GCSE

3400U20-1

TUESDAY, 17 MAY 2022 – MORNING

BIOLOGY – Unit 2:

Variation, Homeostasis and Micro-organisms

FOUNDATION TIER

1 hour 45 minutes plus your additional time allowance

Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	10	
2.	8	
3.	10	
4.	8	
5.	12	
6.	12	
7.	9	
8.	11	
Total	80	

ADDITIONAL MATERIALS

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

ITEMS INCLUDED WITH QUESTION PAPER

A separate Diagram Booklet.

The Diagram Booklet MUST be handed in to the invigilators and sent for marking.

INSTRUCTIONS TO CANDIDATES

Use black ink, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces provided on the front cover.

Answer ALL questions.

(Turn over)

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional pages 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 4(a) is a quality of extended response (QER) question where your writing skills will be assessed.

Answer ALL questions.

1. Cystic fibrosis (CF) is an inherited condition caused by a DNA mutation.

(a) COMPLETE THE SENTENCES. Select your answers from the words below.

[3 marks]

radiation	**increase**	**random**
prevent	**regular**	

A mutation is a _____ change in DNA.

Ionising _____ can _____ the rate of mutations.

1 (b) Look at IMAGE 1.1 in the Diagram Booklet. It shows a family tree.

In the family tree, some people have CF.

(i) Calculate the PERCENTAGE OF PEOPLE in this family tree who have CF. [2 marks]

Percentage = _____ %

1 (b) (ii)

State how many males and females in this family tree have CF. [1 mark]

Males = _____

Females = _____

1 (b) (iii)

In the whole population of the UK,

- **0.01% of people have CF**
- **The ratio of males to females is 1 : 1**

Use your answers to (i) and (ii). Give TWO ways in which this family is different from the whole population of the UK: [2 marks]

I. _____

_____

II. _____

_____

1 (c) CF affects the lungs.

Patients with CF have treatment. They are given DNA which does not have the CF mutation.

Complete the following sentences.

<u>Underline</u> the correct word. [2 marks]

(i) The treatment is called:

chemotherapy

gene therapy

physiotherapy

1 (c) (ii)

The DNA is given to the patient by:

injection

infusion

inhalation

10

2. Look at IMAGES 2.1A and 2.1B in the Diagram Booklet. They show the hazel dormouse (*Muscardinus avellanarius*) in winter and summer.

- Dormice are nocturnal (active only at night).

- In summer, they live high up in trees and bushes. They eat berries and insects.

- In winter, they hibernate (being completely inactive) and keep warm in nests at ground level.

- Between the years 2000 and 2020 the dormouse population in the UK decreased. It became an endangered species in some areas.

- 1 000 dormice were released into an area and their numbers later increased to 1 050. This was part of a local action plan in the year 2000.

(Turn over)

Use the information. Answer the following questions.

2 (a) State ONE way in which the dormouse BODY STRUCTURE is adapted to: [3 marks]

(i) survive in low temperatures;

_____

_____

(ii) climb in branches of trees;

_____

_____

2 (a) (iii)

look for food at night.

(b) State ONE way in which the BEHAVIOUR of the dormouse helps it to survive in its environment.

[1 mark]

2 (c) Use the information. Complete the table by writing true or false for each statement. [4 marks]

2 (c)

Statement about the hazel dormouse	True or false
Its habitat is woodland.	true
It eats only plants.	_____
The species became extinct in the UK in 2020.	_____
It does not hunt for food in daylight.	_____
As a result of a local action plan, numbers increased by 5%.	_____
It belongs to the genus **Muscardinus**.	_____

8

3 (a) COMPLETE THE SENTENCE. Select your answers from the words below.

[2 marks]

brain	muscles
spinal cord	nerves

The central nervous system consists of the _____ and the _____ .

3 (b) Look at IMAGE 3.1 in the Diagram Booklet. It shows a section through the human eye.

(i) Identify parts A and B on IMAGE 3.1.

[2 marks]

A _____

B _____

3 (b) (ii) Use some labels from IMAGE 3.1. COMPLETE TABLE 3.2 by stating the parts of the eye which match the functions. [3 marks]

TABLE 3.2

Part of the eye	Function
_____	changes shape to focus light
_____	prevents reflection of light
_____	carries nerve impulses to the brain

3 (b) (iii)

Joanna leaves a dark room and goes out into bright sunlight.

(Turn over)

3 (b) (iii)

Parts C and D in IMAGE 3.1 change to control how much light enters her eyes when she goes into bright sunlight. Explain how. [3 marks]

4. Serious kidney failure can be treated using a dialysis machine or by a transplant from a donor. Look at TABLE 4.1 in the Diagram Booklet. It shows a fact file about the treatment of kidney failure.

(a) Use the information in TABLE 4.1 and your own knowledge:

Describe the ADVANTAGES of treating kidney failure by a transplant.

Describe the ADVANTAGES of treating kidney failure by dialysis.

4 (a) More people could be encouraged to become donors. Suggest how. Explain why this is necessary.

[6 marks QER]

continue your answer on the next page

(Turn over)

25

(Turn over)

4 (b) The tissue type of the patient and the donor kidney must be tested. This is before a transplant operation is carried out. Explain why. [2 marks]

8

5 (a) COMPLETE THE FOLLOWING description of Type 2 diabetes. Fill in the missing words. [3 marks]

In Type 2 diabetes, body cells

do not respond to the hormone

_____

which is produced by the

_____

and so the level of

_____

in the blood becomes too high.

5 (b) Researchers in Spain stated the following hypothesis.

‘Drinking coffee reduces the risk of having Type 2 diabetes, high blood pressure and obesity.’

- Scientists working for a large chain of coffee shops carried out an investigation to test this hypothesis.

- They used 2 000 volunteers, 1 000 of whom drank coffee every day and the other 1 000 who never drank coffee.

5 (b)

- They recorded the number of volunteers from each group who had Type 2 diabetes, had high blood pressure or were obese.

It shows the results of the investigation.

Look at TABLE 5.1 in the Diagram Booklet.

5 (b) (i) Use GRAPH 5.2 in the Diagram Booklet. Complete the bar chart by:

[4 marks]

I. adding a scale for numbers of volunteers.

II. drawing bars of the results for high blood pressure and obesity.

III. labelling your bars.

5 (b) (ii) The scientists concluded that the hypothesis was only partly supported. Give the reasons for this conclusion. [2 marks]

5 (b) (iii)

The scientists should have ensured that the investigation was a fair test. State ONE way. [1 mark]

5 (b) (iv)

A doctor said that she did not have confidence in the results. She said it was because the investigation was biased. [1 mark]

Give ONE reason to support this point of view.

5 (c) In 2019 the cost to NHS Wales of medical treatments for Type 2 diabetes was £500 million.

Individuals can reduce the risk of developing Type 2 diabetes. Suggest ONE lifestyle change they could make. [1 mark]

(Turn over)

6. Limpets (*Patella vulgata*) are animals without backbones. They live on rocky seashores. They feed on plants.

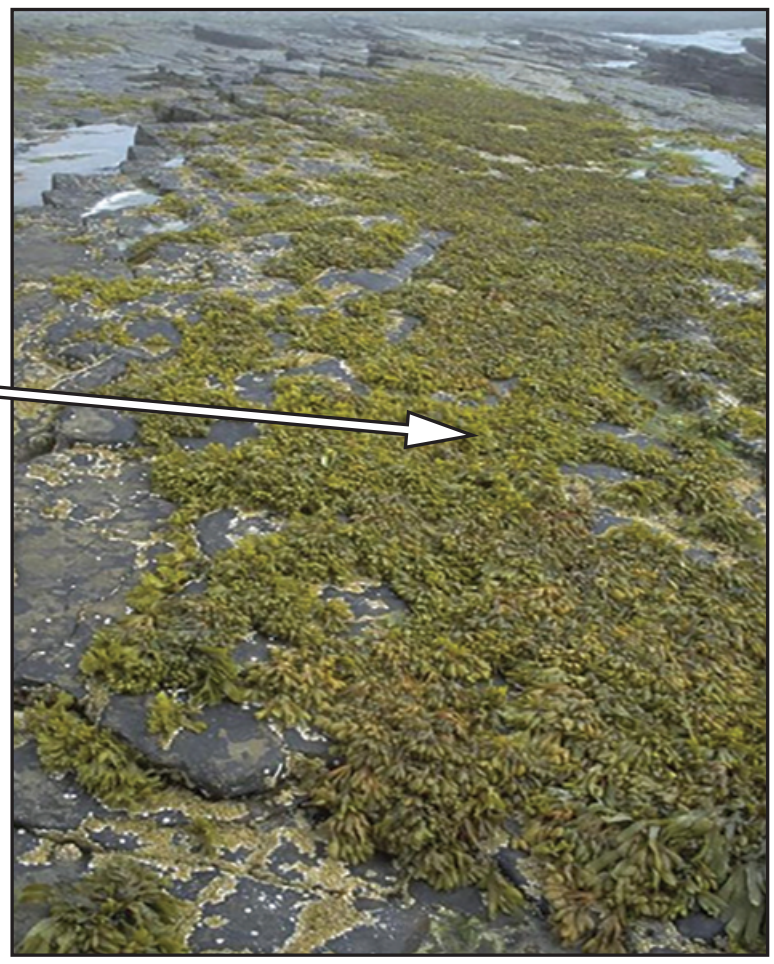
Photograph of limpets

(a) State the scientific term for animals which do not have backbones.

[1 mark]

6 (b) Students investigated the density of limpets (number per m^2). They did this on two rocky shores in Anglesey. One shore was sheltered and one was exposed to heavy wave action.

6 (b)



A sheltered shore

An exposed shore

(Turn over)

6 (b) Students' method:

- Select a section on each shore of 300 m^2.
- Place quadrats, each of area 1 m^2, at 10 random co-ordinates in each of the two shore sections and collect data.
- Compare the data for the two shores.

(i) Look at TABLE 6.1 in the Diagram Booklet. It shows one part of the students' risk assessment for the investigation.

COMPLETE TABLE 6.1. [1 mark]

6 (b) (ii) Describe the techniques the students should use to PLACE THEIR QUADRATS AT RANDOM and COLLECT DATA. Give your answer in detail. [3 marks]

6 (b) Look at TABLES 6.2 and 6.3 in the Diagram Booklet. They show the results of the investigation.

(iii) COMPLETE TABLE 6.3 FOR THE SHELTERED SHORE. Calculate:

[3 marks]

I. The mean number of limpets per m^2.

II. The estimated total number of limpets in the 300 m^2 section of the shore.

6 (b) (iii) I. and II.

Space for working

(Turn over)

6 (b) (iv)

I. Use these results. State what the students could conclude about the density of limpets when they compared the two shores. [1 mark]

II. Suggest an explanation for this observation. [1 mark]

6 (b) (v)

State which of the quadrats (1 – 10) from the exposed shore shown in TABLE 6.2 had an anomalous result. Describe what should have been done to take account of this. [2 marks]

7. Biological control is used to reduce the numbers of a pest population. This is done through the introduction of another species. It has been used with varying success since the 19th century.

(Turn over)

7 (a) (i) State TWO advantages of this method of control. [2 marks]

Advantage 1

Advantage 2

7 (a) (ii)

State TWO disadvantages of this method of control. [2 marks]

Disadvantage 1

Disadvantage 2

7 (b) The whitefly (*Trialeurodes vaporariorum*) is a pest.

It damages greenhouse crops such as tomatoes. Whitefly numbers can be reduced by using the biological control agent *Encarsia formosa*.

7 (b)

Encarsia formosa FACT FILE

- **E. formosa** is a tiny wasp that lays eggs inside developing whitefly.
- When the eggs hatch, the young wasps kill the developing whitefly from the inside.
- Optimal conditions for **E. formosa** are temperatures over 20°C.
- When daytime temperatures are less than 17°C, **E. formosa** activity is significantly reduced, making it less effective.

7 (b) Look at GRAPH 7.1 in the Diagram Booklet. It shows the number of whiteflies in a greenhouse containing tomato plants. *E. formosa* were introduced on day 7.

(i) I. The use of *E. formosa* to reduce the number of whiteflies is successful when there are 20 or fewer whiteflies per plant. Use GRAPH 7.1. Determine how many days it took for the number of whiteflies to fall to 20 following the introduction of *E. formosa*.

[2 marks]

_____ days

7 (b) (i)

II. Suggest a reason why it took this long for the number to fall to 20.

[1 mark]

7 (b) (ii) This method of pest control would not be effective to use if whiteflies damaged wheat crops grown in Wales. Suggest ONE reason why.

[1 mark]

7 (b) (iii) An alternative approach to reducing pest numbers is to use pesticide. State why it is not appropriate to use pesticide along with *E. formosa*.

[1 mark]

_____

_____

_____

9

8. Hair length in cats is controlled by a pair of alleles. The allele for short hair (H) is dominant to the allele for long hair (h).

(a) State what is meant by the terms:

(i) allele; [1 mark]

8 (a) (ii)

dominant; [1 mark]

(iii) recessive. [1 mark]

8 (b) (i) A cat breeder crossed a homozygous short-haired cat with a long-haired cat. COMPLETE THE PUNNETT SQUARE below. Show the predicted genotypes of the offspring. Use the letters **H** and **h** for the alleles.

[2 marks]

Gametes		

8 (b) (ii)

State the **phenotype** of the offspring in the F1 generation.

[1 mark]

8 (b) (iii)

COMPLETE THE PUNNETT SQUARE below. Show the possible genotypes of the offspring if two of the F1 offspring were crossed. [2 marks]

Gametes		

8 (b) (iv)

Use the results from (b)(iii). State how many kittens would be predicted to be short-haired in a litter of 8 kittens. [1 mark]

8 (b) (v)

The cat breeder wanted to determine whether one of the short-haired cats was homozygous or heterozygous. She decided to breed the short-haired cat with a long-haired cat. Predict the phenotypes of the offspring you would expect if the short-haired cat was:

I. Homozygous [1 mark]

8 (b) (v)

II. Heterozygous [1 mark]

END OF PAPER

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

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Diagram Booklet

Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

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TURN OVER

IMAGE 1.1

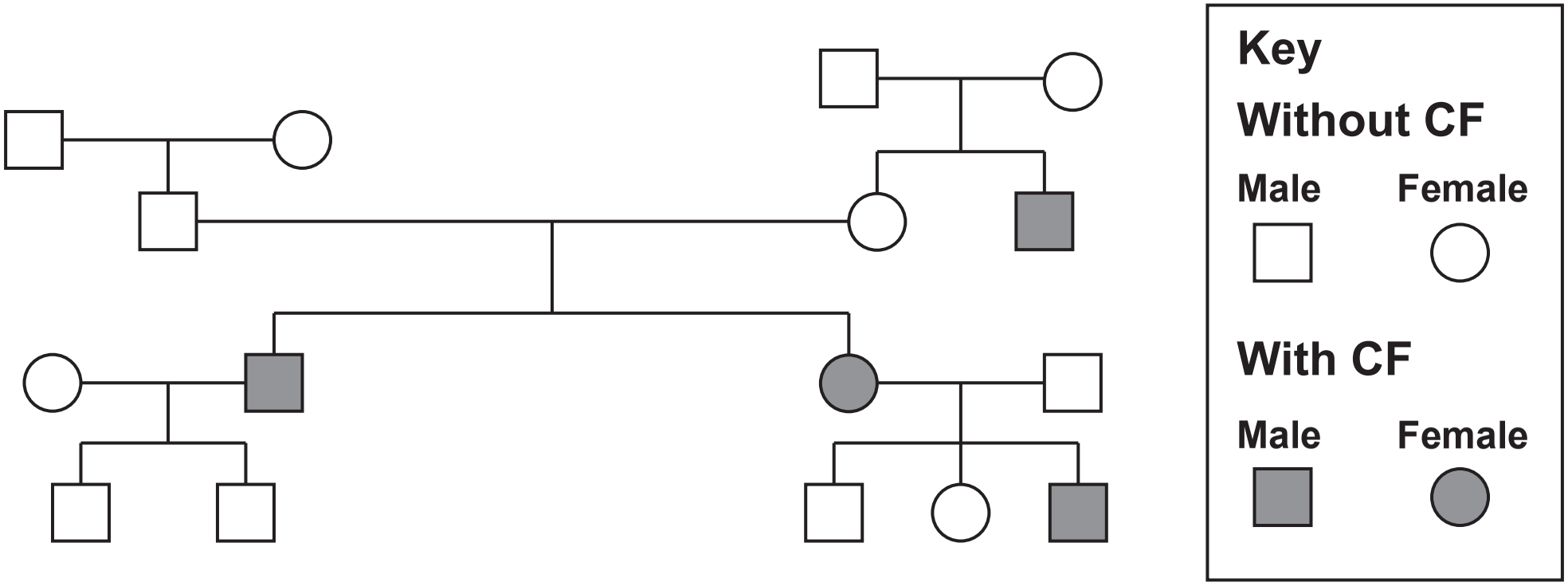

IMAGE 2.1A winter

thick fur covering the body and long tail

IMAGE 2.1B summer

grasping feet with claws

large eyes for seeing in dim light

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TURN OVER

IMAGE 3.1

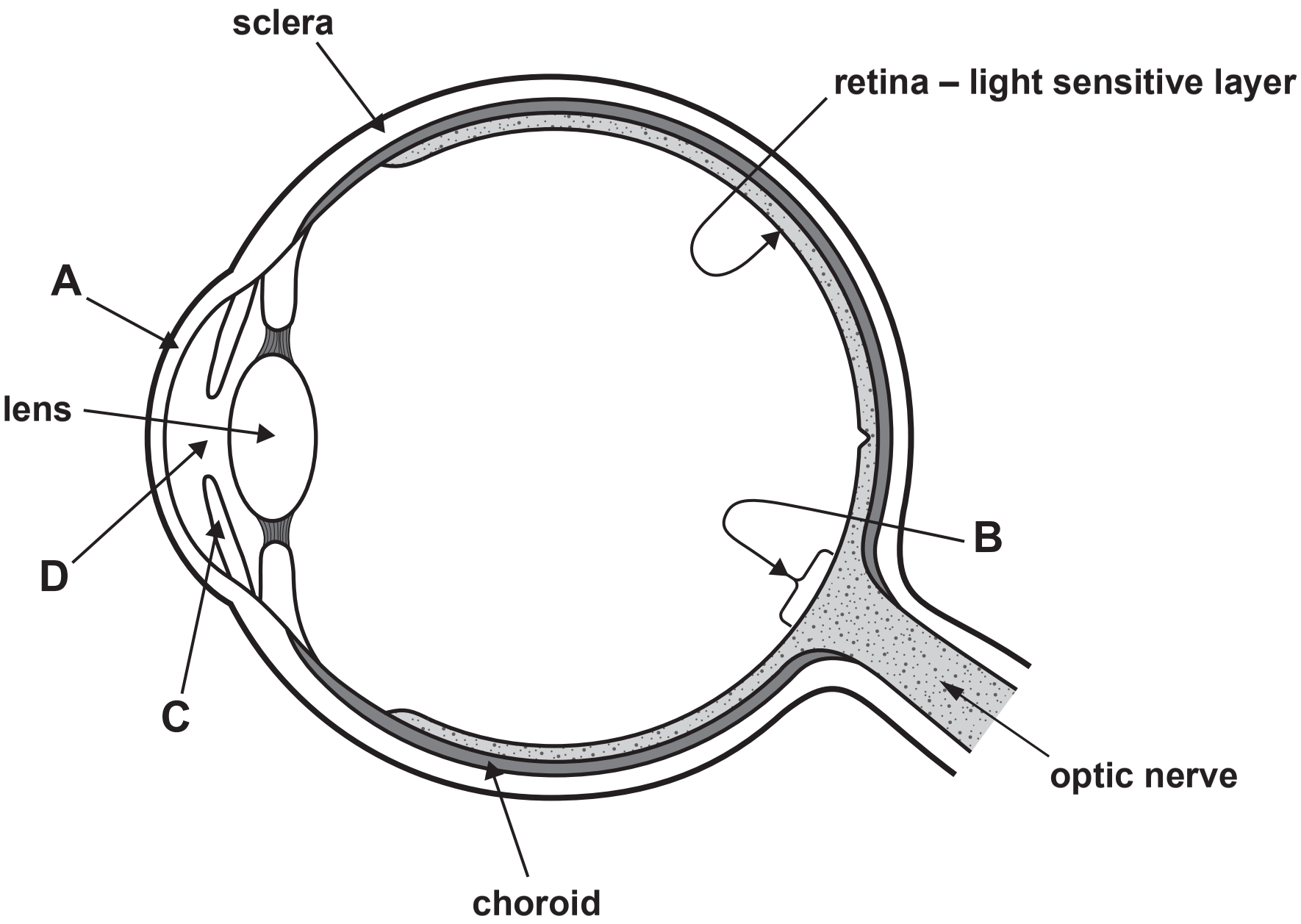
sclera
retina – light sensitive layer
A
lens
D
C
B
optic nerve
choroid

TABLE 4.1

Fact file – Treatment of Kidney Failure		
	Dialysis	Transplant
Percentage of patients surviving after five years	35	97
Waiting time for treatment	2–3 weeks	3–4 years
Usual time spent in hospital	3 days every week for life	one 5-day stay for an operation
Procedure	needles inserted into blood vessels	major surgery
Drugs	anti-rejection drugs not required	anti-rejection drugs needed for life
Diet	special low-salt foods and restricted fluid intake	normal balanced diet and normal fluid intake
Employment and sports	very limited choice	most types of jobs and many sports can be done

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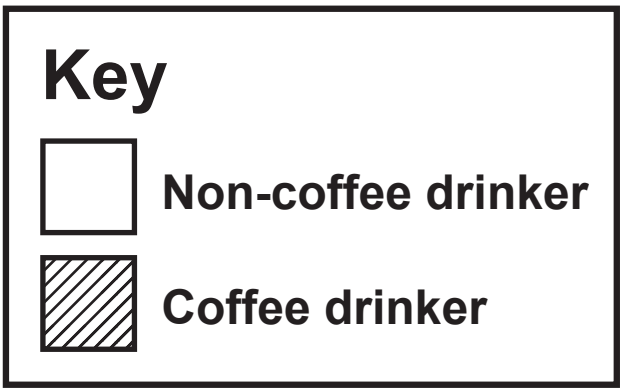
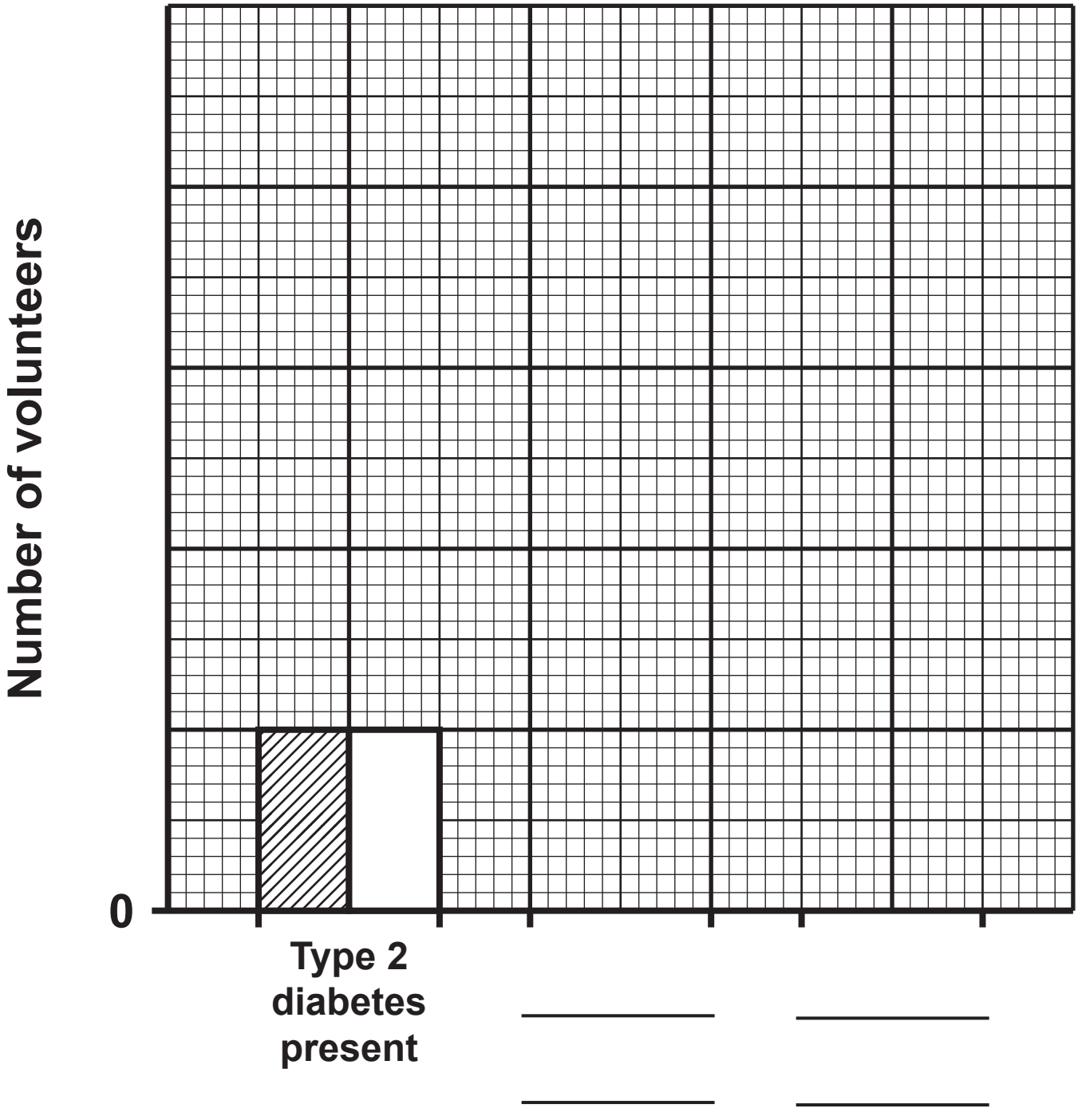
TURN OVER

TABLE 5.1

Condition	Number of volunteers with the condition	
	Coffee drinkers	Non-coffee drinkers
Type 2 diabetes	100	100
High blood pressure	280	420
Obesity	340	460

GRAPH 5.2


Key
Non-coffee drinker
Coffee drinker


Number of volunteers
0
Type 2 diabetes present

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TURN OVER

TABLE 6.1

Hazard	Risk	Control measure
Sharp edges on rocks		

TABLE 6.2

Number of limpets on exposed shore:

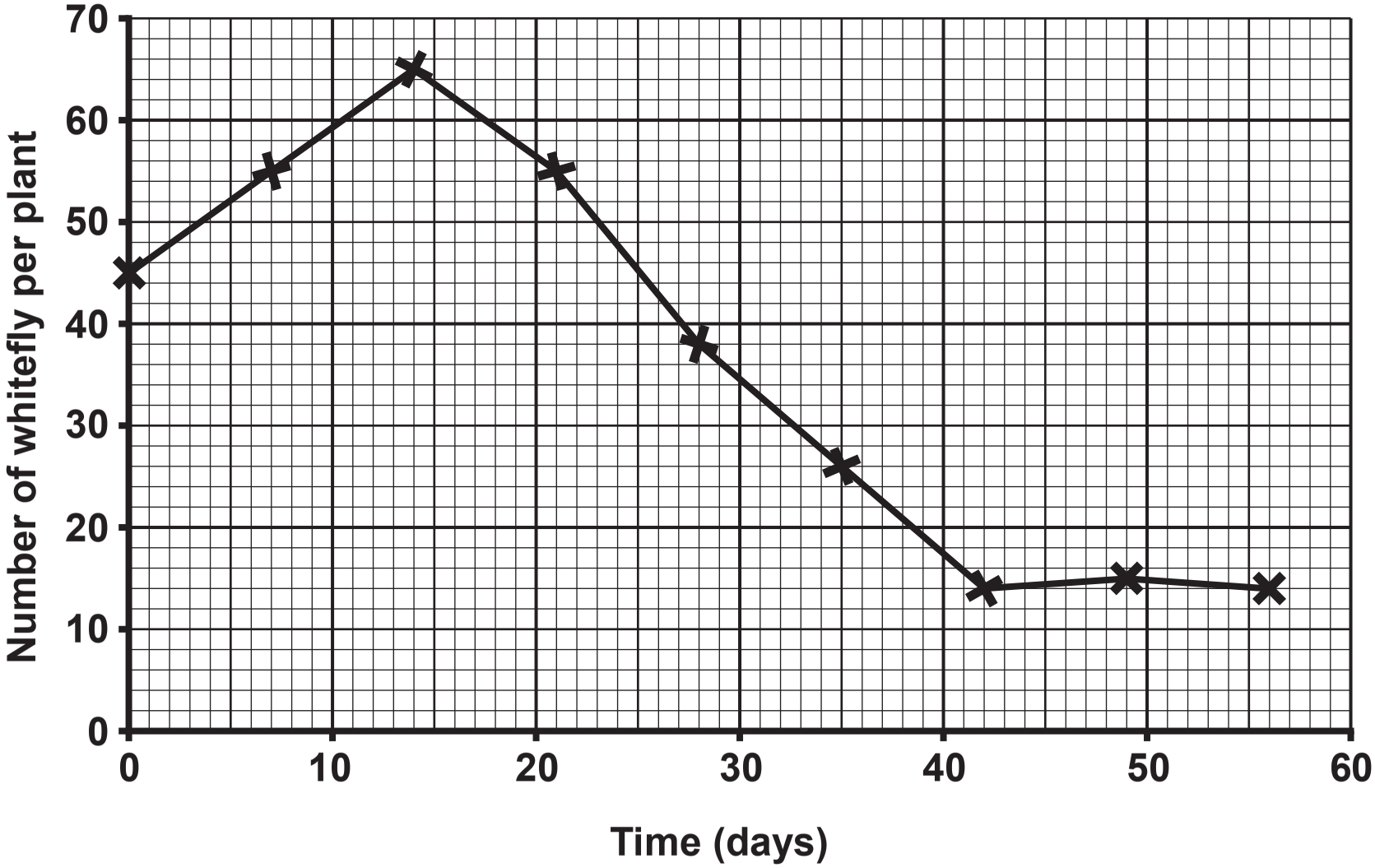
Quadrat number	1	2	3	4	5	6	7	8	9	10	Mean number per m^2	Estimated total number in the 300 m^2 section of shore
Number of limpets	26	21	22	18	5	21	17	23	19	26	19.8	5940

TABLE 6.3

Number of limpets on sheltered shore:

Quadrat number	1	2	3	4	5	6	7	8	9	10	Mean number per m^2	Estimated total number in the 300 m^2 section of shore
Number of limpets	30	22	26	31	28	25	23	19	31	26	_____	_____

GRAPH 7.1


Number of whitefly per plant
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
Time (days)