Questions are for both separate science and combined science students unless indicated in the question

Q1.

Gardeners can grow plants from:

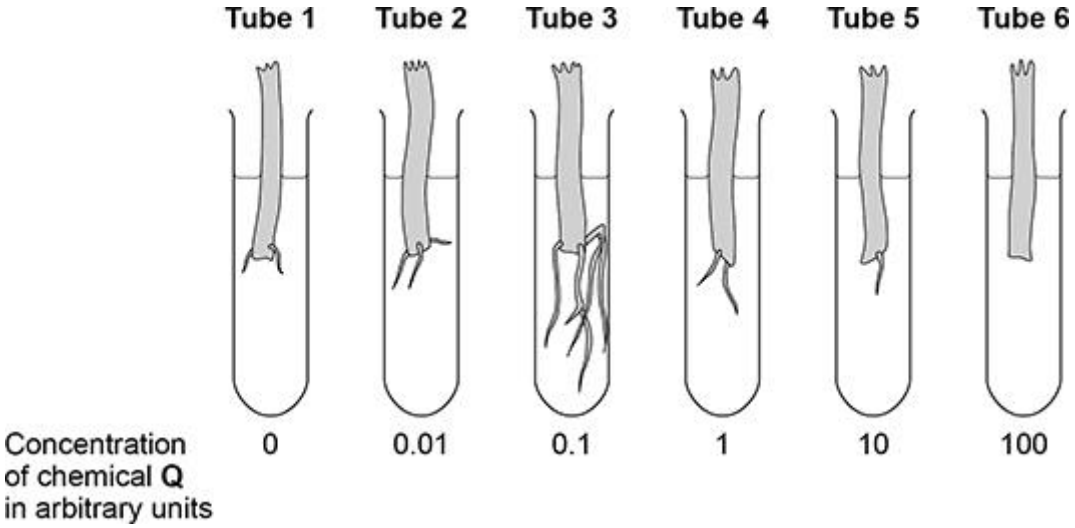
- seeds
- cuttings taken from adult plants.

A gardener investigated the growth of roots on cuttings from a geranium plant.

This is the method used.

1. Take 6 cuttings from the stems of the same plant.
2. Prepare 6 test tubes, each containing a different concentration of a solution of chemical **Q**.
3. Place 1 cutting in each test tube with the cut end of each stem in the solution.
4. Leave the test tubes at room temperature for 10 days.

The figure below shows the results.



(a) Tube **1** contains no chemical **Q**.

Tube **1** is a control.

Why did the gardener include tube **1** in the investigation? **(biology only)**

_____

_____

(1)

(b) How many times more concentrated is chemical **Q** in tube **6** than in tube **2**? **(biology only)**

_____

_____

Number of times more concentrated = _____

(2)

(c) What was the best concentration of chemical **Q** for stimulating root growth? **(biology only)**

Tick (✓) **one** box.

0.01 arbitrary units	☐
0.1 arbitrary units	☐
1 arbitrary unit	☐
10 arbitrary units	☐

(1)

(d) Give evidence from the figure above that a high concentration of chemical **Q** may be toxic to geranium plants. **(biology only)**

_____

_____

(1)

(e) The gardener has four types of geranium plant: **A**, **B**, **C** and **D**.

Plant **A** produces larger, more brightly-coloured flowers than any of the other plants.

The gardener wants to grow more plants of type **A**.

Explain why the gardener chooses to take cuttings from plant **A** instead of growing seeds from plant **A**. **(biology only)**

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(4)

(Total 9 marks)

Q2.

Evolution of new species occurs by mutation and natural selection.

(a) What is a mutation?

_____

_____

(1)

(b) Describe the process of natural selection.

_____

_____

_____

_____

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_____

(3)

(c) Which scientists suggested the theory of evolution by natural selection?
(biology only)

Tick (✓) **one** box.

Alexander Fleming and Carl Woese ☐

Alfred Wallace and Alexander Fleming ☐

Alfred Wallace and Charles Darwin ☐

Charles Darwin and Carl Woese ☐

(1)

(d) The hoverfly and the wasp are insects with bright yellow and black markings.

The figure below shows a hoverfly and a wasp.

Hoverfly

Wasp

The wasp has a sting to defend itself against predators.

The hoverfly does **not** have a sting.

Hoverflies and wasps live in the same habitat.

Explain how having yellow and black markings helps the **hoverfly** survive.

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_____

(3)

(Total 8 marks)

Q3.

Reproduction can produce offspring which are:

- genetically different

  or

- genetically identical.

Farmers grow tomato plants in greenhouses.

The tomatoes are sold in supermarkets.

(a) Suggest **one** advantage of growing tomato plants that are genetically different. **(biology only)**

_____

_____

(1)

(b) Suggest **one** advantage of growing tomato plants that are genetically identical. **(biology only)**

_____

_____

(1)

(c) Scientists can grow genetically identical tomato plants using tissue culture.

What is tissue culture? **(biology only)**

_____

_____

(1)

(d) Genetically identical tomato plants growing in the same garden do **not** all grow to the same height.

Give **one** reason why.

_____

_____

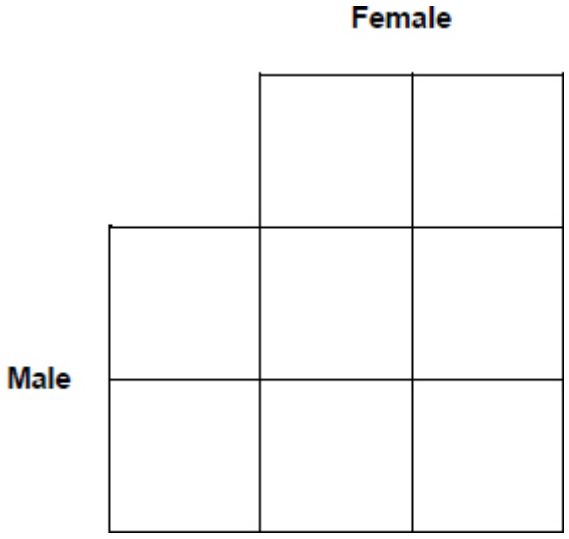
(1)

The sex of dogs is determined by **X** and **Y** chromosomes in the same way as in humans.

(e) Complete the Punnett square diagram in **Figure 1** to show the inheritance of sex in dogs.

Use the symbols **X** and **Y**.

Figure 1



(3)

(f) A female dog gave birth to six offspring.

Why would you expect there to be three male offspring and three female offspring?

Use your answer to part (e).

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_____

(1)

Farmers keep chickens for:

- meat production
- egg production.

Some varieties of chicken grow more quickly and are more suitable for meat production.

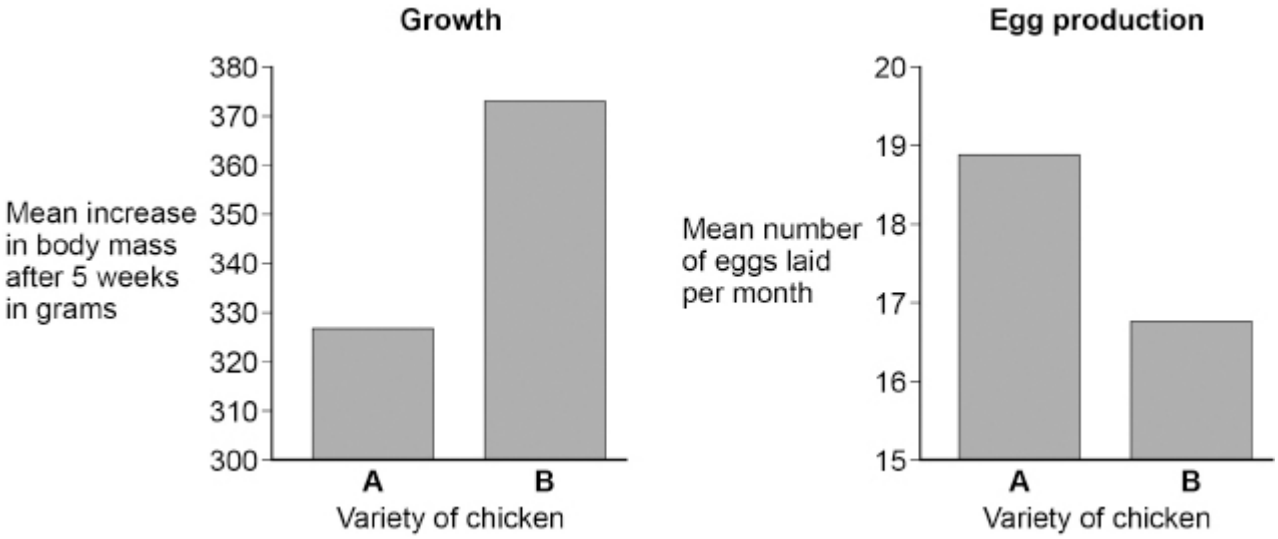
Other varieties of chicken produce more eggs.

A farmer keeps two varieties of chicken, **A** and **B**.

The farmer investigated the growth rates and egg-production rates of both varieties.

Figure 2 shows the results.

Figure 2



(g) Suggest **two** control variables the farmer should have used in this investigation.

1 _____

_____

2 _____

_____

(2)

(h) **Figure 2** shows mean values from 500 chickens of each variety.

Give the reason the farmer used a large number of chickens.

_____

_____

(1)

(i) The farmer wants to produce a new variety of chicken that is good for **both** meat production **and** egg production.

Describe how selective breeding of chicken varieties **A** and **B** can produce the new variety of chicken.

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(4)

(Total 15 marks)