Surname		Centre Number	Candidate Number
First name(s)			0

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GCSE – CONTINGENCY

3400U40-1

Z22-3400U40-1

WEDNESDAY, 22 JUNE 2022 – AFTERNOON

BIOLOGY – Unit 2:
Variation, Homeostasis and Micro-organisms

FOUNDATION TIER

1 hour 45 minutes

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

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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 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 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 **7**(b)(ii) is a quality of extended response (QER) question where your writing skills will be assessed.

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Answer **all** questions.

1. (a) The following statements relate to micro-organisms and disease.
Using a ruler, draw lines to join each term with its correct meaning. [2]

Term   **Meaning**

| Lymphocyte | • | | • | A micro-organism which causes disease |

| Pathogen | • | | • | A medicine that kills bacteria |

| Antibiotic | • | | • | A type of white blood cell |

| Antigen | • | | • | A molecule recognised by the immune system |

(b) State **two** ways that micro-organisms can be spread between people. [2]

....

....

(c) (i) State the type of micro-organism that causes Chlamydia. [1]

....

(ii) The common cold is caused by a virus. State why antibiotics cannot be used to treat the common cold. [1]

....

(iii) Underline **one** reason why doctors are now prescribing fewer antibiotics. [1]

Bacteria are becoming immune to the antibiotics.

Bacteria are becoming resistant to the antibiotics.

Humans are becoming immune to the antibiotics.

Humans are becoming resistant to the antibiotics.

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2. Amber and Mark carried out an experiment. They investigated how the distance from a wall in the school grounds affected the height of plants. They grew five plants at different distances from the wall. This is shown in **Image 2.1**.

Image 2.1
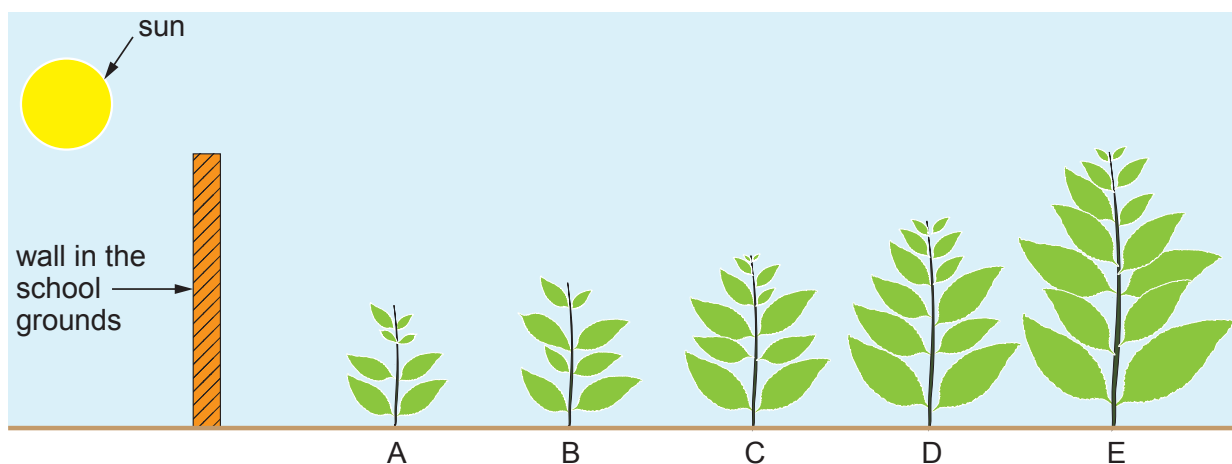
They measured the height of the plants after 1 year.
The results are shown in **Table 2.2**.

Table 2.2

Plant	Distance from wall (m)	Height of plant (cm)
A	1	20
B	2	33
C	3	39
D	4	54
E	5	64

(a) Use the results in **Table 2.2** to draw a line graph on **Graph 2.3** by: [3]

   (i) plotting the points;

   (ii) joining the plots using a **ruler**.

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Graph 2.3
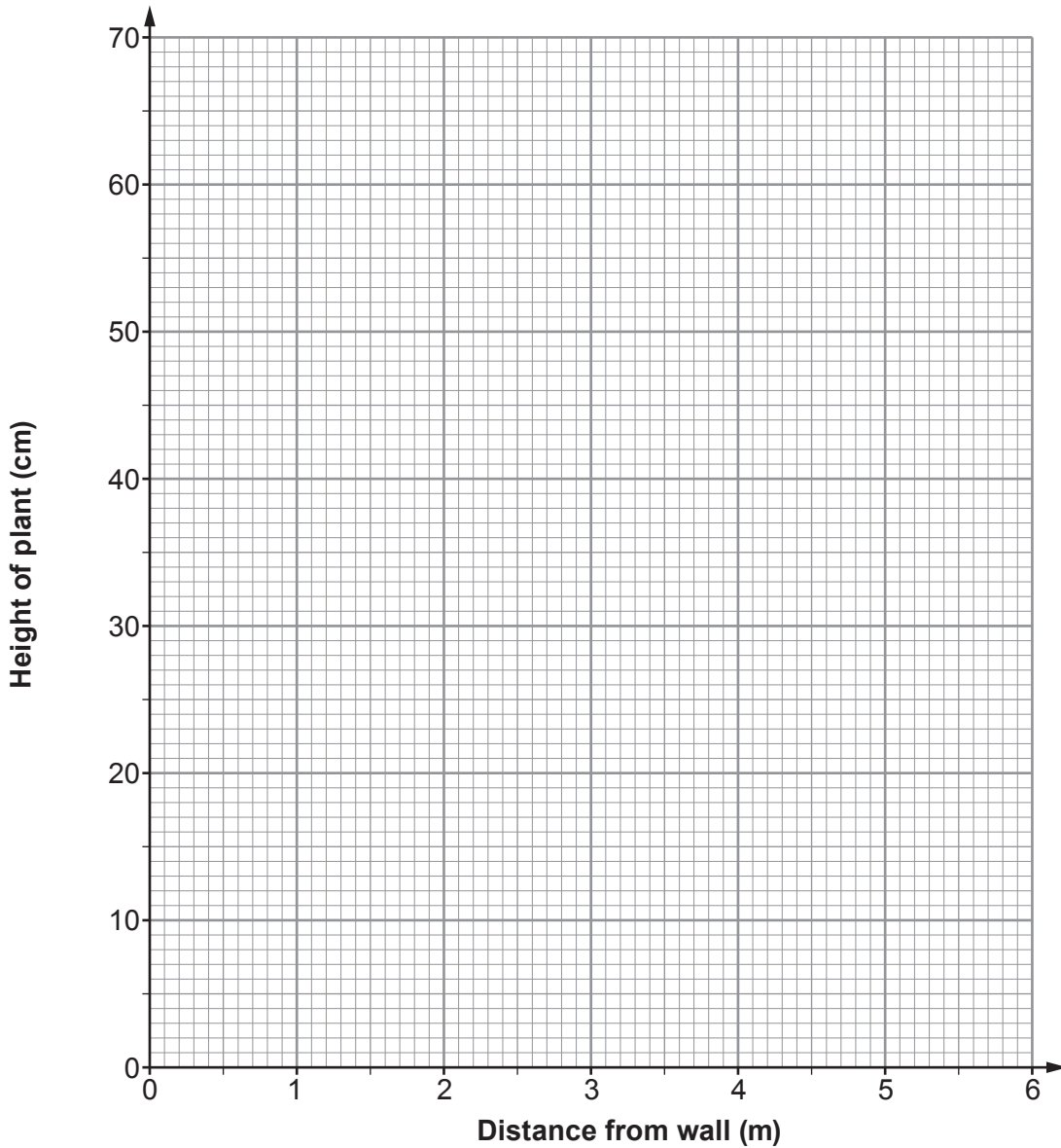
(b) Describe the trend shown in the results. [1]

....

....

(c) Suggest **two** environmental factors which could have affected the height of the plants. [2]

....

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(d) Suggest **one** way in which Amber and Mark could improve their confidence in the
results. [1]

....

(e) Amber and Mark did another experiment in a laboratory. They gave five plants different
carbon dioxide concentrations. They measured the heights of the plants after one year.

Identify the following for this experiment:

(i) Independent variable .... [1]

(ii) Dependent variable .... [1]

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3. Malaria kills a large number of people in the world each year. It is caused by the single celled organism called *Plasmodium*, which is spread by female mosquitoes *(Anopheles gambiae)*.

Female mosquito *(Anopheles gambiae)*

In 1898, some Italian scientists developed a method to control malaria which they called bonifica. They used this approach in a small test area in Italy.

Bonifica involved:

*   spraying insecticides in people's houses;
*   hanging mosquito nets in windows of houses;
*   pouring petrol on the water in the marshes, where mosquitoes reproduce.

There were 99 new cases of malaria in the test area during the year before bonifica. In the year after there were no new cases.

More recently, anti-malarial tablets have been developed along with a vaccine against *Plasmodium* and the use of biological control.

(a)   (i)   Use the information above to complete the following table by writing True or False against **each** statement.   [3]

Statement	True or False
In 1899 there were no new malaria patients in the test area.	
Insecticides kill *Plasmodium*.	
There is evidence that bonifica was successful.	
Plasmodium is passed directly from person to person.	

(ii)   State the genus of the mosquito that spreads *Plasmodium*.   [1]

....

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(b) (i) State the purpose of the nets that were put up at the window. [1]

....

....

(ii) Suggest why bonifica could be dangerous to the people who live near the
marshes where the mosquitoes reproduce. [1]

....

....

(c) **Graph 3.1** shows the number of annual global deaths from malaria and the amount of
money spent on preventing malaria from 2006 to 2013.

Graph 3.1

Source: WHO
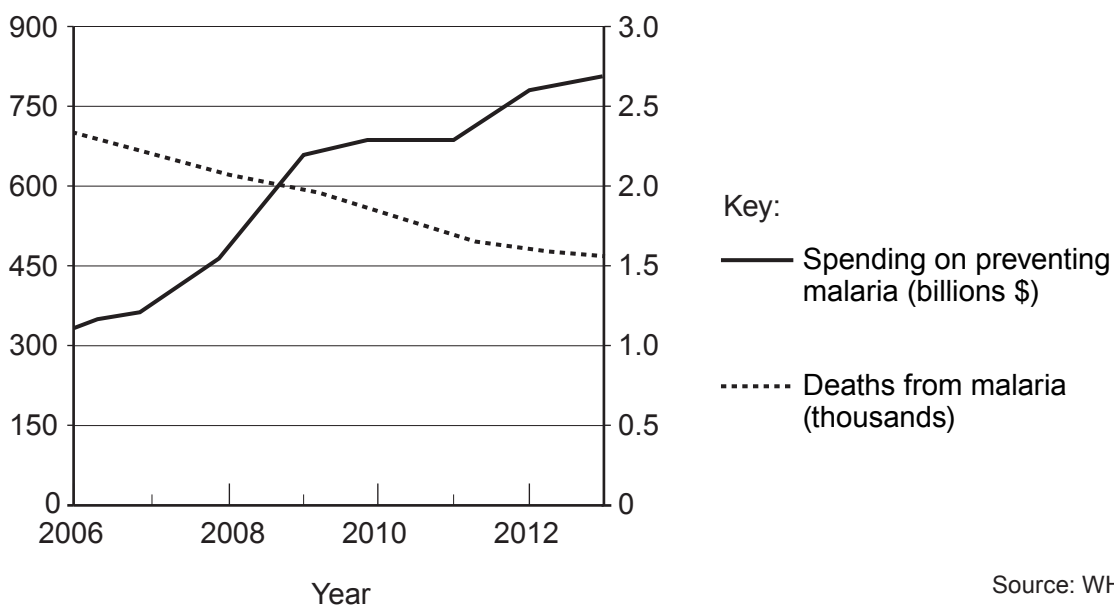
State the relationship between the money spent on preventing malaria and the number
of deaths from malaria. [1]

....

....

....

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(d) Some of the modern methods used to control malaria include the use of vaccines and biological control.
Choose words from the list to complete the following sentences.   [2]

starving   preventing   killing   protecting

Vaccines work by ……………………………………… a person getting malaria.

Biological control works by ……………………………………… the mosquito that is spreading malaria.

4. **Image 4.1** shows a section through the human eye.

Image 4.1

pupil

A ....

B ....

C ....
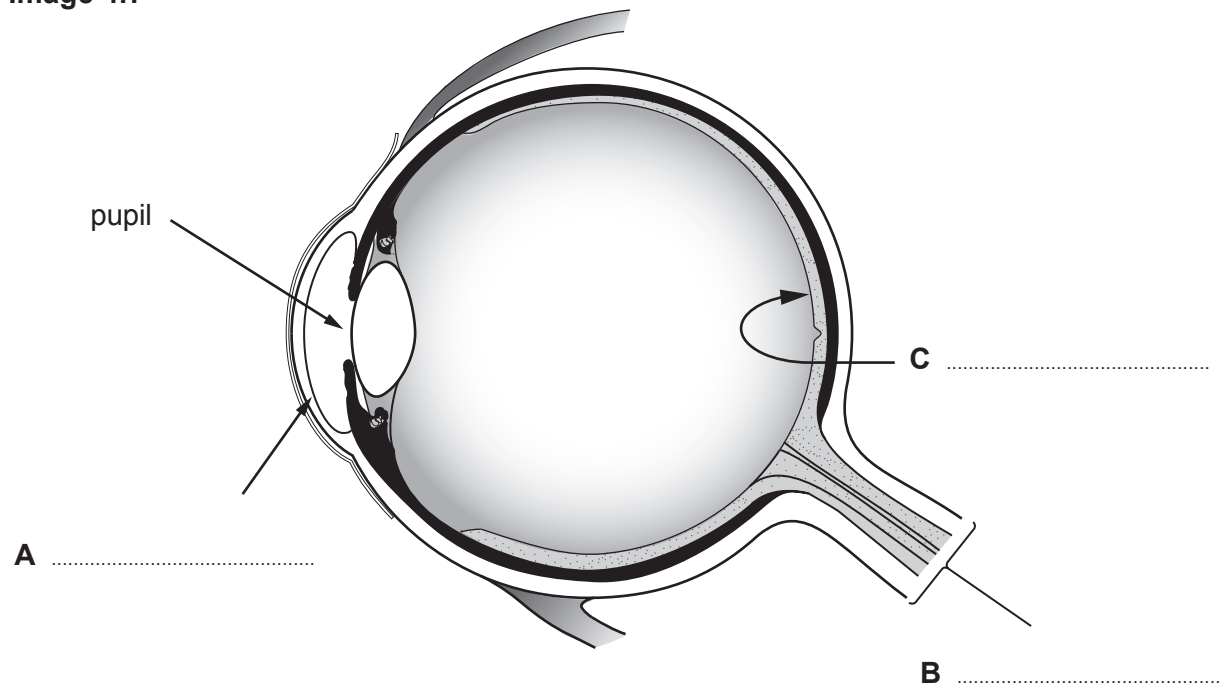
(a)   (i)   Complete the labels **A–C** on **Image 4.1**.   [3]

(ii)   State the function of the lens.   [1]

....

....

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(b) The pupil allows light to enter the eye. The pupil can change in diameter depending on the light intensity. **Image 4.2** shows the appearance of the front of the eye in dim light.

Image 4.2
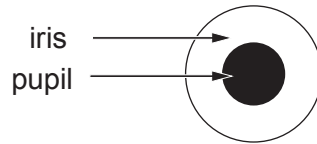
Use the following information to calculate the area of the pupil. [2]

radius, r = 4.0 mm

area of pupil = $3.14 \times r^2$

Area of pupil = ... mm^2

(c) State what would happen to the area of the pupil if a bright light is directed into the eye. [1]

....

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5. Chromosomes are structures made of DNA and are found inside the nucleus of cells. The meerkat *(Suricata suricatta)* has 36 chromosomes in its body cells.

(a)   **Image 5.1** shows two different types of cell division in the **meerkat**.

Image 5.1

Cell division A

Cell division B

36

36

.... body cells

18   18

gametes   ....

(i)   **Complete Image 5.1** by writing in the number of chromosomes in **each** body cell and gamete. [2]

(ii)   State the name of cell division **A**. [1]

....

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(iii) State the disease that occurs when cell division **A** is uncontrolled. [1]

....

(b) **Image 5.2** shows part of a DNA molecule. Complete **Image 5.2** by adding the correct
letters to represent the names of the missing bases. [2]

Image 5.2

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

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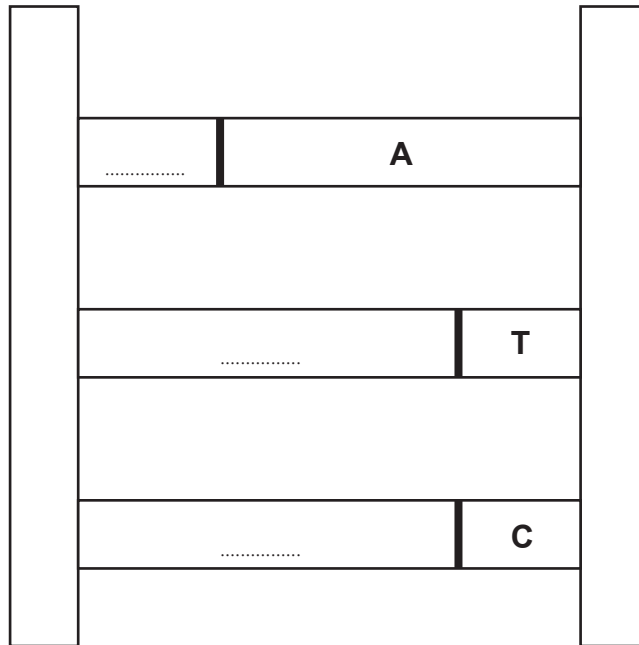
(c) Scientists use DNA profiling to find out how closely related different species of animals are. The DNA profiles of three different animals are shown in **Image 5.3**.

Image 5.3
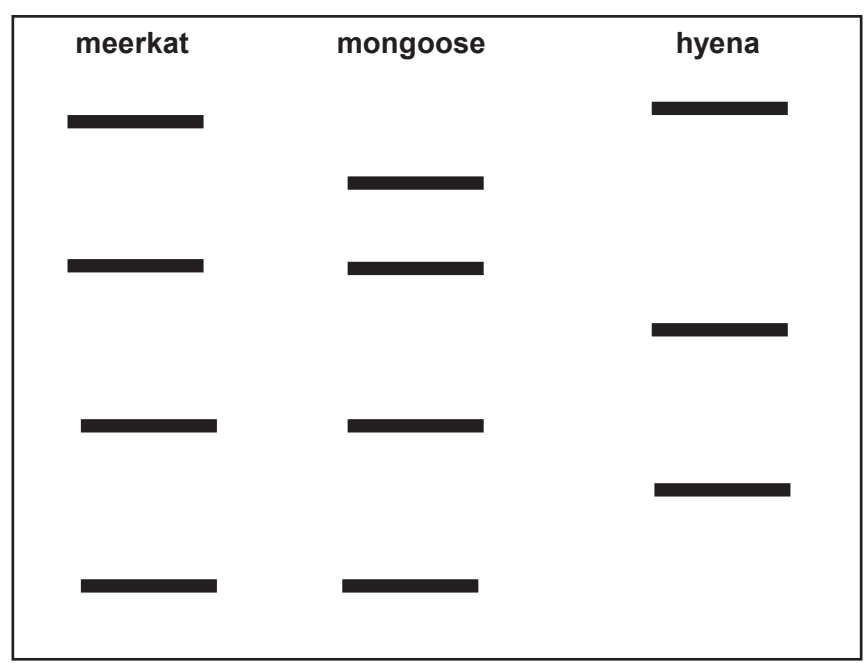
Use the DNA profiles in **Image 5.3** and your knowledge to answer the following questions:

(i) State the **two** animals which are most closely related. Explain your answer. [2]

Animals ....

Explanation ....

....

(ii) State **one** other use for DNA profiling. [1]

....

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6. **Image 6.1** shows a BATAK machine being used to measure an individual's reactions.

Image 6.1

The method for using the BATAK machine is:

- The lights in the buttons flash randomly, for differing lengths of time.
- The individual has to hit each button when it flashes.
- The number of lights successfully hit in 1 minute is recorded.

Table 6.2 shows the results recorded for five year 11 students. Use the data to answer the questions that follow.

Table 6.2

Name	Number of lights hit successfully in 1 minute			
	Attempt 1	Attempt 2	Attempt 3	Mean
Sean	31	34	39	35
Mark	36	38	41	....
Eleri	40	41	42	41
Gwen	29	35	40	35
Gruffydd	21	22	23	22

All the students except Gruffydd did their test during the first lesson of the day. Gruffydd did his test in the last lesson of the day.

(a) Calculate the mean number of lights hit in 1 minute by **Mark**.
Write your answer to the nearest whole number in Table 6.2. [1]
Space for working

(b) State the name of the student with the fastest reactions. [1]

....

(c) Suggest why Gruffydd's results are not valid in this investigation. [1]

....

....

(d) State **two** other variables that should have been controlled in this method. [2]

....

....

(e) State **two** properties of reflex actions. [2]

....

....

7

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7. **Image 7.1** is a diagram of the human excretory system.

Image 7.1

A ....

B ....

C ....
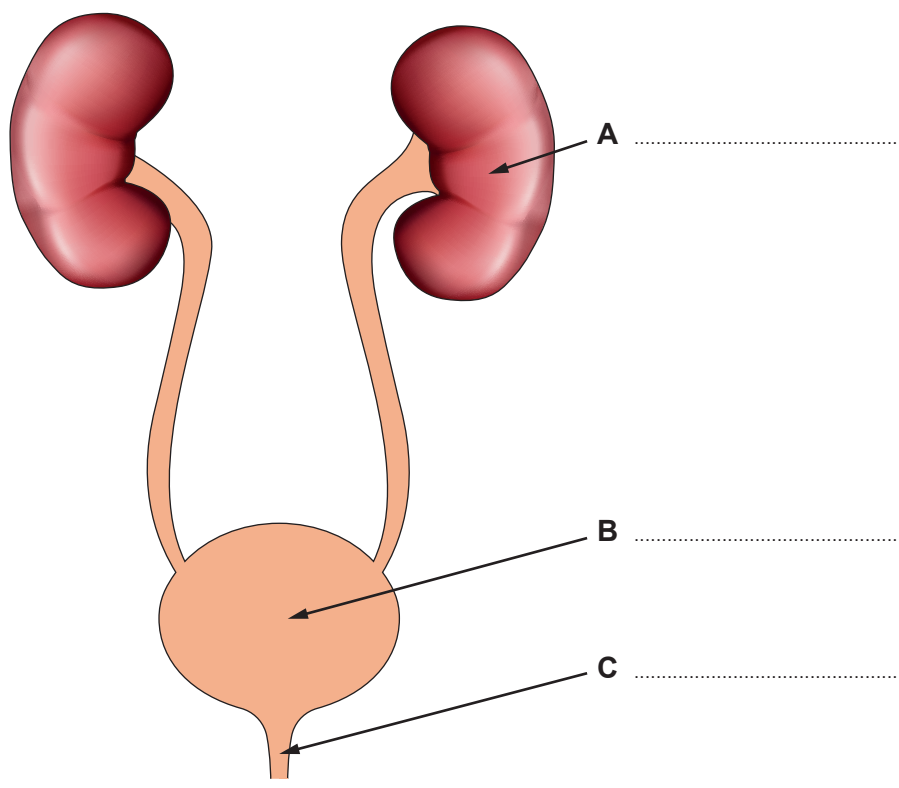
(a) (i) Label structures **A–C** on **Image 7.1**. [3]

(ii) **Draw an arrow** on **one** ureter to show the direction that the urine flows. [1]

(b) **Table 7.2** shows the composition of the urine of three people.

Table 7.2

Name	Presence or absence in urine			
	Salt	Water	Urea	Glucose
James	✓	✓	✓	✗
Ethan	✓	✓	✓	✗
Sophie	✓	✓	✓	✓

✓ indicates present, ✗ indicates absent

(i) Sophie has a medical condition. Use the information in **Table 7.2** to state the name of the condition. Give a reason for your answer. [2]

....

....

(ii) Describe how a sample of urine could be tested for the presence of glucose. You must describe how you would use all the apparatus in the diagram and the colour that would be observed for Ethan's and Sophie's samples. [6 QER]

eye protection

boiling tube holder

water bath

boiling tubes in rack

Bunsen burner

Benedict's reagent

Ethan's urine sample

Sophie's urine sample

....

....

....

....

....

....

....

....

....

....

....

....

....

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8. A group of students investigated the biodiversity of a moorland over a period of three years. Two years before the investigation started, the drainage ditches in the moorland had been closed in order to increase the water content of the land. **Image 8.1** is a map showing the moorland (shaded area) being investigated. The black squares represent locations of eight sample areas. Each sample area is $625\,m^2$ ($25\,m \times 25\,m$).

Image 8.1
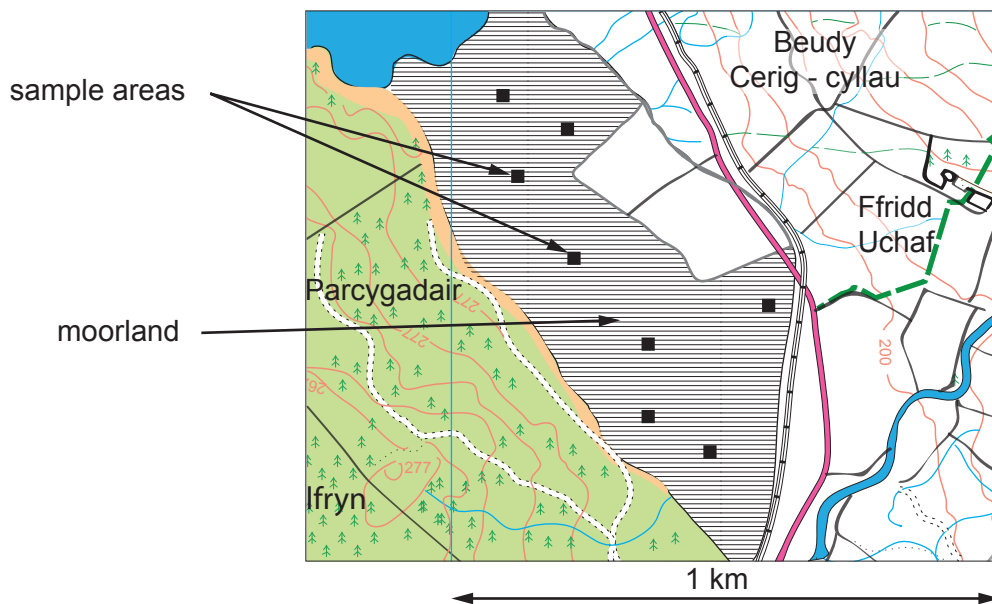
The results of the survey are shown in **Graph 8.2**.

Graph 8.2

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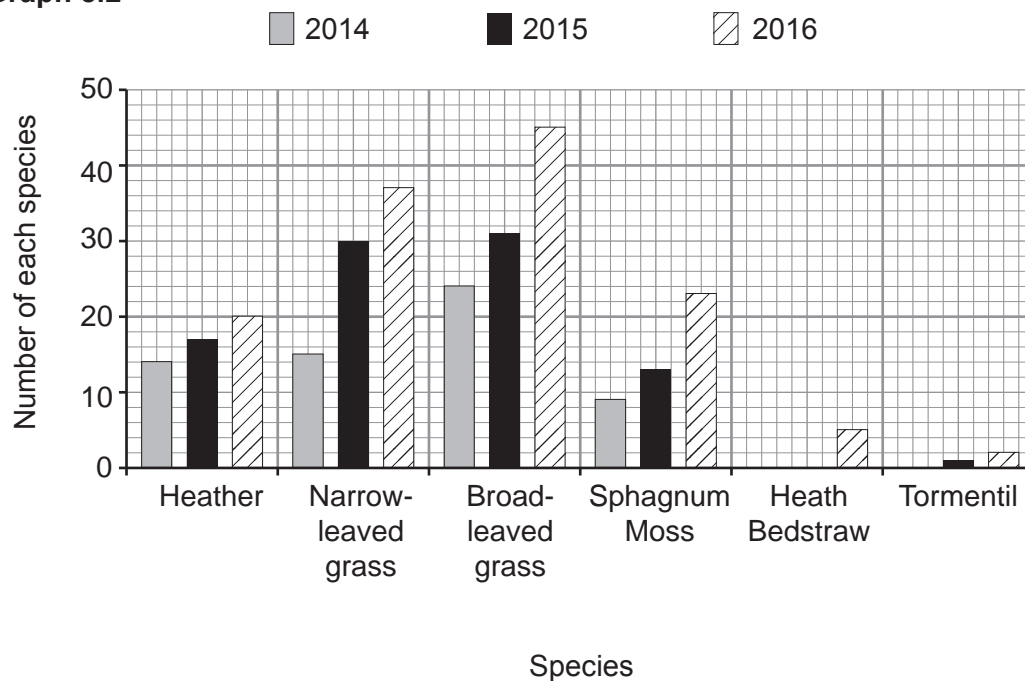
(a) Describe the method that the students would have used to investigate the abundance of plant species in the moorland. [4]

....

....

....

....

....

....

(b) (i) Calculate the percentage change in narrow-leaved grass between 2014 and 2016. [2]

Percentage change = ... %

(ii) State **two** pieces of evidence that show that the biodiversity of the moorland increased between 2014 and 2016. [2]

....

....

....

....

(c) (i) Suggest why the students sampled several areas over the whole moorland. [1]

....

....

(ii) Suggest how, over the three years, the students made sure the investigation was a fair test. [1]

....

....

10

Turn over.

9. A peach is a fruit which has tiny hairs on its surface. A nectarine is a type of peach where the hairs are absent. The production of hair on the surface is controlled by a single gene. A dominant allele codes for the production of hair. A mutation to this gene produces a recessive allele which does not produce hair. **Image 9.1** is a picture produced by an electron microscope showing the hair growing on the surface of a peach.

Image 9.1

Peach scab disease is caused by the fungus *Cladosporium carpophilum* and can affect both peaches and nectarines. Fungi reproduce by producing spores, which are spread by wind and rain. When the spore lands on the surface of a fruit, the fungus begins to grow and scabs soon develop. Nectarines are more likely than peaches to develop scab disease. **Image 9.2** is a picture of a nectarine showing scabs caused by *Cladosporium carpophilum.*

Image 9.2

scabs
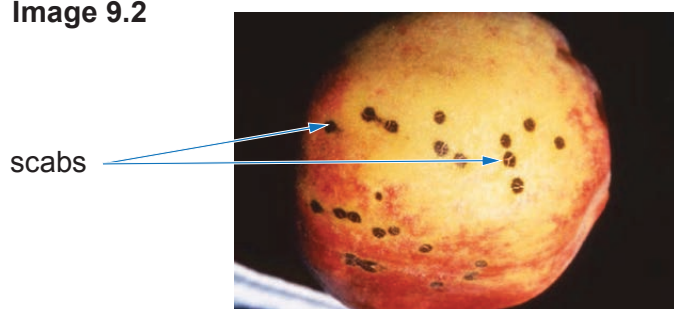
Image 9.3 shows a fungal spore developing and forming a scab.

Image 9.3

spore   surface of fruit   tube from spore   scab on surface of nectarine

1. Spore on surface of fruit

2. Tube grows out from spore and forms a network in the fruit

3. Network of tubes causes the fruit to form a scab
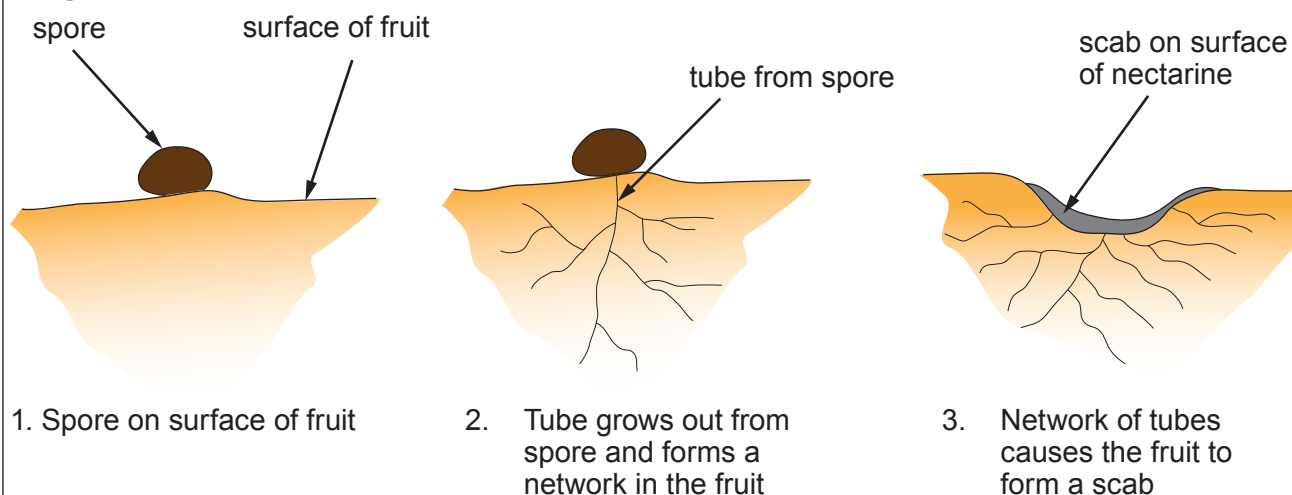
(a) (i) State why scientists use the name *Cladosporium carpophilum* rather than the common name peach scab when discussing this disease. [1]

....

....

(ii) Using all the information given, suggest why nectarines are more likely than peaches to develop scab disease. [2]

....

....

....

....

(b) (i) State what is meant by the term allele. [1]

....

....

(ii) State what is meant by a mutation. [1]

....

....

(iii) Give **one** example of an **environmental** factor which increases the rate of mutations. [1]

....

Continued overleaf

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(c) (i) Use the letters **H** and **h** to show the result of a genetic cross between two peach trees that would result in the production of seeds that could grow into nectarine trees. [3]

Key: **H** = allele for hairy fruit

h = allele for hairless fruit

Phenotype = peach tree   ×   peach tree

Genotype = ... × ....

Gametes		

(ii) Using your answer from the Punnett square above, state the probability of producing a nectarine tree from this cross. [1]

Probability = ...

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