals height values.



[2 marks]

[2 marks]

Question 3b

b)

Name the type of variation shown in the example in part (a).

[1 mark]

[1 mark]

Question 3c

c)
Another characteristic that was surveyed was hair colour.

It was found that most individuals had black, brown, blonde, or ginger hair, but a small number of individuals had hair colours like pink, blue and green.

Describe the factors that can cause variation in hair colour.

[2 marks]

[2 marks]

Question 3d

d)
Some characteristics that are more likely to be examples of continuous variation are those that are coded for by several genes that work in combination to produce the phenotype.

State the scientific term used for this type of characteristic.

[1 mark]

[1 mark]

Question 4a

a)
Describe the process of autosomal linkage.

[3 marks]

[3 marks]

Question 4b

b)
In tomato plants, the genes for height and for the type of leaf are autosomally linked.

The allele *T*, for a tall plant, is dominant to the allele *t*, for a dwarf plant. The allele *M*, for normal leaves, is dominant to the allele *m*, for mottled leaves.

A tomato plant is heterozygous, with both dominant alleles located on one chromosome and both recessive alleles located on the other.

Draw the correct notation to represent the genotype of this plant.

[2 marks]

[2 marks]

Question 4c

c)
The plant from part (b) was crossed with another plant with the same genetic composition.

By drawing a genetic diagram, predict the genotypes and phenotypes of the offspring produced by this cross.

[3 marks]

[3 marks]

Question 4d

d)
A small number of offspring from the cross possess phenotypes that were different to the ones predicted in part (c).

Suggest how it is possible for some plants to have different combinations of phenotypes than expected.

[2 mark]

[2 marks]

Question 5a

One mark is available for clarity of communication throughout this question.

a)
Describe the purpose of a test cross as well as the steps involved in carrying it out.

[4 marks]

[4 marks]

Question 5b

b)
Outline the causes of variation.

[7 marks]

[7 marks]

Question 5c

c)
Explain how an understanding of inheritance would allow farmers to selectively breed their livestock for specific characteristics.

[4 marks]

[4 marks]