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BIOLOGY

INHERITANCE AND HARDY-WEINBERG PRINCIPLE

Level & Board	AQA (A-LEVEL)
TOPIC:	INHERITANCE AND HARDY
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	6
TOTAL MARKS	34

Inheritance and Hardy-Weinberg Principle - 1

1.

Male fruit flies have sex chromosomes XY, whereas females have sex chromosomes XX. An X chromosome gene controls the color of the eyes in fruit flies. In comparison to the allele for white eyes, r, the allele for red eyes, R, is dominant.

(a) White eyes are more common in male fruit flies than in female ones.

Describe your reasoning. **(2)**

(b) To produce a large number of progeny, a male fruit fly with red eyes and a female fruit fly with white eyes were crossed.

Mark (✓) the box next to the statement that accurately characterizes the offspring of this cross. **(1)**

All offspring red-eyed ☐

All females red-eyed, all males white-eyed ☐

All males red-eyed, all females white-eyed ☐

All males white-eyed, females red-eyed and females white-eyed ☐

The genes responsible for wing development and body color in fruit flies are not located on the sex chromosomes. Compared to the gene for black body color, g, the allele for grey body color, G, is dominant. In comparison to the allele for short wings, l, the allele for long wings, L, is dominant.

Fruit flies with black bodies and short wings were crossed with fruit flies with grey bodies and long wings (heterozygous for both genes) by a geneticist.

The outcome of this cross is displayed in the table below.

Phenotype of offspring	**Number of offspring**
Grey body **and** long wings	223
Black body **and** short wings	218

(c) Describe the outcomes seen in the preceding table. **(3)**

(d) There were fifty female fruit flies in the population's first generation.

Determine the number of female fruit flies that would be produced in the fifth generation from this population.

One may presume:

There is no immigration or emigration, every female produces 400 children per generation, half of the offspring produced are female, and no flies perish before reproducing.

Display your work.

Provide a standard response. **(3)**

2

(a) One reason for genetic variety in organisms is mutation.

Name two more reasons why there is genetic variation. **(2)**

The T allele for tallness is dominant over the t allele for dwarfism in a species of flowering plant. Two alleles, CR (red) and CW (white), in the same species, code for the color of flowers. All of the progeny produced pink flowers when homozygous red-flowered plants were crossed with homozygous white-flowered plants.

(b) Identify the connection between the two alleles that determine the color of the bloom. **(1)**

(c) A heterozygous tall plant with white flowers was mated with a dwarf plant that had pink flowers.

Fill in the genetic diagram to see every potential genotype and the proportion of traits anticipated in this cross progeny. **(3)**

Phenotypes of parents:	Dwarf, pink-flowered	×	Tall, white-flowered
Genotypes of parents:	________________		________________

Genotypes of offspring: ____

Phenotypes of offspring: _______________________________________

____

Ratio of phenotypes: ____

3.

(a) Nine percent of the plants in a population of this species had red flowers.

Determine the proportion of pink-flowered plants there are in this population using the Hardy–Weinberg equation.

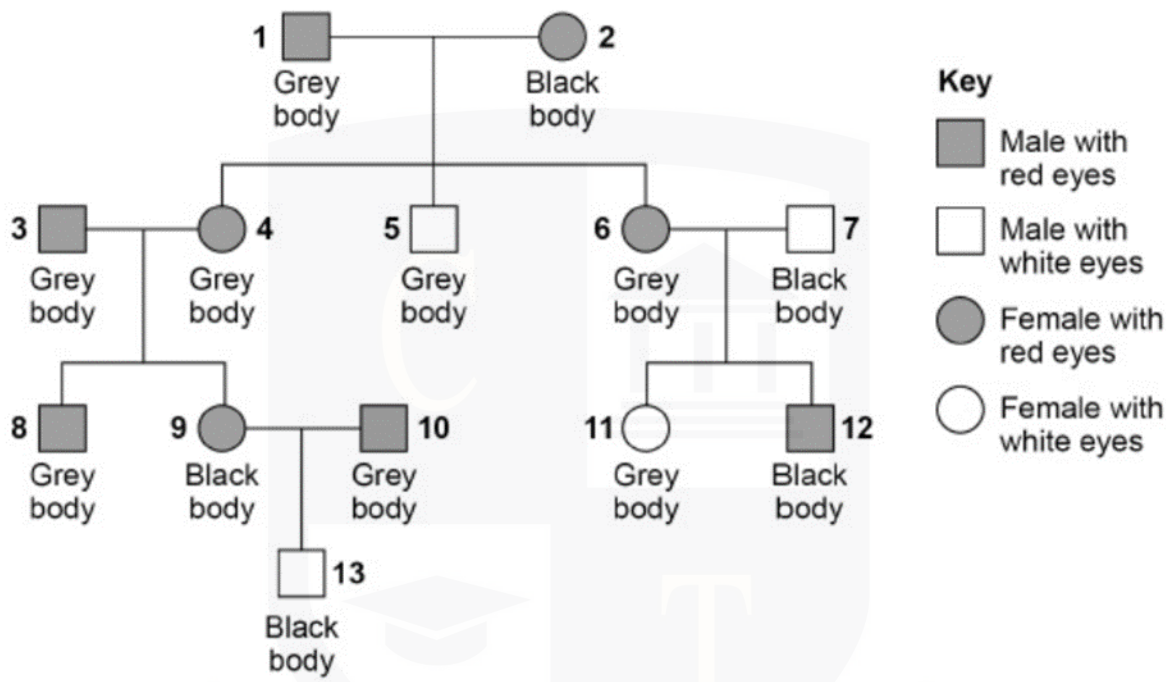
Display your work. **(2)**

4.

In fruit flies, a gene for body colour has a dominant allele for grey body, G, and a recessive allele for black body, g.

A gene for eye colour has a dominant allele for red eyes, R, and a recessive allele for white eyes, r, and is located on the X chromosome.

The diagram shows the phenotypes of fruit flies over four generations.



(a) Give the fly with number six in the diagram its whole genotype**. (1)**

(b) Provide one example from the following graphic to demonstrate the dominance of the grey body color allele. **(1)**

(c) Describe one example from the above graphic that demonstrates the body color gene is not located on the X chromosome. **(2)**

5.

(a) A male fly with red eyes and a black body was crossed with a heterozygous female fly with white body and gray eyes.

Fill in the genetic diagram below to display every potential genotype and the proportion of traits that should be present in the progeny of this cross. **(3)**

Phenotypes of parents:	Grey-bodied, white-eyed female	×	Black-bodied, red-eyed male
Genotypes of parents:	________________	×	________________

Genotypes of offspring ____________________________________

Phenotypes of offspring ____________________________________

____

____

Ratio of phenotypes ____

(b) A population of fruit flies contained 64% grey-bodied flies. Use the Hardy–Weinberg equation to calculate the percentage of flies heterozygous for gene G. **(2)**

6.

(a) The observed phenotypic ratios in the progeny of genetic crossings frequently differ from the predicted ratios.

Give two explanations for this. **(2)**

The genes for leaf type and height are located on the same homologous pair of chromosomes in tomato plants. For tall plants, the gene T is dominant over the allele t for dwarf plants. For normal leaves, the allele M is dominant over the allele m for mottled leaves.

A biologist analyzed the progeny that resulted from crossing parent plants that were heterozygous for both genes. The graphic illustrates how the two alleles for both genes were positioned in each parent plant. Table 1 displays the phenotypes and number of offspring produced.

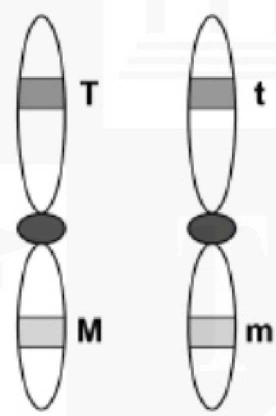


Table 1

Phenotype of offspring	Number of offspring
Tall plants and normal leaves	1860
Tall plants and mottled leaves	68
Dwarf plants and normal leaves	57
Dwarf plants and mottled leaves	580

(b) What genotype would the progeny have if they had mottled leaves and dwarf plants? **(1)**

(c) Explain the outcomes in Table 1 using the available data**. (3)**

(d) Fill in Table 2 to display the predicted phenotypic ratio in the event that the same cross had been performed but the genes determining the plant's height and leaf type were on distinct homologous pairs of chromosomes. **(2)**

Table 2

Phenotype of offspring	Ratio of offspring

I am Sorry !!!!!

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