Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3430U40-1

Z22-3430U40-1

TUESDAY, 17 MAY 2022 – MORNING

SCIENCE (Double Award)

Unit 4 – BIOLOGY 2
FOUNDATION TIER

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**4**	
3.	**4**	
4.	**5**	
5.	**6**	
6.	**7**	
7.	**8**	
8.	**6**	
9.	**8**	
10.	**7**	
Total	**60**	

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01

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **8** is a quality of extended response (QER) question where your writing skills will be assessed.

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Answer **all** questions.

1. (a) **Draw straight lines** to join each sense organ to the stimulus it detects. One has been done for you. [2]

Sense Organ	Stimulus
nose	sound
tongue	chemicals in the air
ear	light
eye	chemicals in food and drink

(b) Complete the following sentences using words from the box. [3]

brain	reflex	electrical	spinal cord	neurone

The central nervous system is made up of the ..... and .....

The type of response shown by the body which is fast, automatic and often protective is called a ..... action.

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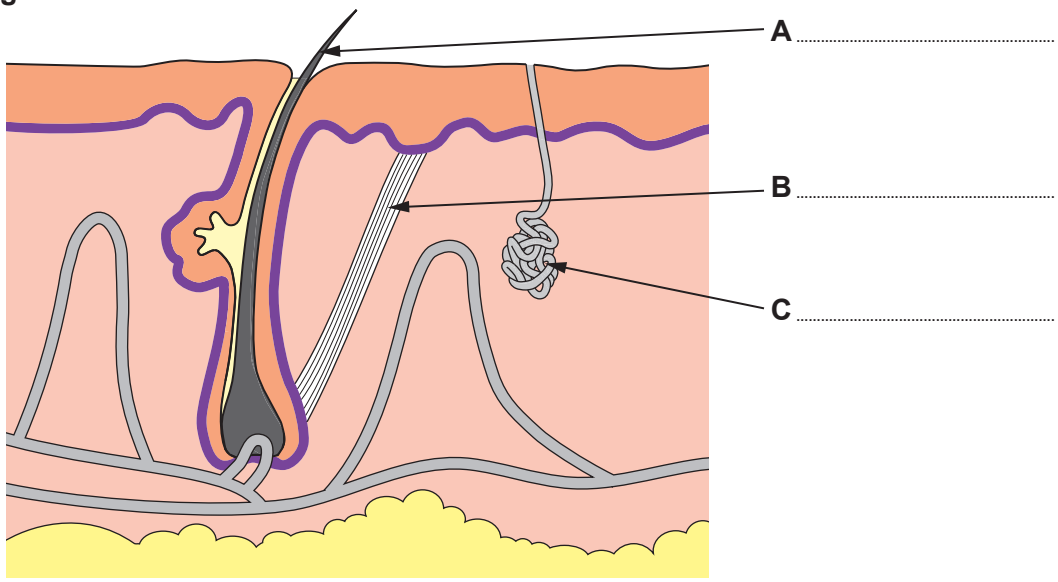
2. **Image 2.1** shows a section through the human skin.

Image 2.1



(a) Label parts **A**, **B** and **C** on **Image 2.1** using words from the box. [3]

sweat duct	**blood vessel**	**erector muscle**	**sweat pore**	**hair**	**sweat gland**

(b) State **one** way the skin reacts to cool us down when we get too hot. [1]

.....

.....

4

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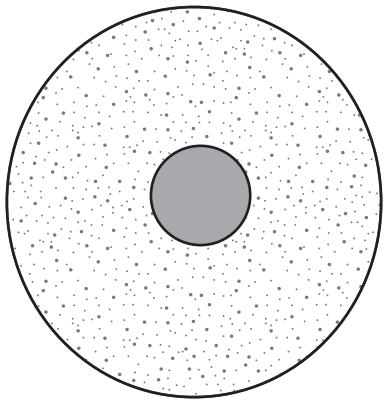
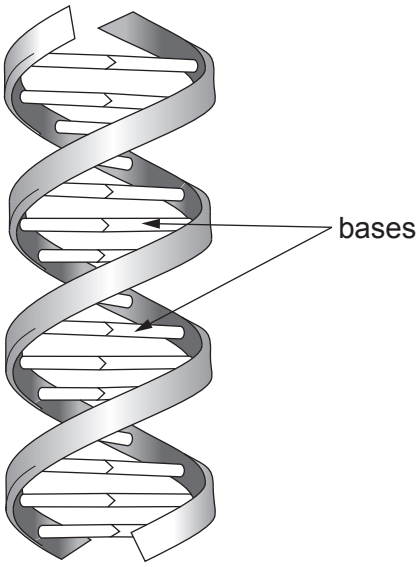
3. (a) **Image 3.1** shows an animal cell. **Draw an arrow** to show the structure where chromosomes are found. [1]

Image 3.1



Chromosomes contain DNA. **Image 3.2** shows a small section of a DNA molecule.

Image 3.2



(b) State the name used to describe the shape of the DNA molecule. [1]

.....

(c) DNA contains bases that are in pairs. In the pairs of letters below, one correct pair has been underlined for you. Underline the other correct pair. [1]

A – T **G – T** **G – C** **C – A**

(d) **Complete the sentence** below by underlining the correct answer. [1]

The order of the bases in DNA codes for the order of amino acids in

(starch / fat / protein).

4

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4. The brown rat (*Rattus norvegicus*) spreads disease. Warfarin is a poison used to kill brown rats. Over time, many brown rats have evolved to become resistant to warfarin.

(a) State the genus of the brown rat. [1]

.....

(b) The brown rat is a vertebrate. State what is meant by the term vertebrate. [1]

.....

(c) The sentences below describe how brown rats evolved to become warfarin resistant. They are not in the correct order:

A. the mutation made the brown rat resistant to warfarin

B. the result is an increase in the population of brown rats resistant to warfarin

C. a mutation occurred in a gene

D. brown rats that were resistant to warfarin lived long enough to reproduce

E. during reproduction the useful gene is passed on to the offspring

Use letters **A–E** from the list above to complete the sequence below to describe how brown rats became warfarin resistant. [2]

..... **C** .... **A** ....

(d) State the term used when all individuals of a species have died out. [1]

.....

5

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5. MMR is a safe and effective vaccine that protects against measles, mumps and rubella. These diseases are caused by viruses.

Photograph showing a child receiving MMR vaccine

- The full course of MMR vaccination requires two doses; a child has the first injection at the age of one year and the second at three years.
- If the child comes into contact with any of these viruses in the future, lymphocytes in the blood will rapidly cause the destruction of these viruses and the child will not become ill.
- A small number of children may get minor side effects due to the vaccine.

(a) Use this information and your own knowledge to complete the following table by writing **True** or **False** against each statement. [2]

Statement	True or False
Measles is caused by a bacterium.	False
The MMR vaccine is given as drops on the tongue.	
Most children do not get side effects.	
Lymphocytes are a type of white blood cell.	

(b) Predict what would happen to the number of cases of measles, mumps and rubella if fewer children were given the MMR vaccine. [1]

.....

.....

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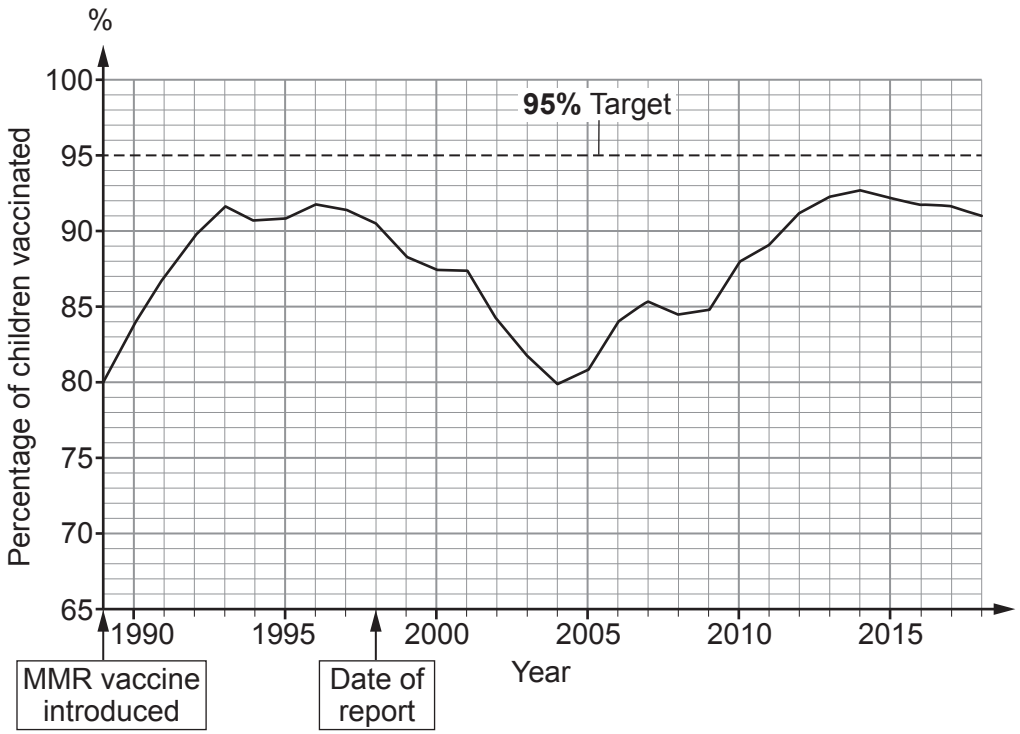
(c) **Graph 5.1** shows the percentage of children receiving the MMR vaccine in the UK between 1989 and 2018. It is the target of any UK vaccination programme to get at least 95 % of children vaccinated.
In 1998, a report was published which claimed that there was a link between the MMR vaccine and a condition called autism. The report was later shown to be completely untrue.

Graph 5.1



(i) State the year the percentage of children receiving the MMR vaccine was closest to the UK target. [1]

.....

(ii) State a conclusion that could be made about the success of the MMR vaccination programme between 1990 and 1993. [1]

.....

.....

.....

(iii) The percentage of children vaccinated decreased after the report was published. Suggest the reason for this. [1]

.....

.....

6

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6. The kestrel (*Falco tinnunculus*) is a bird of prey found in Pembrokeshire, Wales. The photographs show a kestrel in flight and nesting.

Surveys are carried out by the Welsh Kite Trust to monitor the numbers of kestrels in Pembrokeshire. The data gathered by some of these surveys are shown in **Table 6.1**.

Table 6.1

Year	Number of breeding pairs
2010	12
2011	19
2012	14
2016	10

(a) (i) Calculate the percentage decrease in breeding pairs between 2011 and 2016. Use the formula below. [2]

$$\text{Percentage decrease} = \frac{\text{number of breeding pairs in 2011} - \text{number of breeding pairs in 2016}}{\text{number of breeding pairs in 2011}} \times 100$$

Percentage decrease in breeding pairs = ...

(ii) Suggest **two** possible reasons for this decrease. [2]

1. .....

.....

2. .....

.....

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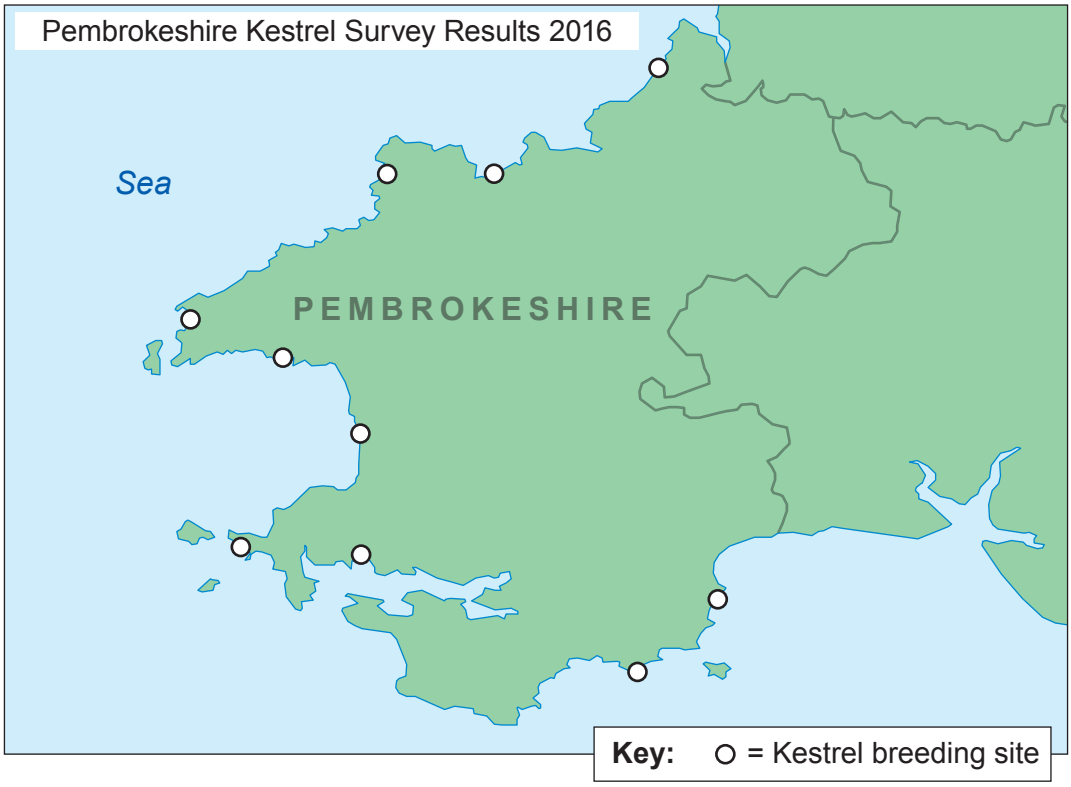
(b) **Image 6.2** shows a map of the nesting sites of kestrels in Pembrokeshire.

Image 6.2



State **one** conclusion that can be made about where kestrels generally choose to nest. Suggest a reason for this. [2]

.....

.....

.....

(c) Another bird of prey called the merlin (*Falco columbarius*) is closely related to the kestrel. Use your knowledge of classification to state the evidence that supports this. [1]

.....

.....

7

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Turn over.

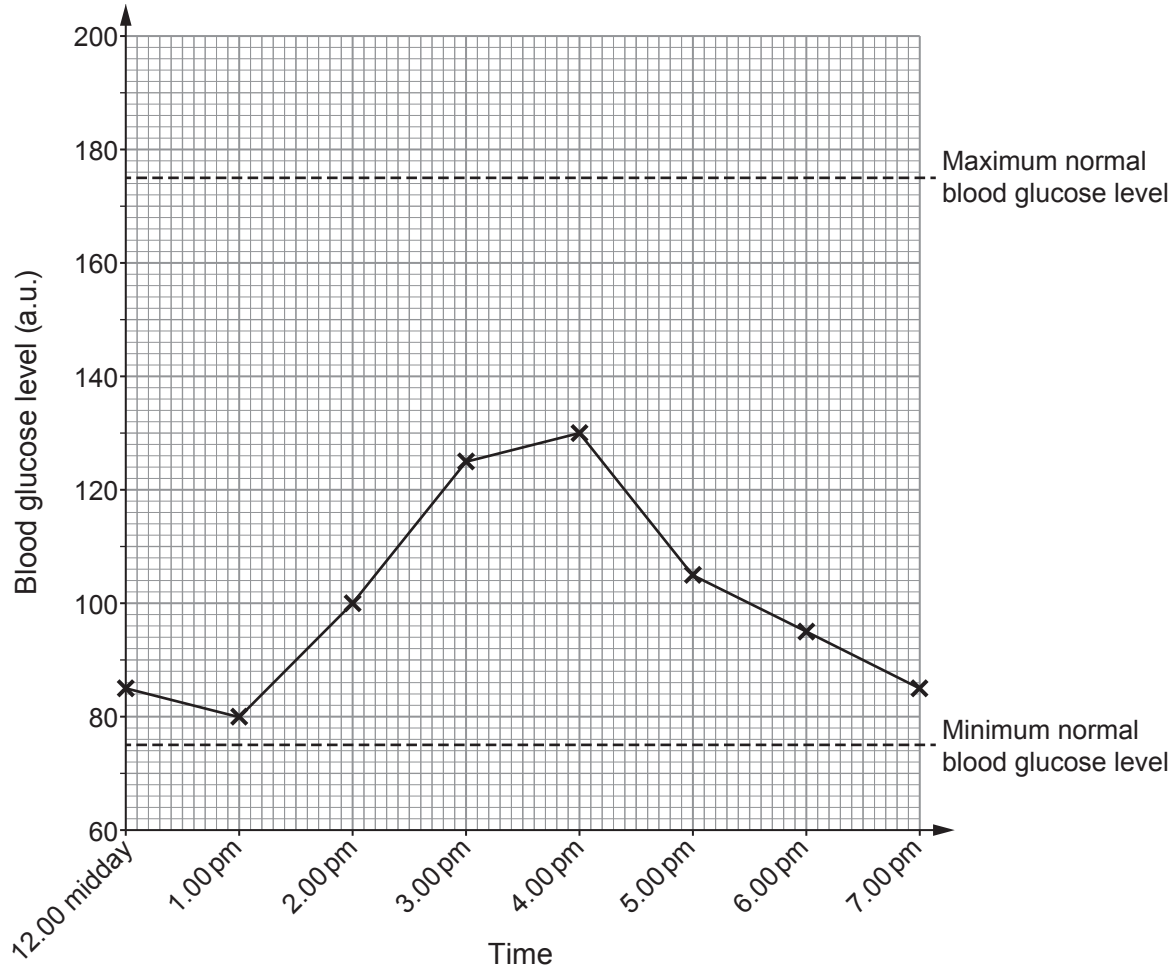
7. James eats a meal that contains glucose. A datalogger was used to record James' blood glucose levels before, during and after the meal. The data are shown in **Table 7.1**.

Table 7.1

Time	Blood glucose level (a.u.)
12.00 midday	85
1.00 pm	80
2.00 pm	100
3.00 pm	125
4.00 pm	130
5.00 pm	105
6.00 pm	95
7.00 pm	85

Graph 7.2 shows the changes in James' blood glucose level. The normal blood glucose range is also shown.

Graph 7.2



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(a) (i) Describe the trend shown in **Graph 7.2** between 1.00 pm and 7.00 pm. [2]

.....

.....

.....

.....

(ii) State the range of James' blood glucose level. [1]

.....

(iii) Suggest how **Graph 7.2** would be different in a person with diabetes. [1]

.....

.....

(b) (i) People with diabetes may have glucose in their urine. Describe the chemical test that could be carried out to test for the presence of glucose. [2]

.....

.....

.....

.....

(ii) State the result you would expect if James' urine was tested for the presence of glucose using this chemical test. [1]

.....

(c) Glucose levels are controlled by hormones. State the name of the hormone that lowers blood glucose levels. [1]

.....

8

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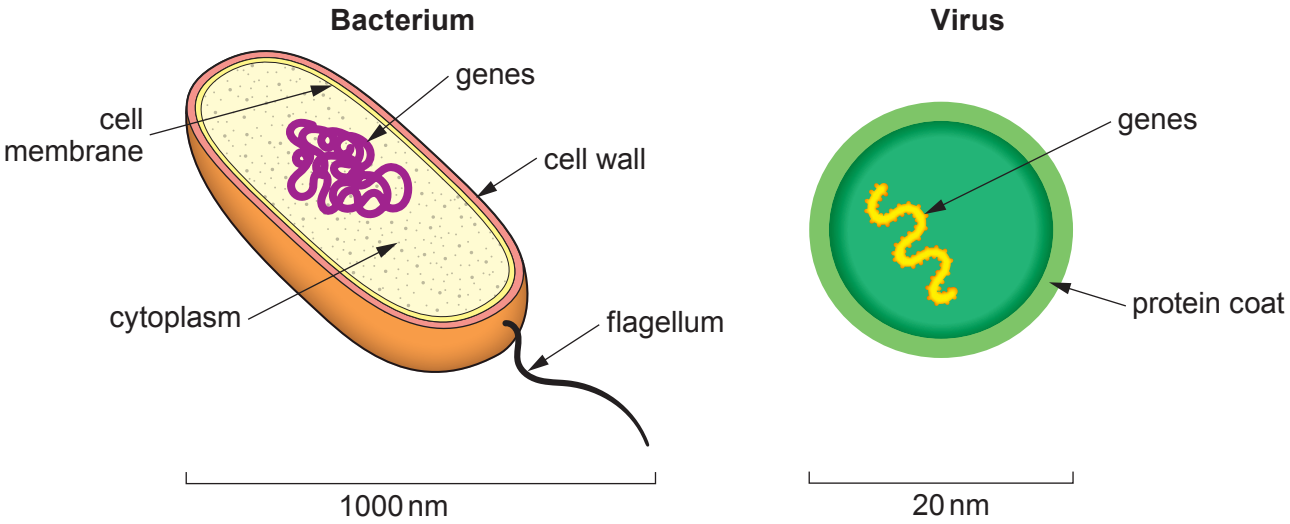
8. **Image 8.1** shows the structure of a bacterium and a virus.

Image 8.1



Use all the information given to describe the similarities and differences between the structure of the bacterium and the virus. [6 QER]

6

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9. Cystic fibrosis is a genetic condition that affects the lungs and other organs. It is caused by a mutation.

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

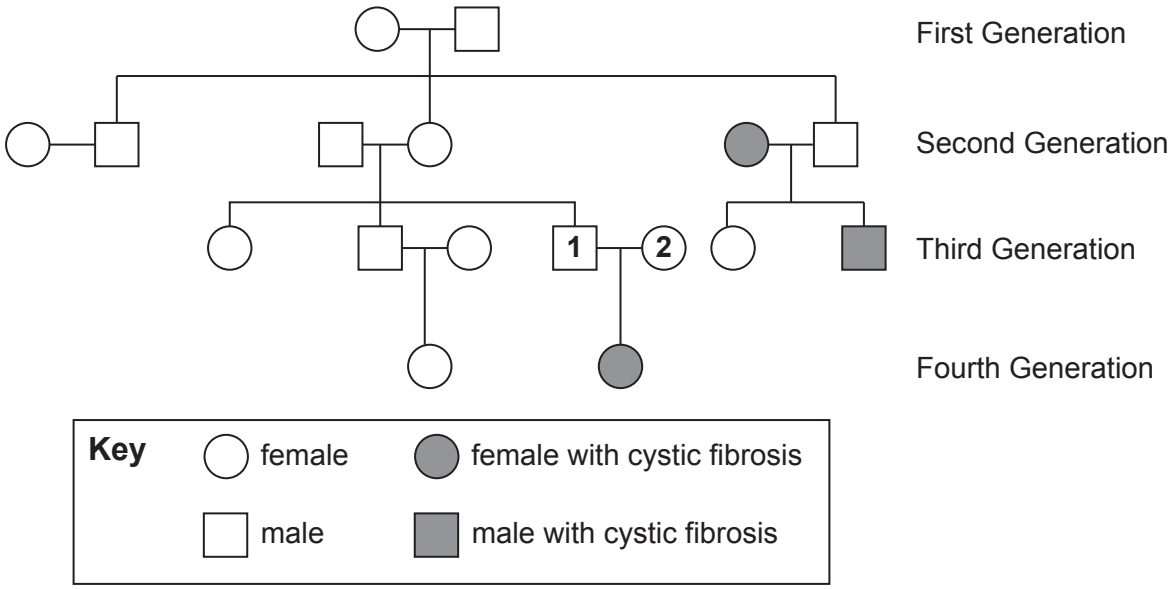
.....

.....

(b) State an environmental factor that will increase mutation rates. [1]

.....

(c) The family tree shows the inheritance of cystic fibrosis. Cystic fibrosis is caused by a recessive allele.



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(i) **Complete the Punnett square** below to show the possible genotypes of the future children of person **1** and person **2**. Use the letters **N** to represent the dominant allele and **n** to represent the allele that causes cystic fibrosis. [2]

(ii) Use the Punnett square to predict the probability of person **1** and person **2** having another child who has cystic fibrosis. [1]

.....

(d) One treatment for cystic fibrosis is to introduce dominant alleles (**N**) into the cells lining the lungs.

(i) State the name of this type of treatment. [1]

.....

(ii) State the method that is used to deliver the dominant alleles to the lungs. [1]

.....

(iii) State **one** problem with the use of this method. [1]

.....

.....

.....

8

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10. Students used a quadrat to investigate the abundance of dandelions (*Taraxacum officinale*) on the school rugby pitch.

The method they used was:

1. Use a 1 m^2 quadrat.
2. Use a random number generator to place the quadrat on the rugby pitch.
3. Count the number of dandelions in the quadrat.
4. Repeat steps 2 and 3 another 5 times.
5. Calculate a mean.
6. Calculate the number of dandelions on the school rugby pitch.

The results they obtained are given in **Table 10.1**.

Table 10.1

Quadrat	Number of dandelions
1	3
2	5
3	2
4	7
5	15
6	6
Mean	.....

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(a) (i) **Draw a circle** around the anomalous result in **Table 10.1**. [1]

(ii) Calculate the mean number of dandelions per quadrat and **write your answer in Table 10.1**. **Do not use the anomalous result in your calculation.** [2]

(b) The teacher said that he did not have confidence in the mean. Suggest why. [1]

.....

.....

(c) The total area of the school rugby pitch is 7 350 m^2. Use your answer to part (a)(ii) to calculate the total number of dandelions on the school rugby pitch. [2]

Total number of dandelions on the school rugby pitch = ...

(d) State the name of the method the students should use to investigate the distribution of the dandelions across the pitch. [1]

.....

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END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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