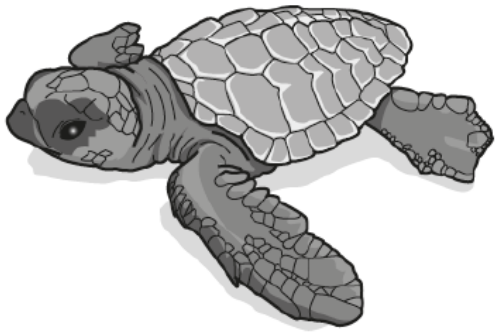
Life on Earth – past, present and future – 2022 GCSE 21st GCSE Biology B

1. May/2022/Paper_J257/03/No.3

The diagram shows a Pacific sea turtle. The sex of Pacific sea turtles' offspring is determined by the temperature at which their eggs incubate.



(a) Explain how sex determination in **humans** is different to sex determination in turtles.

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.....

.....

..... **[2]**

(b) The effect of temperature on the sex of the offspring is shown in the table.

Egg incubation temperature (°C)	Sex of offspring
Below 27.7	male
Between 27.7 and 31.0	mix of male and female
Over 31.0	female

(i) In some locations in 2020 the female turtles outnumbered male turtles in a ratio of 116 : 1.

Calculate the number of female turtles in a sample of 18000 turtles.

Give your answer to the nearest whole number.

Number of female turtles = ... **[3]**

(ii) In the 1970s the ratio of female to male turtles was 6 : 1.

What effect could the change in the ratios from 1970 to 2020 have on the population of sea turtles?

Explain your answer.

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..... **[2]**

(iii) Suggest how scientists could help return the sex ratio in the next generation of turtles to that seen in the 1970s.

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..... **[1]**

2. May/2022/Paper_J257/03/No.9

Elephants live in a habitat where temperatures can get extremely high.

(a) Which statement explains why elephants find it difficult to regulate their body temperature?

Tick (✓) **one** box.

Elephants have a fast heart rate. ☐

Elephants have a large surface area to volume ratio. ☐

Elephants have a small surface area to volume ratio. ☐

Elephants move slowly. ☐

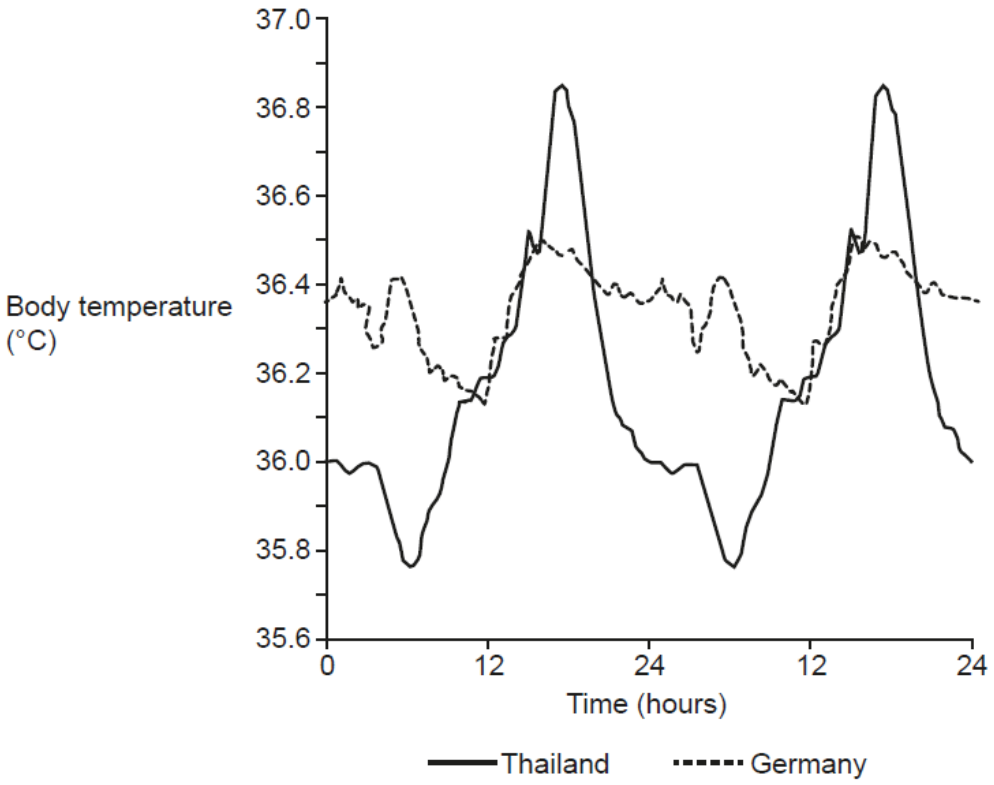
[1]

Elephants cope with these high temperatures using heterothermy.

This means the elephants do not regulate their body temperature during the daytime, so it increases in the sun.
The elephants regulate their body temperature back down to **below** normal overnight.

Scientists monitored the temperature of elephants in a zoo in Germany and in Thailand to see if they used heterothermy to regulate their body temperature.

The graph shows the scientists' data.



(b) The normal body temperature of an elephant is 35.9 °C.

Does the graph provide evidence for heterothermy in elephants? Explain your answer.

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..... **[3]**

(c) Elephants have large ears which are very thin and have a good blood supply.

(i) Describe **one** method that both elephants and humans use to **regulate** their temperature.

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..... **[2]**

(ii) Describe how the human body **monitors** its temperature.

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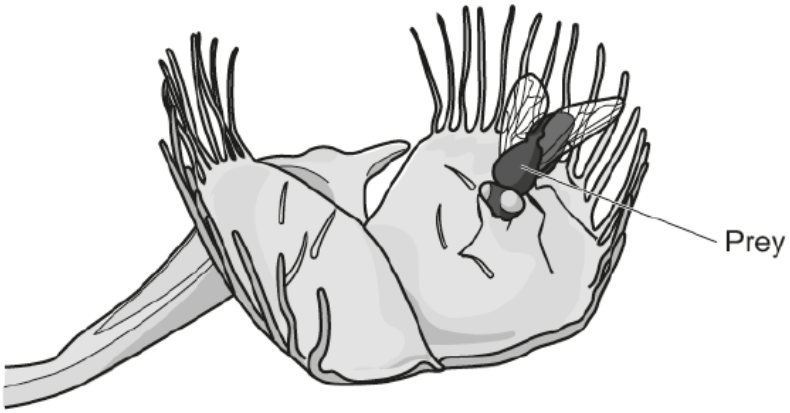
..... **[3]**

3. May/2022/Paper_J257/03/No.10

Venus fly traps, shown in the diagram, are carnivorous plants.

They attract prey using nectar. When prey land on the leaves, they touch hairs and this triggers the leaves to close and lock.



The prey contains different biological molecules that need to be broken down so that they can be absorbed by the plant.

The Venus fly trap secretes enzymes to digest the prey.

(a) Use ideas of the lock and key model to describe how the enzymes break down different biological molecules found in the prey so they can be absorbed.

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..... **[3]**

(b) Explain why several types of enzymes are secreted by the plant.

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..... **[2]**

(c) The Venus fly trap evolved to live in damp soil that is low in nitrogen and phosphorus.

Complete the sentences describing why plants require nitrogen and phosphorus.

Put a (ring) around the correct answer.

Nitrogen is needed by plants to make **fats / glucose / protein**.

Phosphorus is needed by the plants to make **DNA / glucose / starch**.

[2]

(d) Venus fly traps use the glucose produced in photosynthesis for aerobic cellular respiration.

Give the balanced symbol equation for aerobic cellular respiration.

..... + ... ⟶ ..... + ... **[2]**

(e) Venus fly traps produce flowers which are pollinated.

Name this type of reproduction **and** give one advantage of reproducing in this way.

Type of reproduction .....

.....

Advantage .....

.....

[2]

4. May/2022/Paper_J257/04/No.2

Elysia sea slugs are very unusual animals.

(a) The sea slugs eat algae. The slugs take chloroplasts from the algae cells. The chloroplasts stay inside the slugs and continue to work.

Suggest why it is an advantage to a sea slug to have working chloroplasts in its body.

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..... **[2]**

(b) When a sea slug's body is attacked by predators, its head can separate from the body.

The head continues to live and grows a new body. All of the different tissues and organs for the slug's new body grow from a particular type of cell.

(i) From which type of cell must the slug's new tissues and organs grow?

Put a (ring) around the correct answer.

Gametes **Meristem** **Nerve cells** **Stem cells**

[1]

(ii) Explain how these cells make tissues and organs for the slug's new body.

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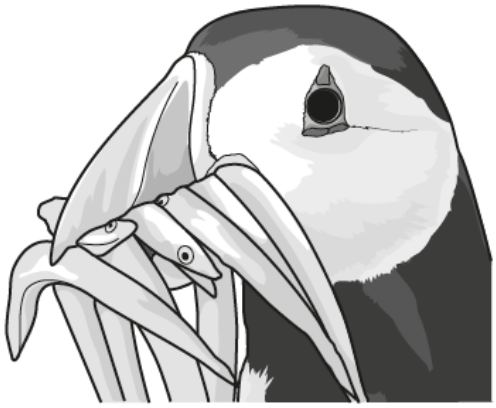
..... **[4]**

5. May/2022/Paper_J257/01/No.5

Puffins are a species of bird.



Puffins nest on the Farne Islands off the coast of North East England.

Every 5 years the number of breeding pairs of puffins is counted. The data are shown in the table.

Year	Number of puffin breeding pairs
2003	55 674
2008	36 835
2013	39 962

(a) Describe the overall trend in the data from 2003 to 2013.

.....

..... **[1]**

(b) Which of the following could be a reason for the change in breeding pair numbers?

Tick (✓) **one** box.

There are no predators. ☐

There is a more favourable climate. ☐

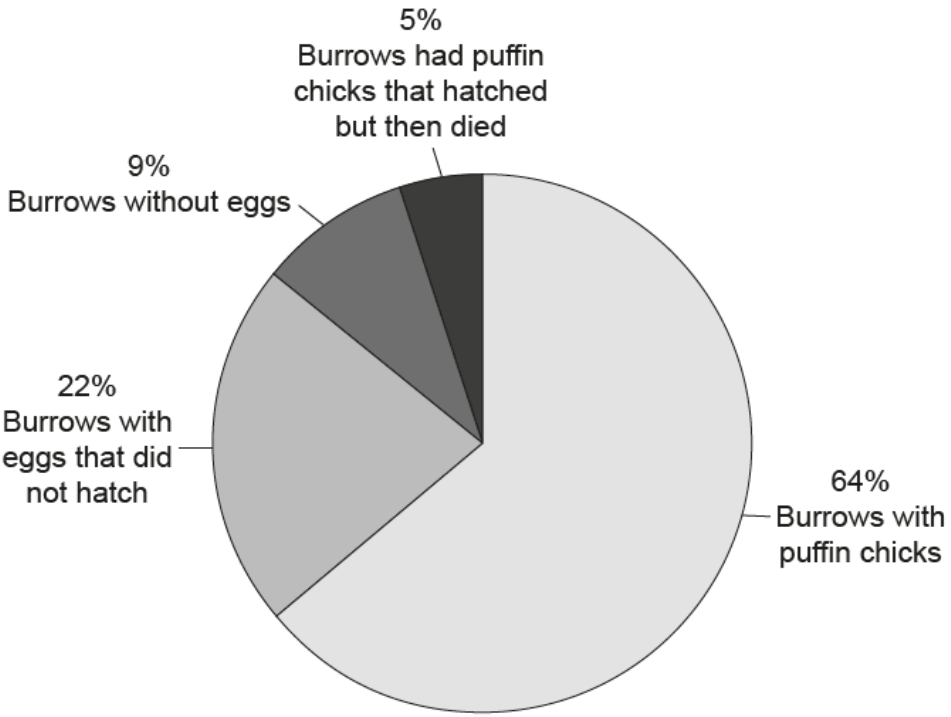
There is less competition in the ecosystem. ☐

There is not enough food. ☐

[1]

(c) Puffins lay their eggs in burrows. They lay 1 egg each year.

The pie chart shows data about puffin burrows.



(i) What percentage of burrows had puffin chicks that hatched?

Percentage = ... % **[2]**

(ii) Use the data in the pie chart to calculate how many chicks would survive if there were 40 000 breeding pairs of puffins.

Put a (ring) around the correct answer.

25 600 **27 600** **36 400** **34 400**

[1]

(d) Puffins eat a diet high in protein.

Draw **one** line to connect the **reagent used to test for protein** and the **colour of a positive** test.

Reagent used to test for protein	**Colour of positive test result**
Benedict's	Black
Biuret	Purple
Iodine	Red

[2]

6. May/2022/Paper_J257/01/No.6

Elephants must maintain their body temperature within a set range.

(a) Which word describes the maintenance of a constant internal environment?

Put a (ring) around the correct answer.

active transport **homeostasis** **osmosis** **respiration**

[1]

(b) Some elephants are kept in zoos.

A zookeeper measures the body temperature of five healthy elephants. The results are shown in the table.

Elephant	Body temperature (°C)
1	36.0
2	36.2
3	37.0
4	36.8
5	36.4

(i) Use the data in the table to work out the normal body temperature range of these elephants.

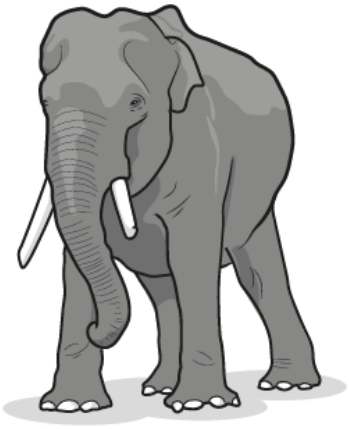
Normal body temperature range = ... to ..... °C **[1]**

(ii) Calculate the mean body temperature of the five elephants.

Give your answer to **one** decimal place.

Mean body temperature = ... °C **[2]**

(c) An elephant is shown in the diagram.



(i) Elephants live in hot climates and have very few sweat glands. They find it difficult to lose heat.

Which statement explains why elephants find it difficult to lose heat?

Tick (✓) **one** box.

Elephants have a large surface area. ☐

Elephants have a small surface area : volume ratio. ☐

Elephants have a small volume. ☐

Elephants sweat a lot. ☐

[1]

(ii) Suggest **one** way elephants can reduce their body temperature.

.....

..... **[1]**

7. May/2022/Paper_J257/01/No.8

Fig. 8.1 shows a coral reef. Coral reefs are underwater ecosystems that support many different species.

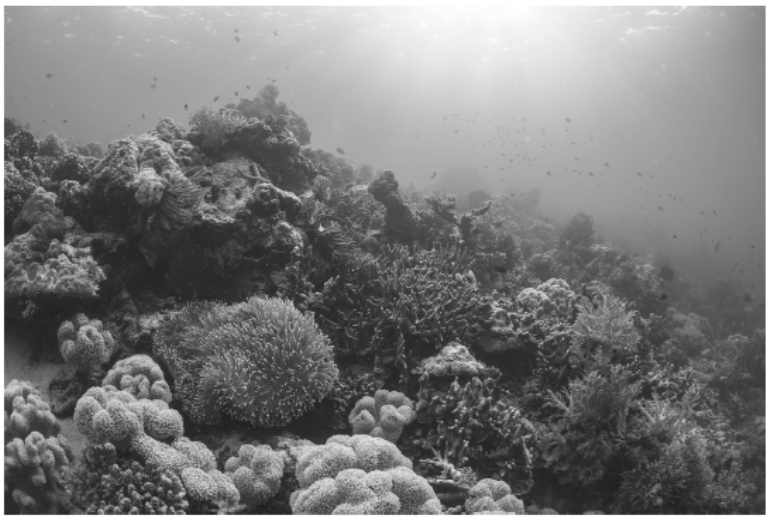


Fig. 8.1

(a) **Fig. 8.2** shows the amount of one species of coral present in a coral reef over time.

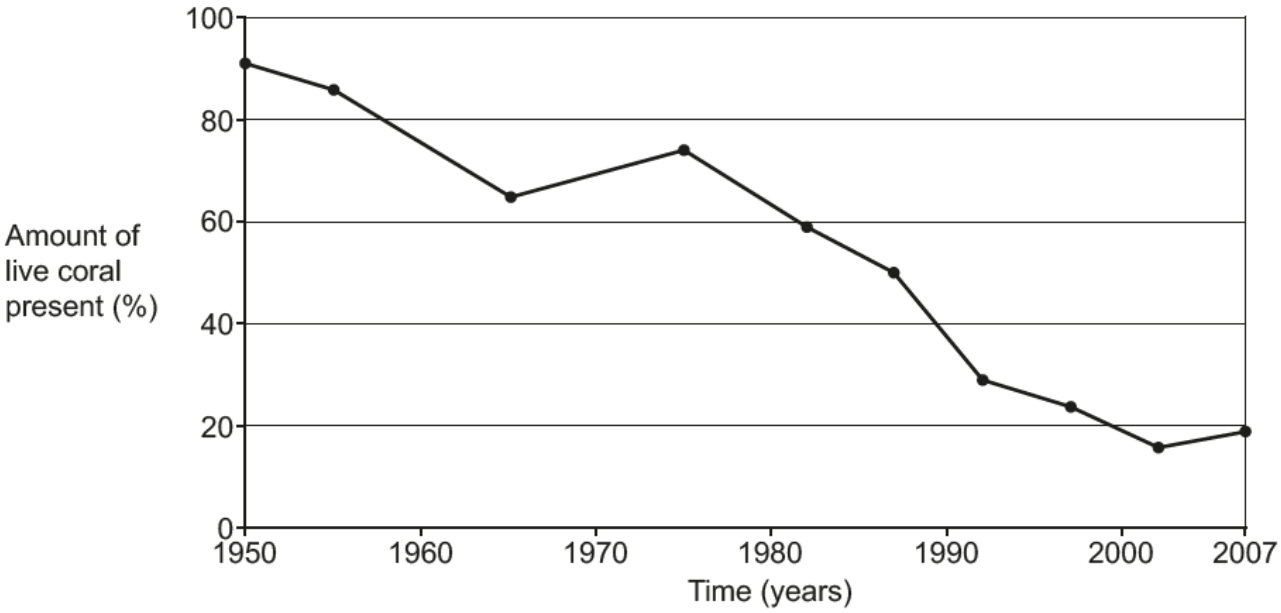


Fig. 8.2

(i) Describe the trend shown by the data in **Fig. 8.2**.

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.....

.....

..... **[2]**

(ii) Coral reef is a habitat for many populations of fish.

Suggest how a population of fish may be affected by the trend shown in the graph.
Give a reason for your suggestion.

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.....

.....

..... **[2]**

(iii) The loss of live coral can be a result of an increase in water temperature.

Predict what will happen to this coral reef in the future.
Give a reason for your answer.

Prediction .....

Reason .....
[2]

(b) Coral are animals. They benefit from having photosynthesising algae living inside them.

Suggest **one** substance the algae provide the coral with.

..... **[1]**

(c) Many marine ecosystems are threatened by human activity, such as overfishing.

Suggest **two** ways in which humans can have a positive effect on these ecosystems.

1 .....

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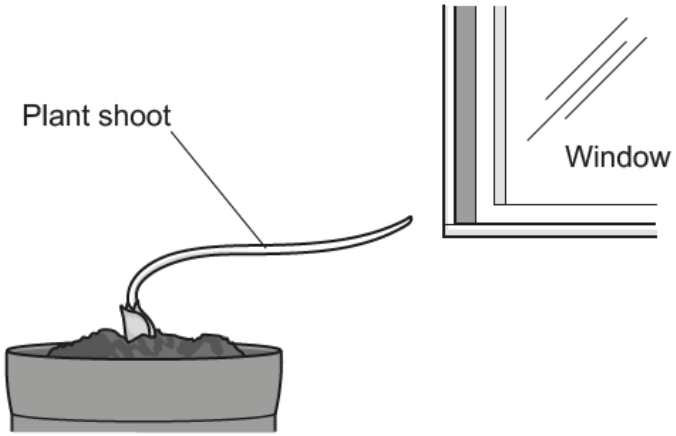
2 .....

.....
[2]

8. May/2022/Paper_J257/01/No.12

Plants respond to their environment.
One example is their response to light, as shown in the diagram.



(a) Complete each sentence to explain how the plant shoot responds to light.
Use words from the list.

auxins	**dark**	**insulin**	**less**
light	**more**	**progesterone**	**shade**

The response to light is controlled by plant hormones called ..... .

When the plant is placed in an environment where the light is coming from one direction, there is an uneven distribution of the hormone in the shoot.

..... hormone collects on the side of the shoot that is in the shade.

This causes more cell elongation on the side of the shoot that is in the

..... so the shoot grows towards the light.

[3]

(b) What word is used to describe a plant root's response to gravity?

..... **[1]**

9. May/2022/Paper_J257/02/No.6

In the 19th century, Gregor Mendel did experiments to investigate the inheritance of flower colour in pea plants.

(a) In his first experiment, Mendel bred two 'parent' plants.

He recorded the flower colour of the 'parent' plants and their offspring in the 'first generation', as shown in **Table 6.1**.

	Flower colour
'Parent' plant 1	The plant had red flowers
'Parent' plant 2	The plant had white flowers
'First generation' plants	All the plants had red flowers

Table 6.1

Scientists have now worked out which alleles the plants in this experiment had, as shown in **Fig. 6.1**.

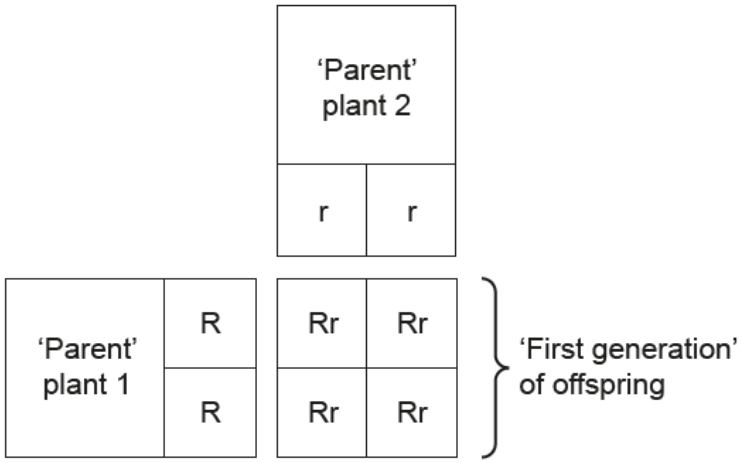


Fig. 6.1

(i) State the genotype of 'parent' plant 1.

..... **[1]**

(ii) Describe the phenotype of 'parent' plant 2.

..... **[1]**

(iii) What is the probability that a plant in the 'first generation' will have red flowers?

Put a (ring) around the correct answer.

0.25 **0.5** **1** **4**

[1]

(iv) What can you conclude about the **R** and **r** alleles?

Use the information in **Table 6.1** and **Fig. 6.1** to help you.

R allele .....

r allele .....

[2]

(b) In his next experiment, Mendel bred plants from the 'first generation'. This created a 'second generation' of offspring.

The alleles of the plants are shown in **Fig. 6.2**.

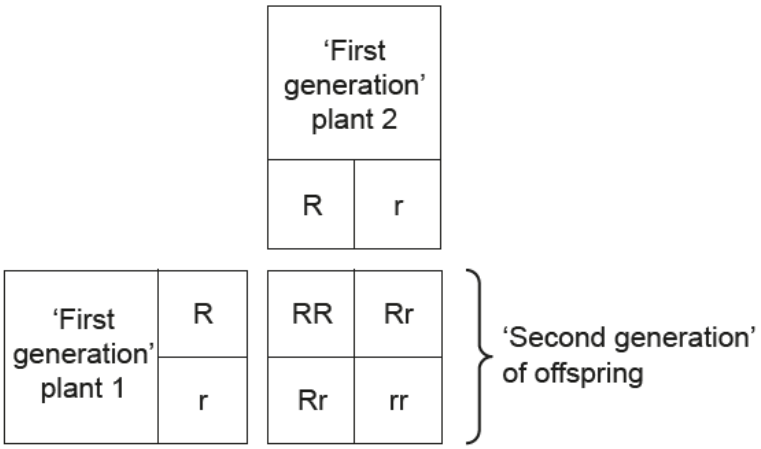


Fig. 6.2

(i) Describe the flower colours Mendel would have observed in the 'second generation' of offspring.

Flower colour of plants with alleles **RR** .....

Flower colour of plants with alleles **Rr** .....

Flower colour of plants with alleles **rr** .....

[1]

(ii) Calculate the percentage of plants in the 'second generation' that have the alleles **Rr**.

Percentage = ... % **[2]**

(iii) What can you conclude about the ratio of red flowered plants to white flowered plants in the 'second generation'?

Ratio of red flowered plants to white flowered plants = ... : ..... **[1]**