

1(a). Hydroponics can be used to try and grow more food.

What is hydroponics?

Tick (✓) **one** box.

- Growing crops with fertiliser

☐
- Growing crops with pesticides

☐
- Growing crops with their roots in water

☐
- Growing crops without water

☐

[1]

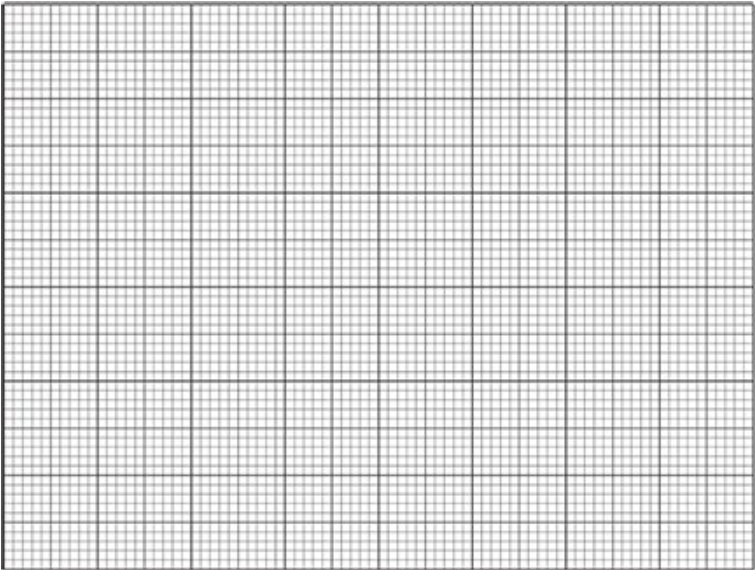
(b). In some countries people do not have food security.

This means they do not have enough food to eat.

The table shows the percentage of people that do not get enough food in four different countries.

Country	Percentage of people who do not get enough food (%)
Haiti	48
Pakistan	12
Sri Lanka	8
USA	3

Draw a bar chart to show the percentage of people that do **not** get enough food in each of the countries in the table.



[3]

(c). The table shows some information about food security in Haiti and USA.

	Total population (million)	Percentage of people who do not get enough food (%)	Number of people who do not get enough food (million)
Haiti	11.5	48	5.5
USA	331.9	3	10.0

Write about food security.

In your answer:

- explain biological reasons for why people may be short of food,
- compare the information in the table about food security in Haiti and USA.

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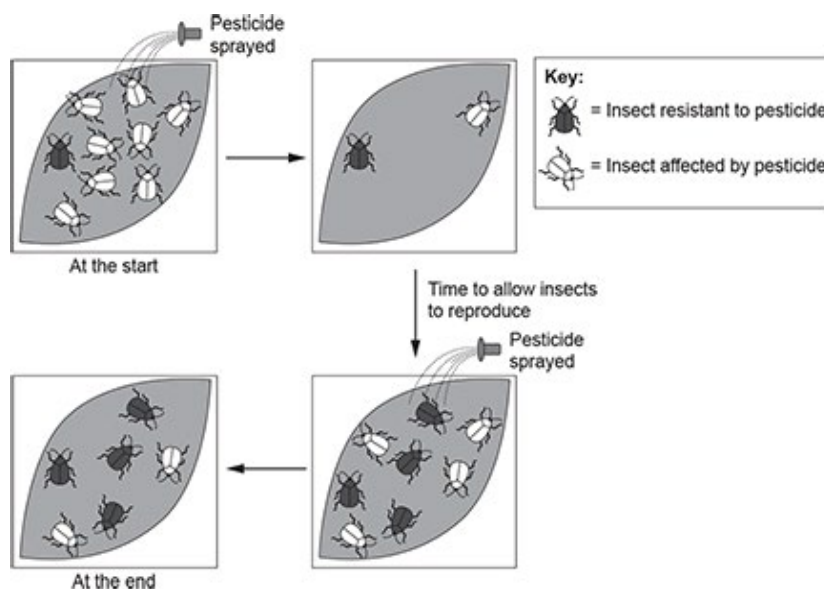
2. A scientist investigates the effects of pesticide on a population of insects.

At the start, the population contained:

- one insect resistant to the pesticide,
- eight insects affected by the pesticide.

They sprayed the insecticide twice, with a time gap between the sprayings.

The diagram shows their results.



Explain why the results of this investigation are important for farmers.

[2]

3. Modern dairy cows are produced by selective breeding.

This involves only some of the female cows breeding with male bulls.

What decides which cows breed during selective breeding?

- A** The bull chooses which cow to mate with.
- B** The cows best suited to the environment will breed.
- C** The farmers choose which cows breed.
- D** Which cows breed is a random process.

Your answer

☐

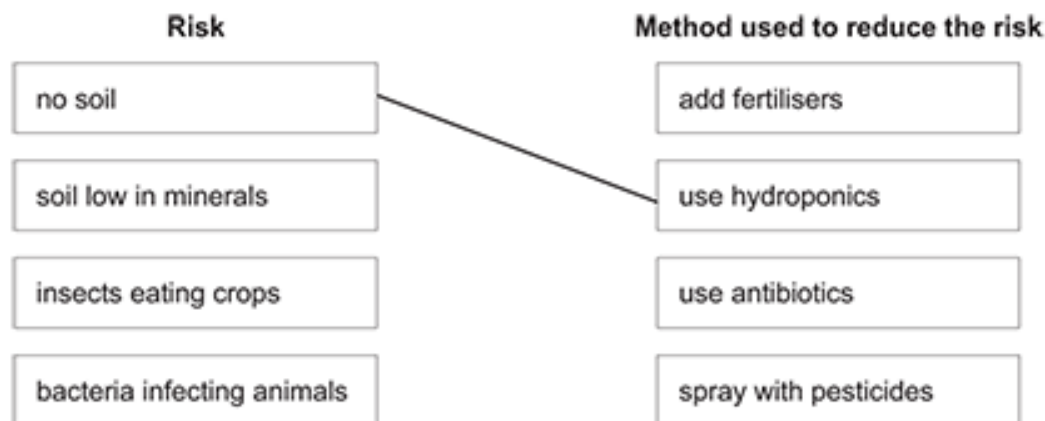
[1]

4(a). The demand for food in the world is growing but there are risks to the supply of food.

There are methods that can be used to reduce these risks.

Draw lines to connect each **risk** with the correct **method used to reduce the risk**.

One line has been drawn for you.

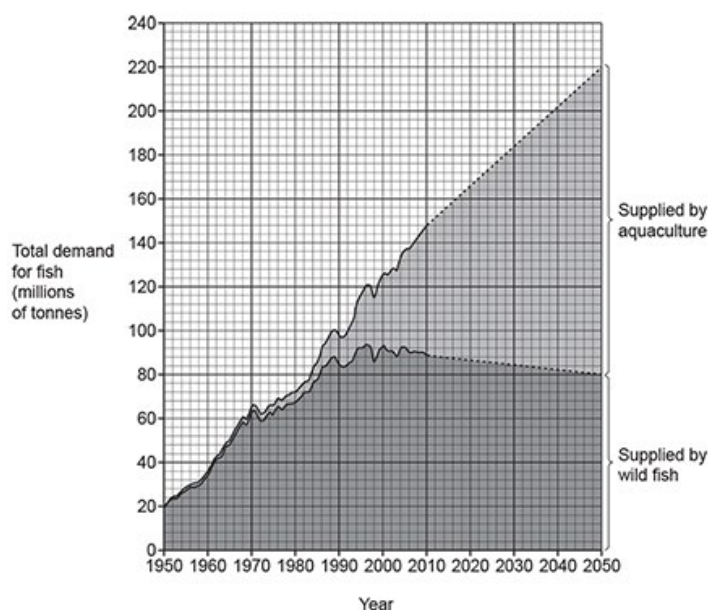


[2]

(b). Many people in the world eat fish as their main source of protein.

Wild fish: caught from the sea
Aquaculture: fish grown in large tanks in lakes or the sea

The graph shows how the total demand for fish has changed since 1950 and how it is expected to change up to 2050. It also shows how the total demand is met by the supply of wild fish and fish from aquaculture.



Use the graph to complete each sentence about the demand for fish.

Put a **ring** around each correct number.

- i. The total demand for fish is expected to increase from 20 million tonnes in 1950 to **80 / 140 / 220** million tonnes in 2050.

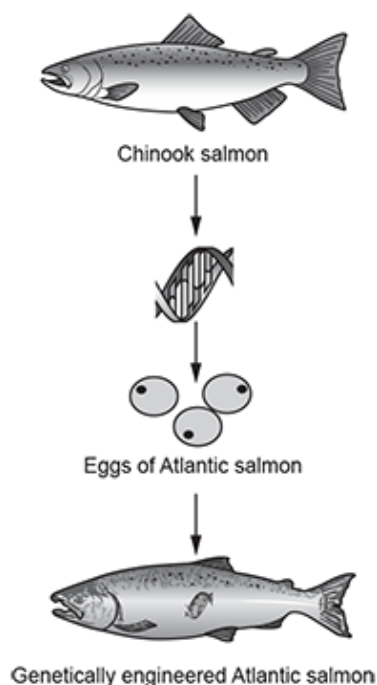
[1]

- ii. In 2050, the percentage of all fish supplied by wild fish is expected to be about **36% / 57% / 64%**.

[1]

(c). Scientists are using genetic engineering to increase the mass of Atlantic salmon produced by aquaculture. In aquaculture, fish are grown in large tanks in lakes or sea. Chinook salmon are fish that grow fast.

The diagram shows how scientists are producing genetically engineered Atlantic salmon.



Genetically engineered Atlantic salmon

- i. Describe how scientists can increase the mass of Atlantic salmon using genetic engineering.

[3]

- ii. In 2020 some salmon escaped into the sea from a tank used in aquaculture.

Suggest why this problem makes some people concerned about producing genetically engineered salmon.

[2]

5(a). Sorghum is a crop plant grown in Africa for its seeds as shown in **Fig. 16.1**.



Fig. 16.1

Sorghum produces a bitter chemical in its seeds.
This makes the seeds less likely to be eaten by birds.

Complete each sentence about how the bitter chemical was first made by sorghum.
Use the words from the list.

gene	meiosis	mutation	pathogen	sugar
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The bitter chemical was first made due to a change in a

This type of change is called a

[2]

(b). Farmers have developed varieties of sorghum with lower levels of the bitter chemical.

To do this they:

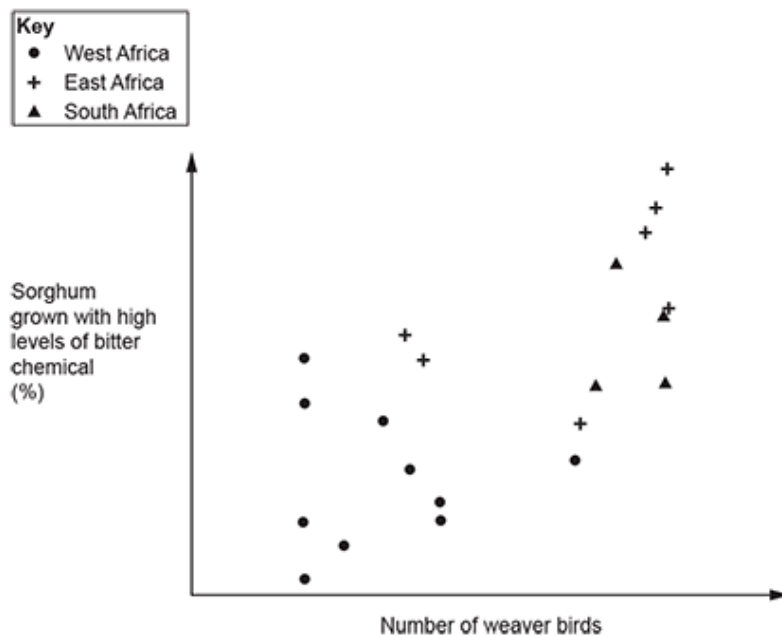
- chose two plants with less bitter chemical than other plants
- bred these plants together
- repeated the same steps with the offspring.

What is the name of this process?

[1]

(c). Scientists recorded the percentage of sorghum grown with high levels of bitter chemical in different areas of Africa. They also recorded the number of weaver birds living in the same areas.

The graph shows the data they collected.



In some areas, there are low numbers of weaver birds.

- i. Which area of Africa, west, east or south, has the least number of weaver birds that eat sorghum?

[1]

- ii. Complete the sentence about the graph.

Put a ring around the correct option.

In the areas with low numbers of weaver birds, farmers choose to grow

a lower / a higher / the same percentage of sorghum with high levels of bitter chemicals.

[1]

- iii. Give a reason why the farmers make this choice.

[1]

6. The table shows the mean mass of four types of rodent and the mean number of years they live.

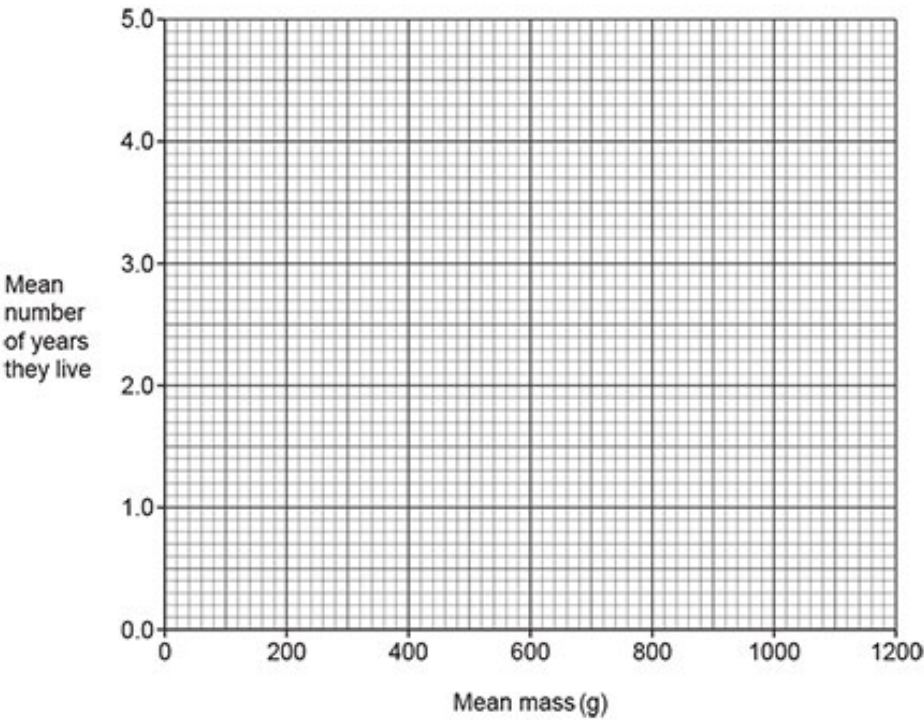
Type of rodent	Mean mass (g)	Mean number of years they live
Gerbil	40	1.5
Guinea pig	1000	4.0
Rat	200	2.0
Squirrel	600	3.0

i. Plot the data from the table on the graph.

[2]

ii. Draw a line of best fit through the points.

[1]



iii. Mole rats are rodents that have a mean mass of 60 g.

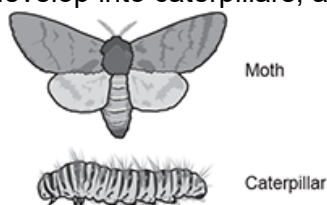
Use your graph to predict the mean number of years that mole rats live.

Mean number = years [1]

[2]

[6]

8. Pine processionary moths lay eggs that develop into caterpillars, as shown in the diagram.



The caterpillars eat pine trees. Scientists use a fungus to kill the caterpillars to protect the pine trees. The fungus is sprayed as spores which develop into the fungus.

Table 20.1 shows three treatments the scientists try.

Table 20.1

	Site of spraying	Concentration of fungal spores used (million spores / ml)	How long the treatment lasts
Treatment 1	on the tops of the pine trees	100	a few months
Treatment 2	on the soil around the pine trees	100000	many years
Treatment 3	control (spraying with water)	0	

- i. Why is the use of the fungal spores an example of biological control?

[1]

- ii. How many times **more concentrated** are the spores in the spray used on the soil compared to the spray used on the tops of the pine trees?

Answer[1]

- iii. Table 20.2 shows the results of the scientists' spraying in one year.

Table 20.2

Site of spraying	Caterpillars killed (%)
on the tops of the pine trees	86.9
on soil	80.0
control (spraying with water)	3.7

The scientists made this statement:

The fungal spores are an effective way to kill the caterpillars.
The fungal spores should be sprayed on the soil not in the trees.

Discuss why the scientists are correct.
Use data from **Table 20.1** and **Table 20.2**.

[3]

9(a). Some other farmers are concerned about growing GM wheat. They think that some people may not buy it.
Suggest **two** reasons why some people may **not** want to buy GM wheat.

1

2

[2]

(b). Some farmers in Ireland want to start growing genetically modified (GM) wheat.
Growing GM wheat would mean that they need to spray less pesticides on their fields.

The table shows an estimate of the costs of growing non-GM wheat compared to GM wheat.

Type of expense	Cost to farmer in euros per hectare (10 000 metres squared)	
	Non-GM wheat	GM wheat
seeds	63	72
government charge	0	25
pesticide costs	165	113

Use data from the table to suggest why the farmers want to start growing GM crops.

[2]

(c). When wheat has been genetically modified,

which type of chemical is inserted into the wheat cells to genetically modify them?

Put a  around the correct answer.

DNA**fertiliser****hormone****pesticide**

[1]

10. The table gives some information about four types of strawberry.

Type	Month when strawberries are ripe	Yield
Calypso	September	medium
Cambridge Vigour	June	very high
Elvira	May	high
Pegasus	July	high

A farmer wants strawberry plants which produce very high yields of ripe strawberries as early as possible in the year.

Which two types of strawberry would a farmer use to produce these plants by selective breeding?

- A** Calypso and Cambridge Vigour
- B** Cambridge Vigour and Elvira
- C** Elvira and Pegasus
- D** Pegasus and Calypso

Your answer ☐

[1]

END OF QUESTION PAPER