

WJEC (Eduqas) Biology GCSE  
Topic 7.2 Inheritance  
Questions by Topic

1.

(a) (i) Which part of a living cell contains chromosomes? [1]

.....

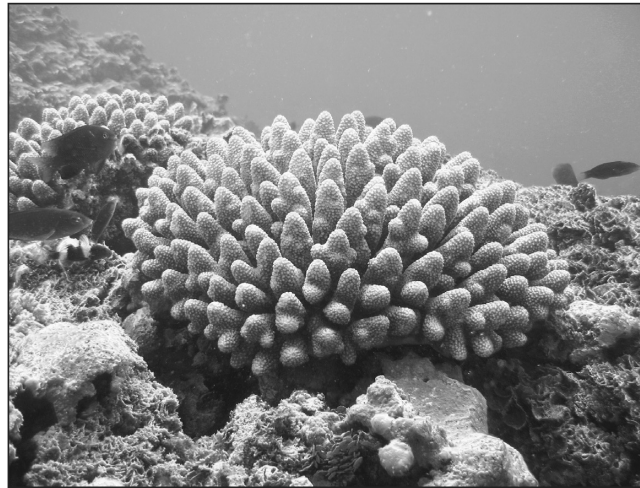
(iii) What is the scientific term used for sex cells such as sperm and eggs? [1]

.....

2.

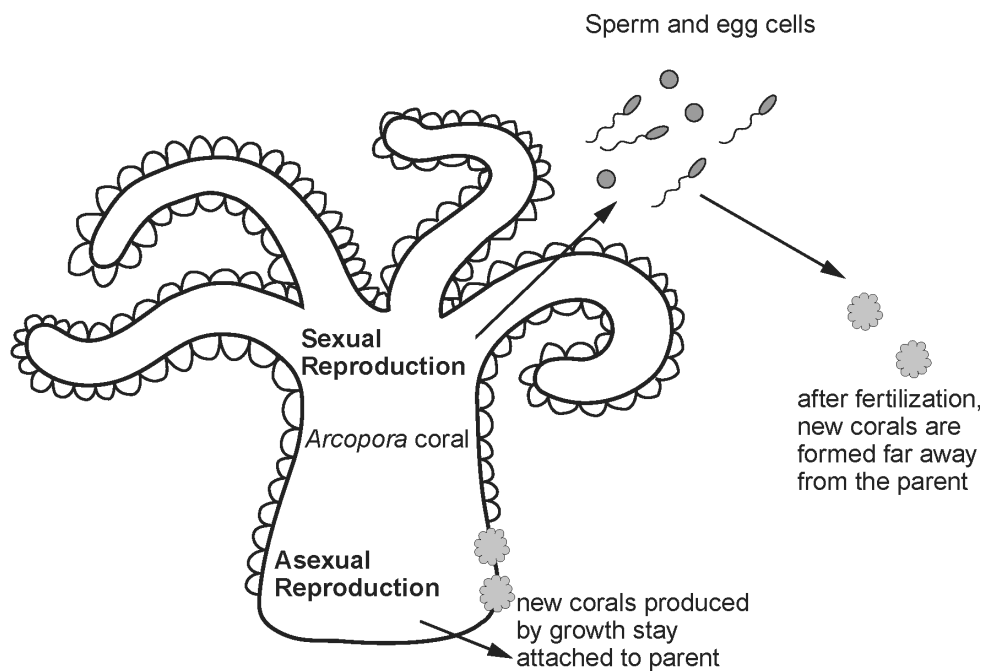
This question is about simple sea animals called corals.

*Arcopora* is a bushy coral which can grow into large colonies forming huge coral reefs.



*Arcopora* coral

*Arcopora* can reproduce by sexual and asexual reproduction as shown in the diagram below.



Use this information and your own knowledge to answer the following questions.

- (b) (i) State the scientific term for the sex cells (sperm and egg cells) produced during sexual reproduction. [1]

.....

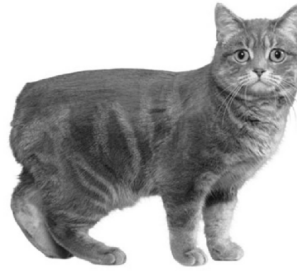
- (c) (ii) Corals such as *Arcopora* increase in diameter by 8.5cm each year. If a coral had a diameter of 15cm in 2002, calculate the expected diameter in 2016, **giving your answer in metres**. [2]

Diameter = ..... m

3.

Manx cats have no tails. This condition arose as a mutation sometime in the 1700 or 1800s. The mutation produced a dominant allele that resulted in the lack of a tail.

Manx cat



(a) What is meant by the term *dominant allele*? [1]

.....

.....

(b) The allele for no tail can be represented by the letter **B**. Cats that lack the **B** allele have normal length tails.

In the following cross two **heterozygous** Manx cats are mated together.

(i) Complete the information below by writing in the genotype of both parents. You must select a **suitable** letter to represent the allele for a normal length tail. [1]

Phenotype of parents      Manx      x      Manx  
Genotype of parents      .....      x      .....

(ii) Complete the Punnett square below to show this cross. [2]

Gametes		

(iii) The dominant allele **B** is lethal in the homozygous condition. The kittens die before birth. How many kittens out of a litter of 8 would be expected to survive in the above cross? [1]

.....

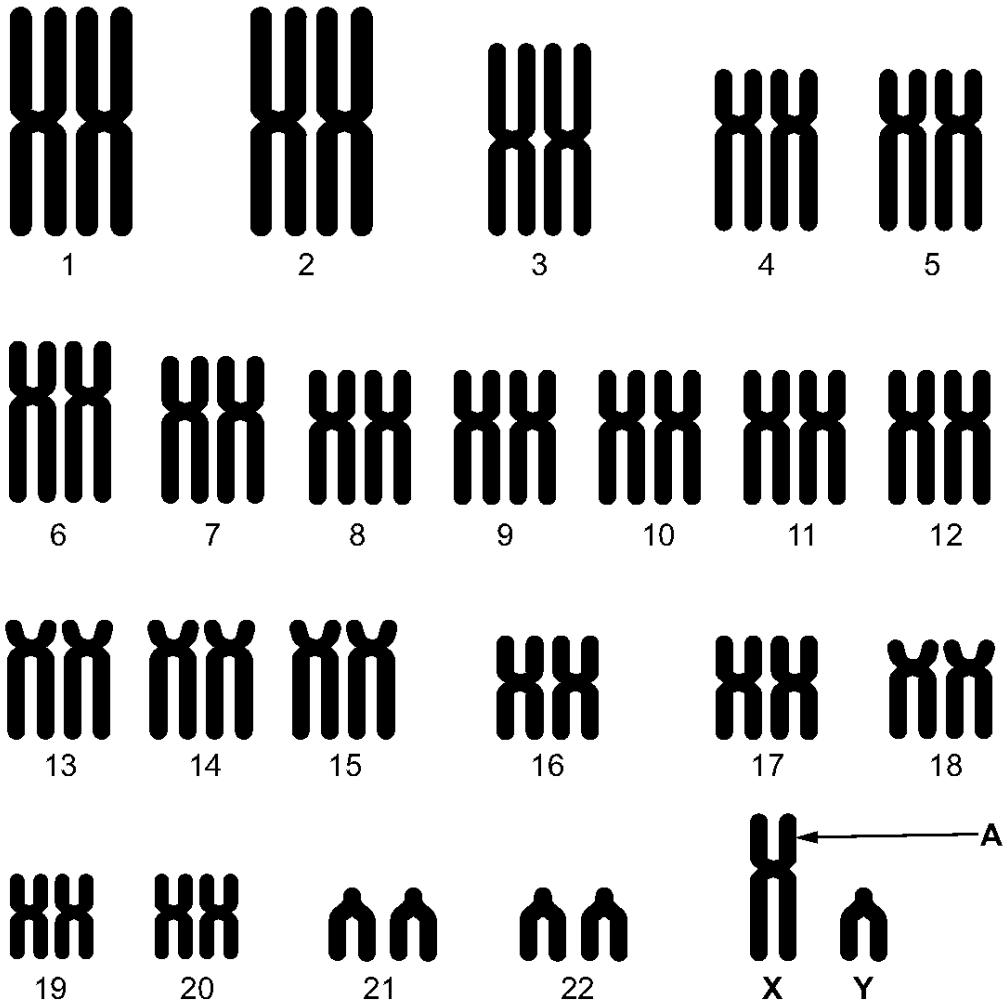
(c) A breeder of Manx cats wants to ensure that **all** kittens survive.

Give the phenotypes and genotypes of the two cats she would have to mate in order to do this. [2]

Phenotype of parents      .....      x      .....  
Genotype of parents      .....      x      .....

4.

The drawing shows the chromosomes from a human cell.



(a) How does the drawing show that the cell is not a gamete? [1]

.....

(b) Point A on the X chromosome shows the position of an allele. Give the reason why a male cannot be heterozygous for this allele. [1]

.....

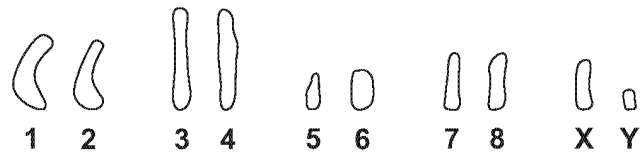
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(c) Describe how genes are arranged on a chromosome. [1]

.....

.....

5. The diagram below shows all the chromosomes in a body cell of an animal.



(a) (i) How many chromosomes are shown? [1]

.....

(ii) What evidence in the diagram shows that the cell comes from a male animal? [1]

.....

(iii) State the number of chromosomes in a sperm cell (male gamete) from this animal. [1]

.....

(b) Use words from the list below to complete the following sentences. [3]

**allele**      **wall**      **protein**      **DNA**      **nucleus**

(i) Chromosomes are found inside a cell in a structure called the

.....

(ii) Chromosomes contain genes, which are made of a chemical called

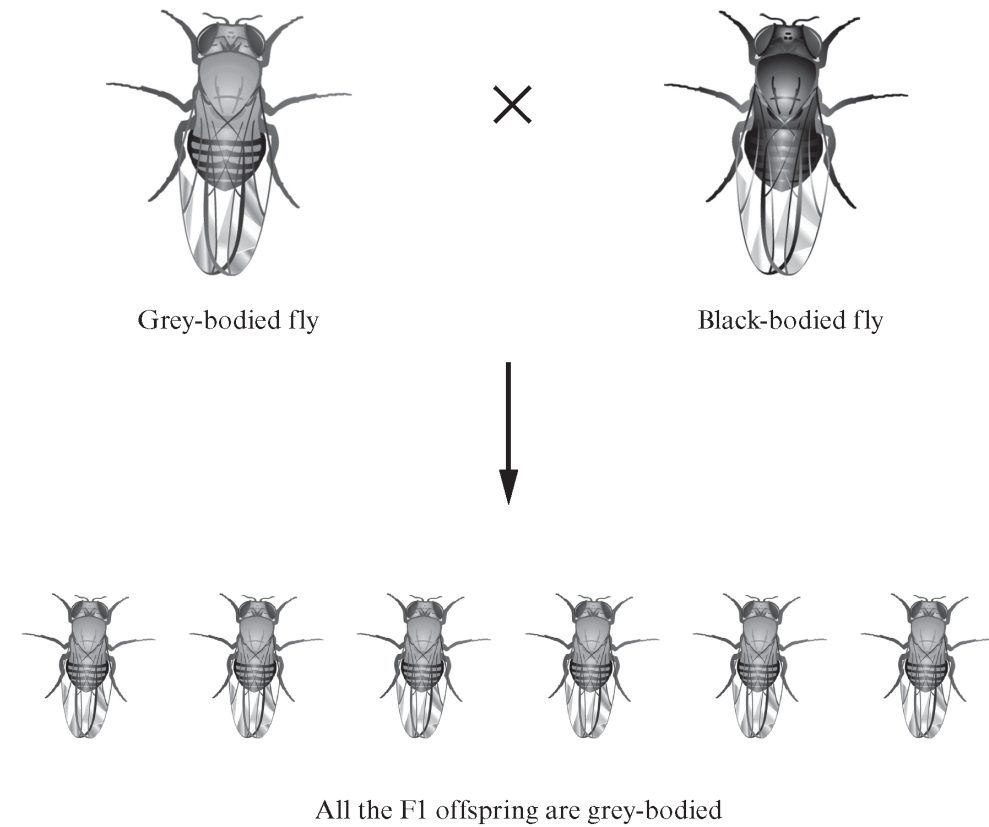
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(iii) A gene codes for the order of amino acids that make up a particular

.....

6.

A grey-bodied fruit fly was mated with a black-bodied fruit fly. All the F1 offspring were grey-bodied.



- (a) Using the letters **A** and **a** to represent the alleles for the two different body colours, complete the Punnett square below to show the offspring produced from the mating between the grey-bodied and black-bodied fruit flies. [2]

	Gametes		
F1			

- (b) (i) Complete the Punnett square below to show the offspring produced when two of the F1 offspring are selfed (bred together). [2]

	Gametes		
F2			

- (ii) What is the ratio of the different phenotypes in the F2 offspring? [1]

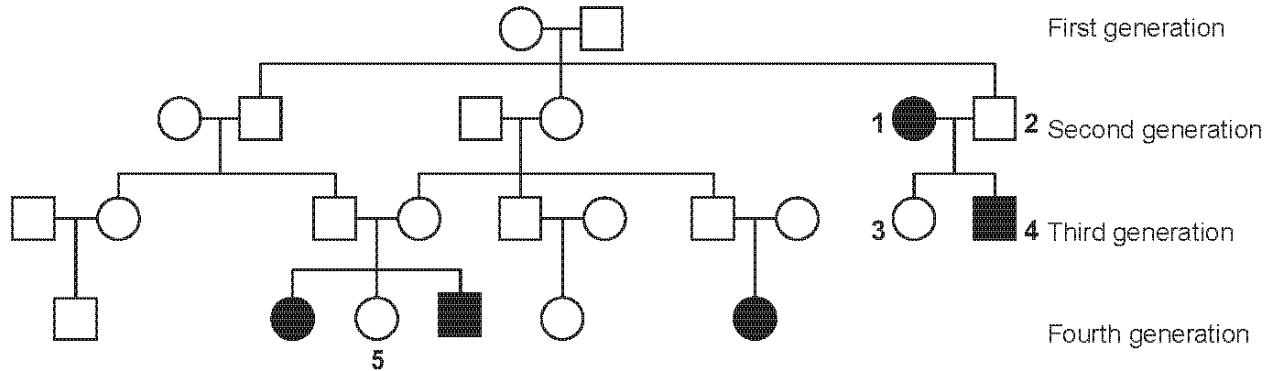
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7.

Cystic fibrosis is a hereditary disease that affects around 1 in every 2 500 babies born in the UK. It affects several organs in the body including the lungs and pancreas. The disease is caused by a recessive allele (n).

The family tree below shows the history of the inheritance of cystic fibrosis.



- Female
- Male
- Female with cystic fibrosis
- Male with cystic fibrosis

(a) (i) State the genotype of person number 2. .... [1]

(ii) Explain your answer. [2]

.....

.....

.....

(b) (i) State the genotype of person number 3. .... [1]

(ii) Explain your answer. [2]

.....

.....

.....

(c) What is the probability of person number 5 being homozygous dominant? [1]  
Place a circle around the correct answer.

- 25%      50%      75%      100%

7

8.

In mice the allele for black colour (**B**) is dominant over the allele for white colour (**b**). Two heterozygous black mice are mated together. They produce a litter of 8 young mice.



(a) (i) Which of the following results would you expect in the litter? [1]

Underline the correct answer.

- A 4 black and 4 white
- B 6 black and 2 white
- C all black
- D 2 black and 6 white

(ii) Complete the Punnett square below to help explain your answer to part (a)(i). [2]

Gametes		

Images: ©Emilia Stasiak/Shutterstock

(b) The sex of mice is determined by which sex chromosomes are present.

(i) State the sex chromosomes present in the body cells of [1]

I the father, .....

II the mother. ....

(ii) Complete the Punnett square below to show the expected sex chromosomes of the offspring in the litter. [2]

Gametes		

6

9.

Phenylketonuria (PKU) is an inherited disease caused by a recessive allele. PKU results in damage to the nervous system in the early years of life.

Key – N represents the allele for **not** having PKU

n represents the allele for having PKU

A couple, neither of whom suffer from PKU, have a child who is found to have PKU.

(a) (i) State the genotype of: [1]

I. the mother .....

II. the father .....

(ii) Complete the Punnett square below to show the possible genotypes of the children produced by this couple. [2]

Gametes		

(iii) Place a circle in the Punnett square around the genotype of a child suffering from PKU. [1]

(iv) From your Punnett square, what is the probability of a child **not** having PKU? [1]

.....

10. Mrs Hughes is a well known breeder of both yellow and black Labrador dogs. The allele for black coat (**B**) is dominant to the allele for yellow coat (**b**). Mrs Hughes finds it easier to sell black Labrador puppies because they are more popular. She does however produce yellow Labrador puppies when there is a demand for them.

Mrs Hughes has recently bought a black Labrador dog because it has many of the features which judges look for in dog shows, but she does not know its genotype.

(a) State the meaning of the term *genotype*. [1]

.....

.....

(b) (i) Mrs Hughes wants to breed from the black Labrador she has just bought but needs to know its genotype. How could she find out its genotype? Give a full explanation of the cross she could carry out and the expected results. [3]

.....

.....

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.....

.....

(ii) Complete the Punnett squares below to show the possible results of this cross. [2]

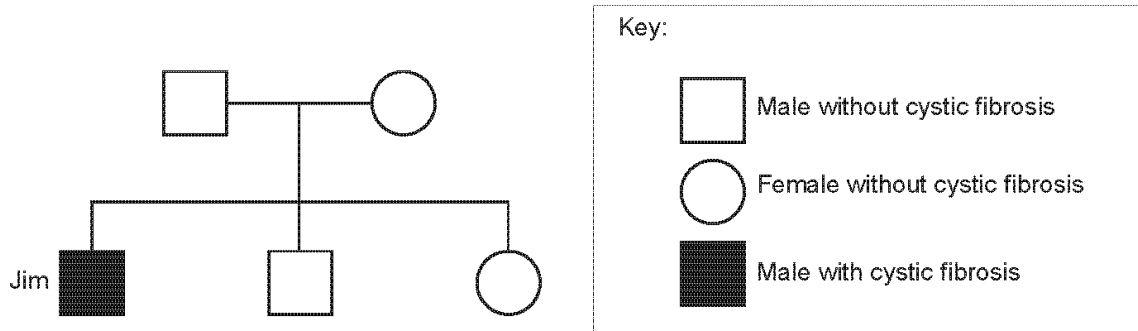
Gametes		

Gametes		

11.

This question is about the disease cystic fibrosis.

(b) Look at the family tree below.



Use information in the family tree above, and your own knowledge, to choose the correct letter to complete the following statements.

(i) Jim inherited cystic fibrosis: [1]

- A only from his father
  - B only from his mother
  - C from his father and his mother
- .....

(ii) Jim's parents are: [1]

- A heterozygous for cystic fibrosis
  - B homozygous dominant for cystic fibrosis
  - C homozygous recessive for cystic fibrosis
- .....

(iii) Jim is: [1]

- A heterozygous for cystic fibrosis
  - B homozygous dominant for cystic fibrosis
  - C homozygous recessive for cystic fibrosis
- .....

(iv) Jim's parents are expecting another child. The probability that the child will have cystic fibrosis is: [1]

- A 25%
  - B 50%
  - C 75%
- .....

(v) In the human population, cystic fibrosis affects: [1]

- A only males
  - B only females
  - C males and females
- .....

12.

(a) State the meaning of the term heterozygous.

[1]

.....

.....

.....

(b) Two tomato plants, both with purple stems, were crossed. The seeds were collected and sown in soil in a greenhouse. When large enough the plants were examined and the colour of the stems was recorded. The cross was carried out five times and the results are shown in the table below.

cross number	number of plants with purple stems	number of plants with green stems
1	616	209
2	746	251
3	409	139
4	892	292
5	534	181
approximate ratio of purple stemmed to green stemmed plants	..... : .....	.....

(i) Complete the table above to show the approximate ratio of purple stemmed plants to green stemmed plants. The ratio must be presented in whole numbers.

[1]

(ii) **Complete the Punnett square below** to show how the approximate ratio of purple stemmed to green stemmed plants, shown opposite, is obtained. You must choose a letter to represent the allele for purple stems and for green stems.

I. Letter to represent: [1]

allele for purple stem colour = .....

allele for green stem colour = .....

II. Punnett square [2]

<b>gametes</b>		

(iii) A heterozygous purple stemmed plant was crossed with a green stemmed plant. Give the probability of the appearance of green stemmed plants in the offspring.

[1]

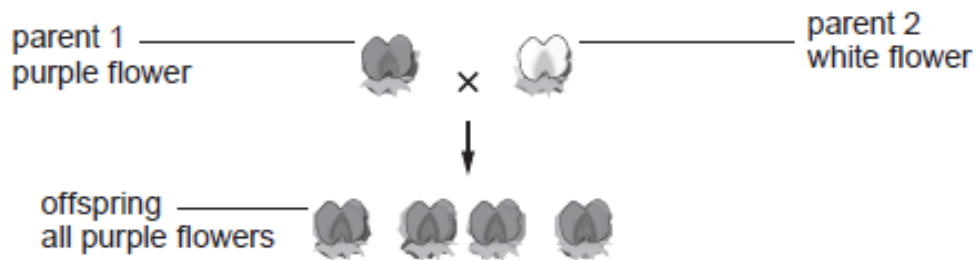
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13.

(b) Alan crossed two pea plants (*Pisum sativum*).

- Parent 1 had purple flowers.
- Parent 2 had white flowers.
- All the offspring had purple flowers, as shown below.



Flower colour in pea plants is controlled by one gene. The gene has two alleles, **D** and **d**.

(i) Underline the correct answer to complete the following sentences.

I. The genotype of parent 1 is **DD** / **Dd** / **dd** [1]

II. The genotype of parent 2 is **DD** / **Dd** / **dd** [1]

(ii) State the phenotype of the offspring. [1]

.....

(iii) The offspring are heterozygous.

State the meaning of the term *heterozygous*. [2]

.....  
.....  
.....

14. A high level of blood cholesterol increases the risk of heart disease. One cause of high blood cholesterol is the inherited condition known as FH (familial hypercholesterolaemia).

FH is caused by a dominant allele (**B**). The recessive form of this allele (**b**) results in low levels of cholesterol (non-FH).

(a) State the meaning of the terms:

(i) allele; [1]

.....

.....

(ii) recessive. [1]

.....

.....

.....

(b) (i) Complete the Punnett square below to show the possible genotypes of the children produced by parents both of whom are heterozygous for FH.

Use the letters **B** and **b**.

[2]

Gametes		

(ii) What is the probability of two heterozygous parents producing a child with FH? [1]

.....

(iii) What is the phenotypic ratio of the children produced? [1]

..... FH : ..... non-FH

15. In mice the allele for black eye colour (**B**) is dominant over the allele for red eye colour (**b**).

(a) What is the phenotype of each of the following mice? [1]

- Mouse 1      **BB** .....
- Mouse 2      **Bb** .....
- Mouse 3      **bB** .....
- Mouse 4      **bb** .....

(b) (i) If mouse 1 and mouse 4 were mated together and had 12 offspring, how many of these would you expect to have black eyes?

Number with black eyes ..... [1]

(ii) Complete the Punnett square below to help explain your answer. [1]

Gametes		

(c) (i) If mouse 2 and mouse 4 were mated together and had 50 offspring over several litters, how many of their offspring would you expect to have red eyes?

Number with red eyes ..... [1]

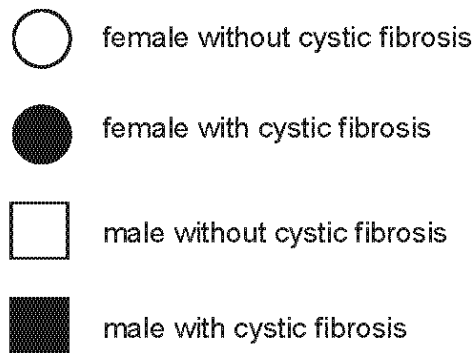
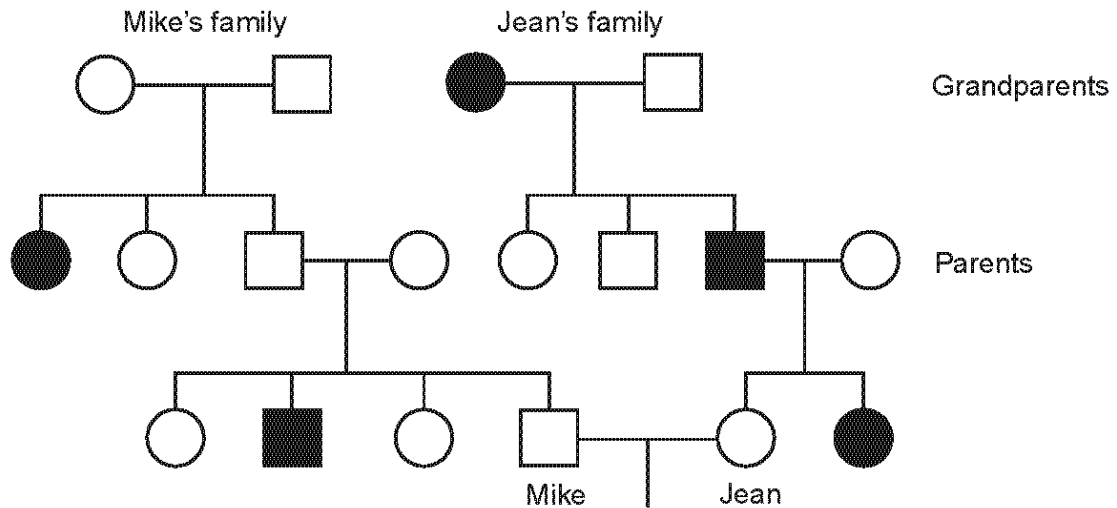
(ii) Complete the Punnett square below to help explain your answer. [1]

Gametes		

(d) If mouse 2 and mouse 3 were mated together and had 48 offspring over several litters the expected Mendelian ratio is 3 black eyed mice : 1 red eyed mouse. Suggest one reason why the expected ratio does not always occur in practice. [1]

.....  
 .....

16. The patterns of inheritance of cystic fibrosis in two families is shown as a family tree below.



Cystic fibrosis results from a homozygous pair of recessive alleles. People who are heterozygous for cystic fibrosis have one normal allele and one cystic fibrosis allele. They are carriers of cystic fibrosis but do not suffer from it.

- (a) In the family trees shown, if  $N$  = the normal allele and  $n$  = the allele for cystic fibrosis, what is the genotype of: [2]
- (i) Mike's grandfather; .....
- (ii) Jean? .....
- (b) What is the percentage chance that Mike is a carrier of cystic fibrosis? [1]

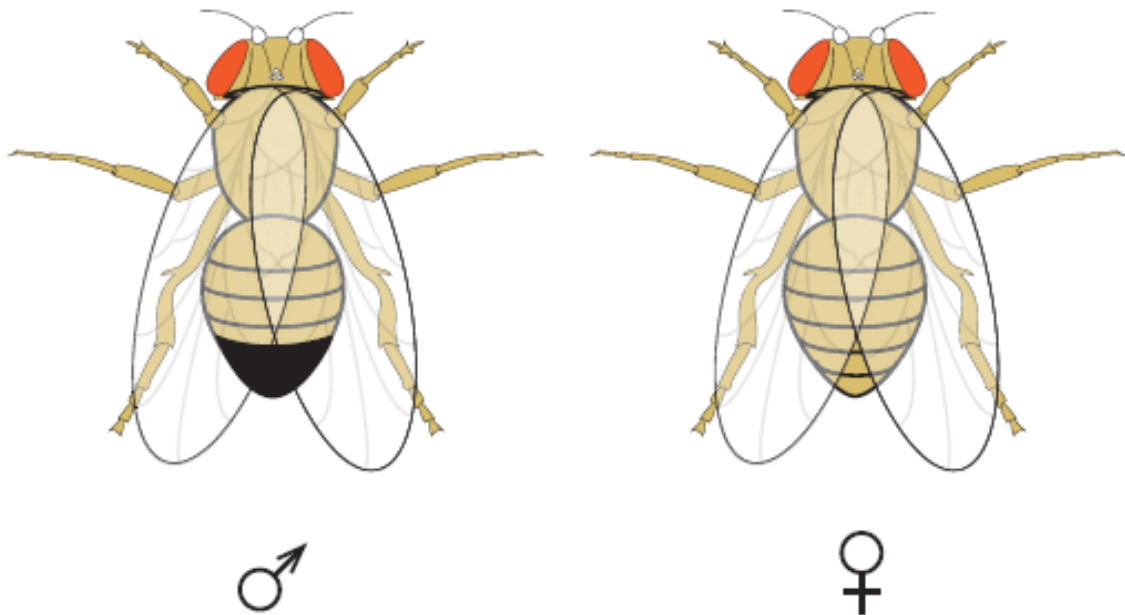
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17.

A class of year 11 students decided to carry out some genetics investigations on the fruit fly *Drosophila melanogaster*. Fruit flies are easily kept in school laboratories and are a good species for genetics investigations because they:

- have a short generation time (a very short time to develop from egg to adult and reproduce)
- are easy to maintain
- males (♂) and females (♀) are easy to identify
- they produce between 200 and 500 offspring per mating

The students were asked to draw a sketch of a male and a female fruit fly. A sketch is shown below.



(a) Suggest an advantage to the students, of the fruit fly:

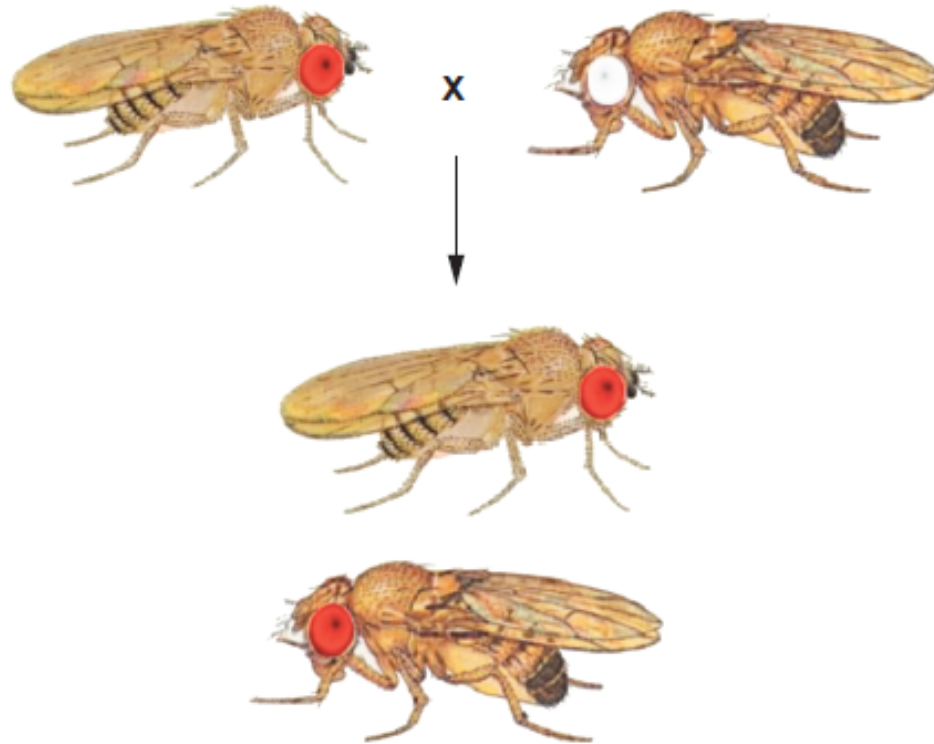
- (i) having a short generation time; [1]

.....

- (ii) producing large numbers of offspring. [1]

.....

- (b) The students were asked to cross a red-eyed fly and a white-eyed fly. One of each of these flies was placed in a specimen tube with some nutrients. The diagram below shows the phenotype of both the flies in this cross and some of the offspring.



**All F1 offspring have red eyes**

- (i) **Label one** of the **male** flies in the diagram above. [1]
- (ii) Show this cross in the Punnett square below. Use the letters **R** to represent the allele for red eye colour and the letter **r** to represent the alleles for white eye colour. [2]

	Gametes		
F1			

- (c) The students then decided to self the F1 generation. There were 8 groups of students. When they examined the F2 generation they obtained the following results.

Group number	Number of offspring in F2 generation	Number of flies with red eyes	Number of flies with white eyes	Approximate ratio of red-eyed to white-eyed flies
1	214	156	58	.....
2	139	108	31	.....
3	0	0	0	No ratio
4	276	206	70	.....
5	319	244	75	.....
6	39	28	11	.....
7	217	55	162	1 : 3
8	312	235	77	.....

- (i) **Complete the table** by writing in the **approximate** ratio of red to white eyed flies for all the remaining groups. Use whole numbers only. [1]

- (ii) The students in group number 3 followed the method correctly. Suggest a reason for their result. [1]

.....

- (iii) Suggest an explanation for the anomalous result obtained by group number 7. [1]

.....

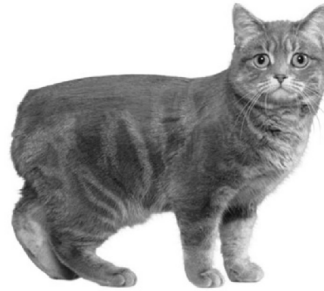
- (iv) Complete the Punnett square below to show the expected result when the F1 were selfed. [2]

F2	Gametes		

18.

Manx cats have no tails. This condition arose as a mutation sometime in the 1700 or 1800s. The mutation produced a dominant allele that resulted in the lack of a tail.

Manx cat



(a) What is meant by the term *dominant allele*? [1]

.....

.....

(b) The allele for no tail can be represented by the letter **B**. Cats that lack the **B** allele have normal length tails.

In the following cross two **heterozygous** Manx cats are mated together.

(i) Complete the information below by writing in the genotype of both parents. You must select a **suitable** letter to represent the allele for a normal length tail. [1]

Phenotype of parents      Manx      x      Manx  
Genotype of parents      .....      x      .....

(ii) Complete the Punnett square below to show this cross. [2]

Gametes		

(iii) The dominant allele **B** is lethal in the homozygous condition. The kittens die before birth. How many kittens out of a litter of 8 would be expected to survive in the above cross? [1]

(c) A breeder of Manx cats wants to ensure that **all** kittens survive.

Give the phenotypes and genotypes of the two cats she would have to mate in order to do this. [2]

Phenotype of parents      .....      x      .....  
Genotype of parents      .....      x      .....



19.

- (a) (i) Gregor Mendel crossed purple flowered pea plants with white flowered pea plants. All the F<sub>1</sub> generation were purple flowered. Show this cross by completing the Punnett square below. Use the letter **D** to represent the purple allele and the letter **d** to represent the white allele. [2]

	Gametes		
F <sub>1</sub>			

- (ii) When Mendel selfed the F<sub>1</sub> generation he obtained a ratio of 3 purple:1 white flowered pea plants in the F<sub>2</sub> generation. In the space below construct and complete a Punnett square to show this cross. [2]

- (b) Mendel's experiments on genetics were carried out with garden peas (*Pisum sativum*). In each of his experiments he used thousands of pea plants. State the importance of the use of such a large number of plants. [1]

- (c) Mendel published his work on the genetics of pea plants in 1866. The significance of his work was not recognised until it was replicated in the early 1900s. Why is it important for scientists to replicate the work of other scientists? [1]

20.

- (a) A human body cell has 46 chromosomes. How many chromosomes are present in:
- (i) a sperm cell; .....
- (ii) a fertilised egg cell? ..... [2]

- (b) Gavin and Tracy are expecting their second baby. Their first baby is female. What is the chance that their second baby will also be female? Circle the correct answer.

0%      25%      50%      100%      [1]