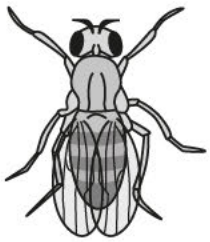
**1** In fruit flies, the length of the wings is controlled by a gene with two alleles. The allele for long wings (**L**) is dominant to the allele for short wings (**l**). The diagram shows a long-winged fruit fly and a short-winged fruit fly.



long-winged fruit fly



short-winged fruit fly

(a) Complete the table by writing the genotype, the description of genotype and the phenotype of the fruit flies.

**(3)**

| Genotype | Description of genotype | Phenotype |
|---|---|---|
| LL | homozygous dominant | |
| Ll | heterozygous | |
| | | short-winged |

(b) Two heterozygous fruit flies mated. The number of long-winged and short-winged offspring produced are shown below.

| Long-winged offspring | Short-winged offspring |
|---|---|
| 612 | 204 |

Tick **one** box to show the number of these offspring that is likely to be heterozygous.

**(1)**

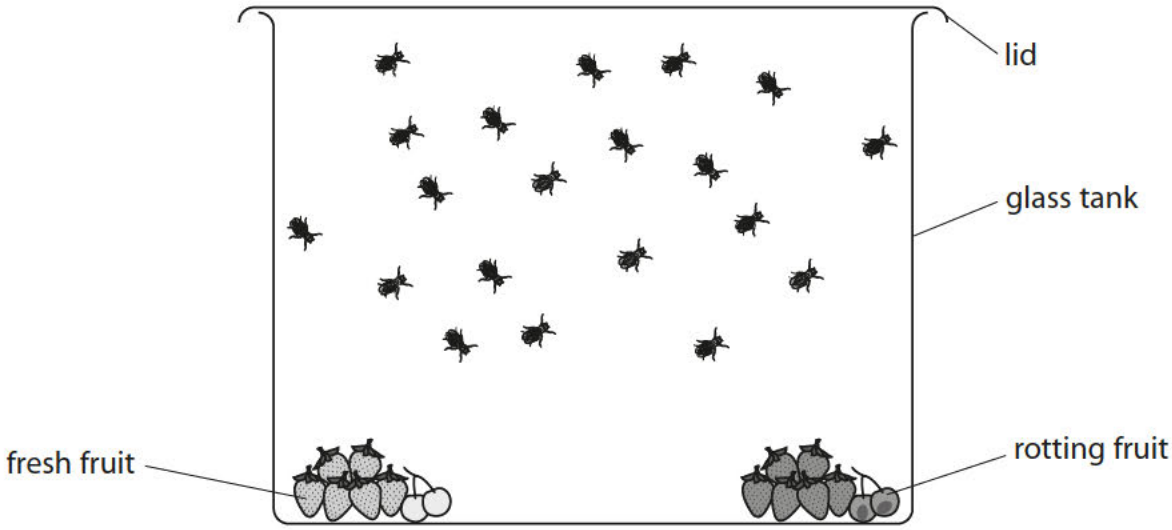
| Number | Tick |
|---|---|
| 204 | |
| 408 | |
| 612 | |
| 816 | |

(c) Yeast cells feed on rotting fruit. Fruit flies feed on these yeast cells.

Use this information to draw a food chain in the space below.

**(2)**

(d) A student wanted to find out if fruit flies are attracted to rotting fruit. He set up this apparatus.




He released 20 fruit flies into the glass tank. After ten minutes, he counted the number of fruit flies found near the fresh fruit and the number found near the rotting fruit. The table shows his results.

| Number of fruit flies counted after ten minutes | |
|---|---|
| near fresh fruit | near rotting fruit |
| 4 | 16 |

(i) Name two factors that the student should control in this investigation.

**(2)**

1 .....

2 .....

(ii) Do you think the student's results are reliable?

Give a reason for your answer.

**(1)**

.....

.....

.....

**(Total for Question = 9 marks)**

**2** In mammals, males have two different sex chromosomes (X and Y) and females have two similar sex chromosomes (X and X).

However, in birds males have two similar sex chromosomes (Z and Z), while females have two different sex chromosomes (Z and W).

(a) Complete the genetic diagram to show how sex is inherited in birds.

**(4)**

Genotype of male parent

Genotype of female parent

Gametes from male parent

Gametes from female parent

Genotypes of offspring

Sex of offspring

(b) In birds, the egg is extremely large and contains food molecules that the growing embryo needs in order to develop.



(i) Suggest **one** food molecule that is present in a bird's egg and describe the role of this molecule in the growth of the bird embryo.

**(2)**

.....

.....

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.....

(ii) Suggest an advantage of the shell of the egg being made of a hard substance.

**(1)**

.....

.....

(iii) Chicken eggs are a rich source of vitamin A.

Give another source of vitamin A and describe the function of vitamin A in humans.

**(2)**

.....

.....

.....

.....

(c) The number of chromosomes in eggs and in sperm is less than the number of chromosomes in the body cells of animals.

Explain how the number of chromosomes in animals is maintained in their offspring.

**(3)**

**(Total for Question = 12 marks)**

**3** Achondroplasia is an inherited condition in humans. Adults with achondroplasia are much shorter than average height.

This condition is controlled by a gene with two alleles. The dominant allele (**A**) codes for shorter than average height and the recessive allele (**a**) codes for average height.

(a) Two parents both had achondroplasia. They had a child who grew up to be of average height.

Use a genetic diagram to show:

- the genotype of each parent
- the gametes they produced
- the genotypes of all the possible offspring
- the phenotypes of all the possible offspring

**(4)**

(b) The parents had a second child.

State the probability that this child grew up to be of average height.

**(1)**

.....

(c) Achondroplasia is caused by a dominant allele.

(i) Explain what is meant by the term **dominant allele**.

**(2)**

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(ii) Suggest why the number of people with achondroplasia is low, even though it is a dominant condition.

**(2)**

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**(Total for Question = 9 marks)**

**4** (a) There are several different stages during the process of human reproduction. Some of these stages are shown in the box.

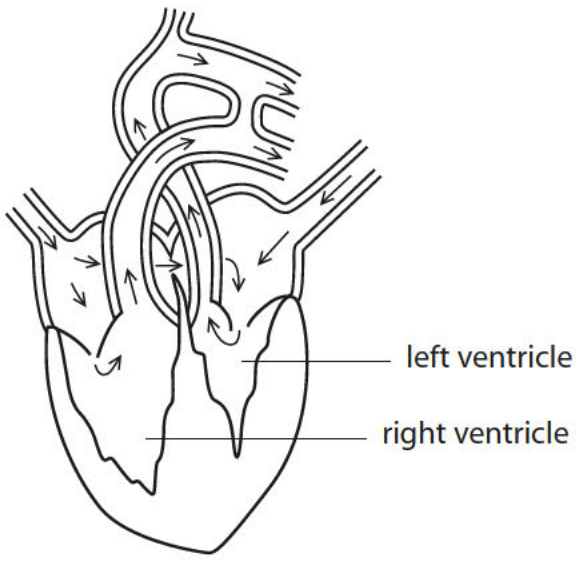
| baby | embryo | fetus | gametes | zygote |
|---|---|---|---|---|

Complete the table by writing the name of the stages in each empty box to show the correct order in which they occur.

**(4)**

| Order | Name of stage |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

(b) The diagram shows a section through the heart of a fetus. The arrows show the direction of blood flow.




Describe **two** differences, shown in the diagram, between the heart of a fetus and an adult heart.

**(2)**

1 .....

.....

2 .....

.....

(c) The sex chromosomes in the cells of a mother are XX. The sex chromosomes in the cells of a father are XY.

(i) Use this information to give the sex chromosomes in the cells of their male fetus.

**(1)**

.....

(ii) Give the number of chromosomes in a body cell of the male fetus.

**(1)**

.....

**(Total for Question = 8 marks)**