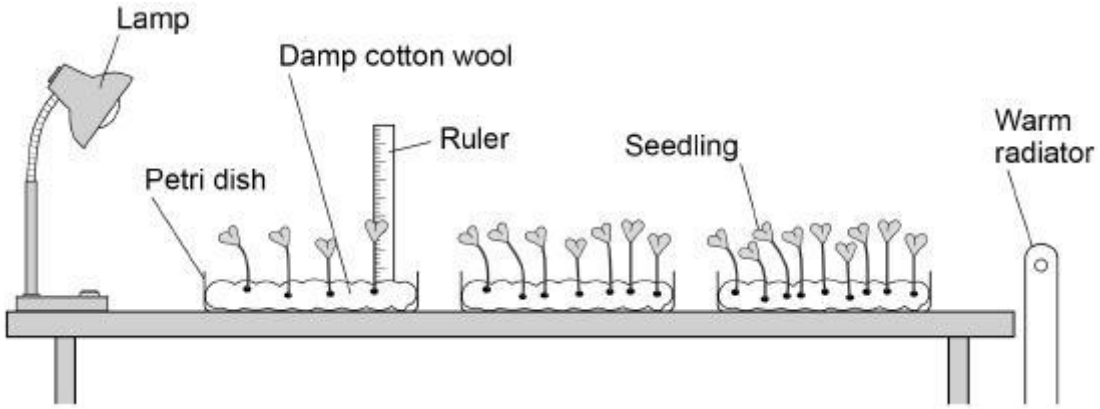
All questions are for separate science students only

Q1.

A student investigated the effect of light intensity on the growth of seedlings.

Figure 1 shows the equipment.

Figure 1



(a) Which **two** improvements should the student make to the investigation?

Tick (✓) **two** boxes.

- Give more water to the seedlings nearest the lamp ☐
- Leave some of the seedlings for a few more days ☐
- Open a window to let more air in ☐
- Put all the dishes the same distance from the radiator ☐
- Use equal numbers of seedlings in each dish ☐

(2)

(b) What is the dependent variable in the investigation?

Tick (✓) **one** box.

- The height of the seedlings ☐
- The mass of cotton wool ☐
- The temperature of the room ☐

(1)

(c) In each dish the seedlings compete with each other.

Give **two** factors the seedlings compete for.

1 _____

_____

2 _____

_____

(2)

Figure 2 shows a seedling growing towards a lamp.

Figure 2

(d) What happened to the growth of the seedling on side **P** compared with the growth on side **Q**?

Tick (✓) **one** box.

Side **P** has grown less than side **Q** ☐

Side **P** has grown more than side **Q** ☐

Side **P** has grown the same as side **Q** ☐

(1)

(e) Plant responses are called tropisms.

Which tropism causes the seedling to grow towards light?

Tick (✓) **one** box.

Geotropism ☐

Gravitropism ☐

Phototropism ☐

(1)

(f) Which hormone causes the seedling to grow towards the light?

Tick (✓) **one** box.

Auxin ☐

Insulin ☐

Testosterone ☐

(1)

(Total 8 marks)

Q2.

This question is about plant hormones.

(a) Farmers can spray seeds with gibberellins to start germination.

What are **two** other uses of gibberellins?

Tick (✓) **two** boxes.

To help in tissue culture ☐

To help roots form ☐

To increase fruit size ☐

To kill weeds ☐

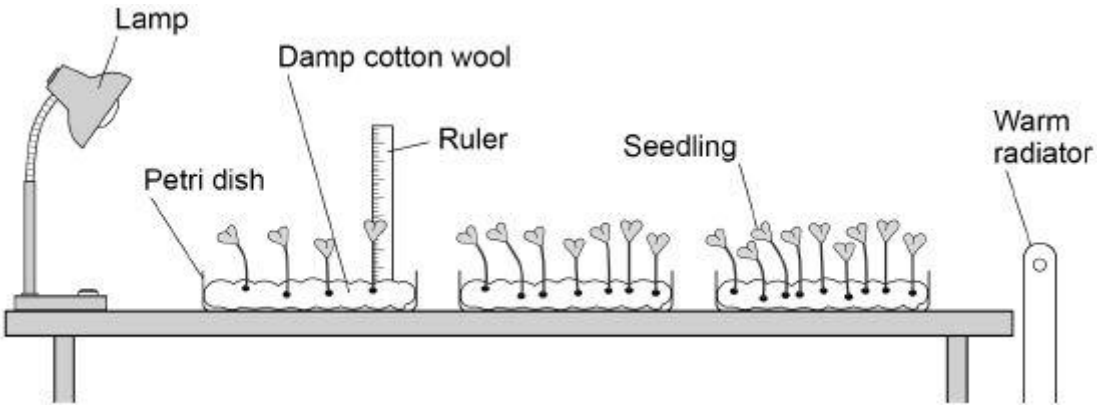
To promote flower production ☐

(2)

Students investigated the effect of light intensity on the height of seedlings.

Figure 1 shows the equipment.

Figure 1



(b) Describe **two** improvements the students should make to their investigation.

1 _____

_____

2 _____

_____

(2)

Figure 2 shows a seedling growing towards a lamp.

Figure 2

(c) Suggest how the students measured the length of the curved seedling in **Figure 2**.

_____

_____

(1)

(d) Explain what happened to the growth of the seedling on side **Q** compared with the growth on side **P**.

_____

_____

_____

_____

_____

_____

(3)

(e) Bananas are often stored separately from other fruits because bananas release a plant hormone.

Why does storing bananas with other fruits cause the other fruits to ripen faster?

_____

_____

(1)

(Total 9 marks)

Q3.

Phototropism is a growth response by part of a plant to light.

(a) Name **one** other tropism.

Give the stimulus the plant responds to in the tropism you have named.

Tropism

_____

Stimulus

_____

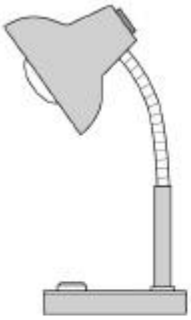
(2)

(b) Plan an investigation to show the effect of light from one direction on the growth of plant seedlings.

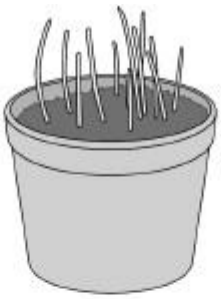
Include details of any controls needed.

You may use some of the equipment shown in **Figure 1** and any other laboratory apparatus.

Figure 1

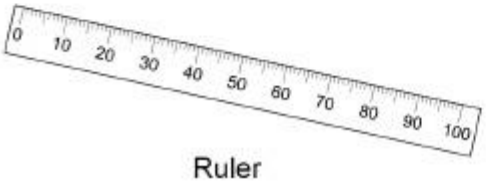


Lamp

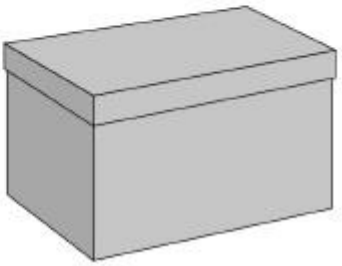


Several pots of seedlings

Scissors



Ruler



Cardboard boxes with lids

(6)

(c) Explain how phototropism in a plant shoot helps the plant to survive.

_____

_____

(3)

(Total 11 marks)

Q4.

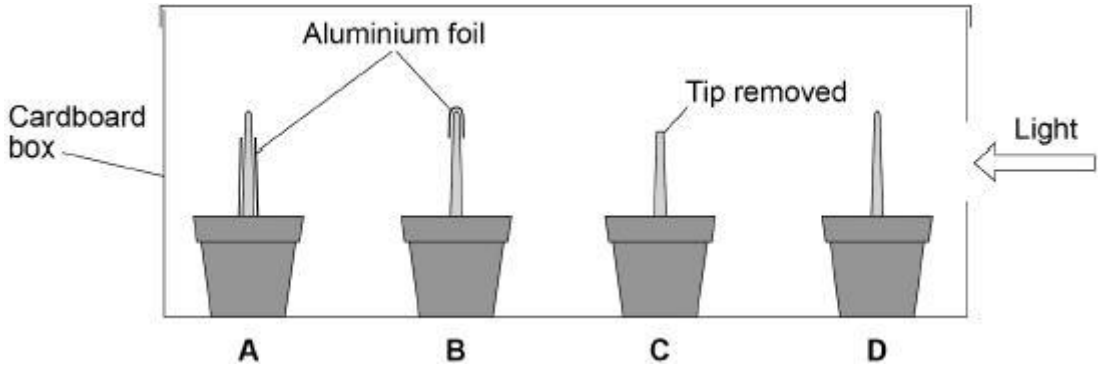
Some students investigated phototropism in plant seedlings.

This is the method used.

1. Measure the lengths of the shoots of 20 seedlings.
2. Set up four groups of seedlings as follows:
   - **A** − bottom of shoot covered in aluminium foil
   - **B** − tip covered in aluminium foil
   - **C** − tip removed
   - **D** − no changes.
3. Put the seedlings in a cardboard box.
4. Use a lamp to shine a light into the box through a hole in one side.
5. After one day, re-measure the lengths of the shoots.
6. Make a drawing of the appearance of one seedling from each group.

Figure 1 shows the appearance of one seedling in each group at the start of the investigation.

Figure 1



(a) Which **two** conditions should the students have kept constant for each group of seedlings?

Tick **two** boxes.

The length of the roots ☐

The number of seedlings in each group ☐

The temperature ☐

The thickness of the aluminium foil ☐

The volume of water added to the soil ☐

(2)

(b) What is the purpose of the aluminium foil?

Tick **one** box.

To hold the shoot straight ☐

To keep the shoot warm ☐

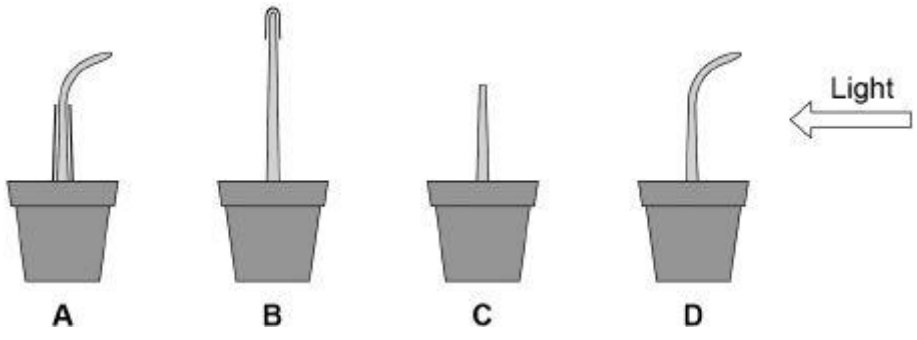
To remove the effect of gravity ☐

To stop light reaching the shoot ☐

(1)

Figure 2 shows the students' results.

Figure 2



	A	B	C	D
Mean length of shoot at start in mm	23	24	21	25
Mean length of shoot after 1 day in mm	28	30	23	30
Mean change in length of shoot in mm	5	6	2	5

(c) Suggest how the students measured the lengths of the curved shoots of seedlings **A** and **D** at the end of the investigation.

_____

_____

_____

_____

(2)

(d) The students concluded that the **tip** of the shoot is needed for the plant to respond to light.

Give evidence for this conclusion from **Figure 2**.

_____

_____

_____

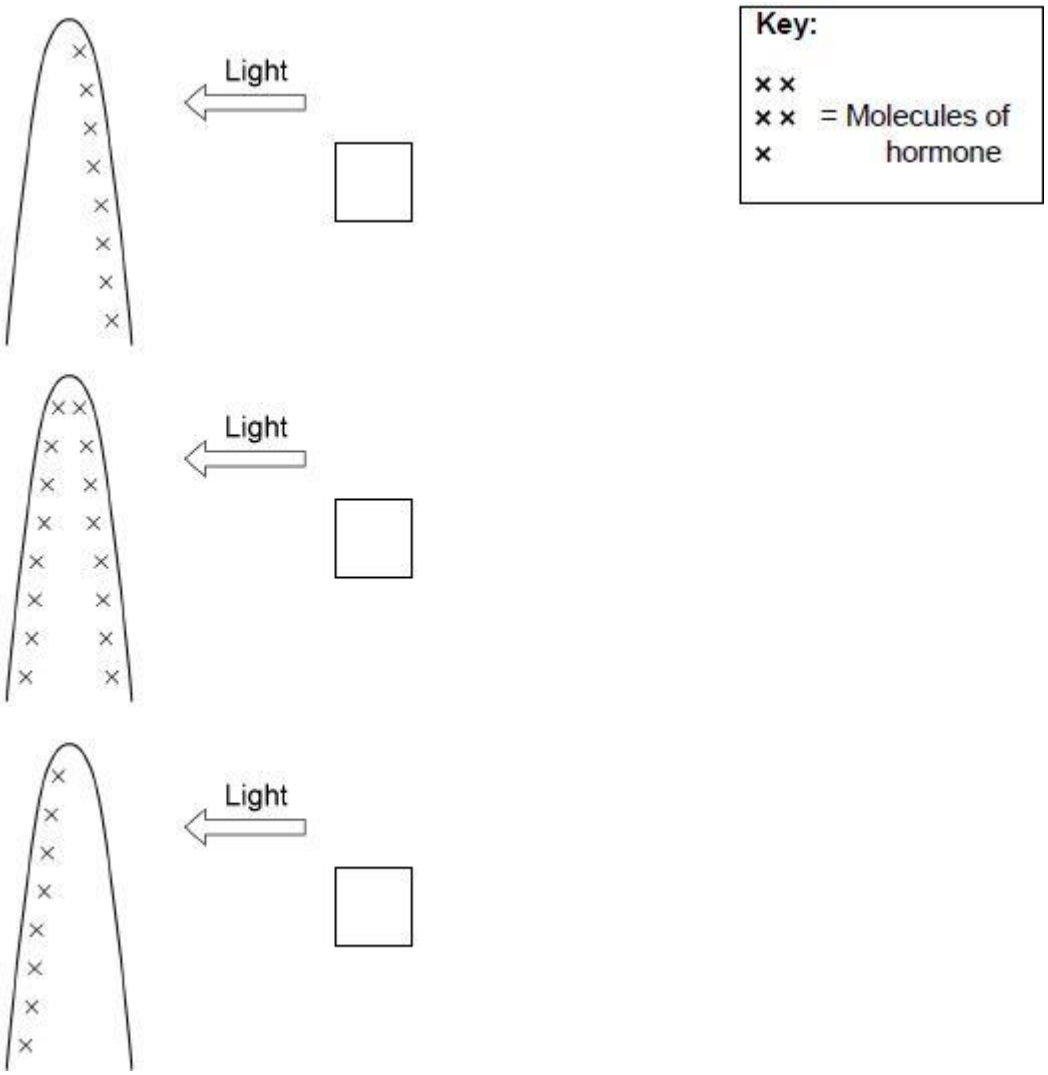
_____

(2)

(e) A hormone stimulates growth in shoots.

Which distribution of the hormone would cause the results seen in shoot **D**?

Tick **one** box.



(1)

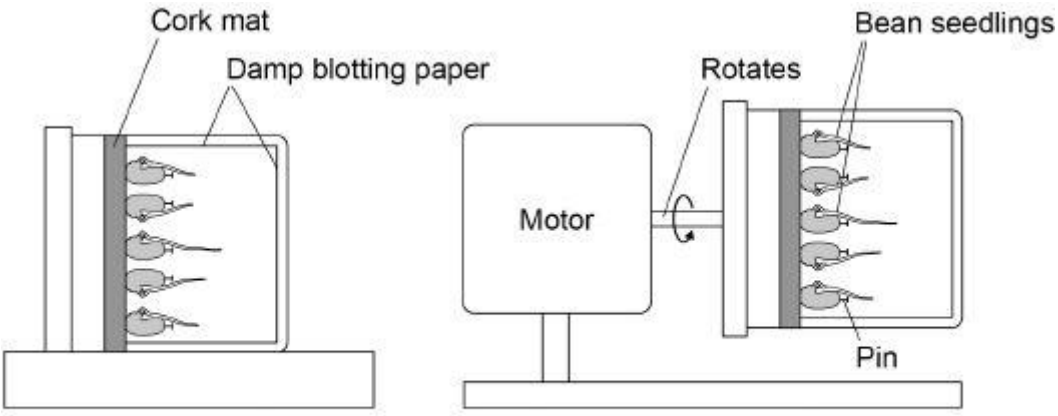
(Total 8 marks)

Q5.

Some students investigated geotropism in the roots of bean seedlings.

Figure 1 shows the apparatus used.

Figure 1



This is the method used.

1. Measure the length of the root of each of 10 bean seedlings.
2. Pin 5 seedlings to the cork mat in apparatus **A**.
3. Pin 5 seedlings to the cork mat in apparatus **B**.
4. Leave **A** and **B** in a dark cupboard for 2 days.
5. After the 2 days:
   - make a drawing to show the appearance of each seedling
   - measure the length of the root of each seedling.

(a) Why did the students surround the seedlings with damp blotting paper?

Tick **one** box.

To prevent light affecting the direction of root growth	☐
To prevent photosynthesis taking place in the roots	☐
To prevent the growth of mould on the roots	☐
To prevent water affecting the direction of root growth	☐

(1)

Apparatus **B** is a control.

Apparatus **B** rotates slowly.

(b) How does apparatus **B** act as a control?

_____

_____

(1)

The table below shows the students' results.

	Apparatus A					**Apparatus B**				
Seedling number	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Length at start in mm	35	41	32	33	39	30	33	29	28	31
Length after 2 days in mm	49	57	43	45	54	45	45	44	29	44
Length change in mm	14	16	11	12	15	15	12	15	1	13
Mean length change in mm	14					11				

(c) One student stated:

'The mean length change for the seedlings in apparatus **B** is **not** valid.'

Suggest the reason for the student's statement.

_____

_____

(1)

(d) Suggest **one** improvement the students could make to obtain a more valid mean length change for the seedlings in apparatus **B**.

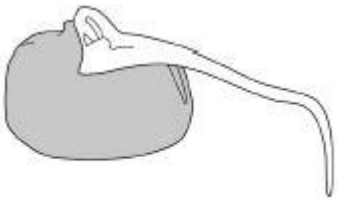
_____

_____

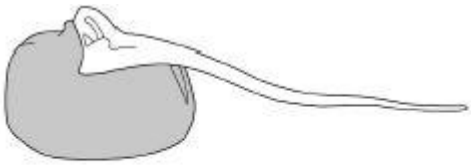
(1)

(e) **Figure 2** shows the students' drawings of two seedlings at the end of the 2 days.

Figure 2



Seedling from Apparatus A



Seedling from Apparatus B

A plant hormone is made in the root tip.

The hormone diffuses from the tip into the tissues of the root.

Explain how the hormone causes the appearance of the seedlings in **Figure 2** to be different.

You should refer to **both** seedlings in your answer.

(3)

(f) In horticulture plant hormones are used for controlling plant growth.

Draw **one** line from each plant hormone to the correct use of that hormone.

Plant hormone	**Use of hormone**
Auxin	To reduce the time taken for tomatoes to ripen
	To slow down the growth of plant stems

Ethene	To promote seed germination
Gibberellin	To stimulate root growth in plan cuttings

(3)

(Total 10 marks)

Q6.

Hormones called auxins control plant growth.

A student investigated plant growth responses in roots.

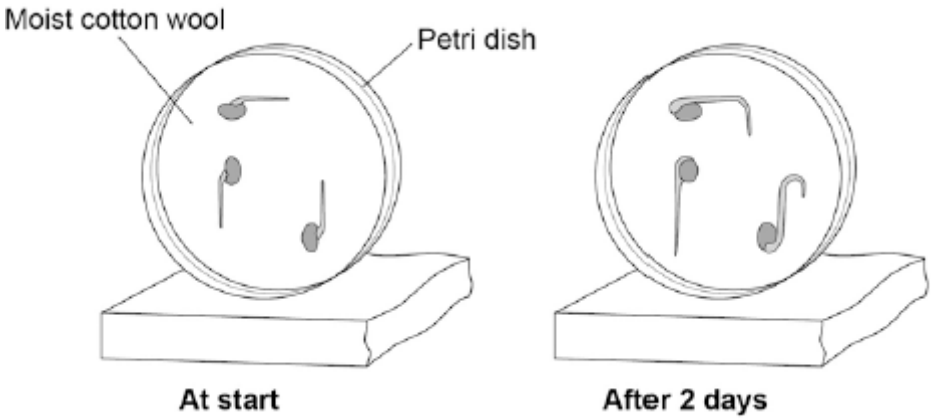
This is the method used.

1. Grow three bean seeds until their roots are 1 cm long.
2. Attach the three bean seeds to moist cotton wool in a Petri dish.

   Each bean seed root should point in a different direction.
3. Fix the Petri dish vertically for 2 days in the dark.

Figure 1 shows the results.

Figure 1



(a) Describe the direction of growth of the bean **roots** after 2 days.

Give **one** reason for this growth response.

Direction of root growth _____

Reason _____

_____

(2)

(b) The student then noticed the shoots growing from the seeds.

He then:

1. put a light above the Petri dish but did not move the seeds
2. allowed the seeds to grow for 2 **more** days.

Predict the direction of growth of the bean **shoots** after 2 days.

Give **one** reason for your prediction.

Direction of root growth _____

Reason _____

(2)

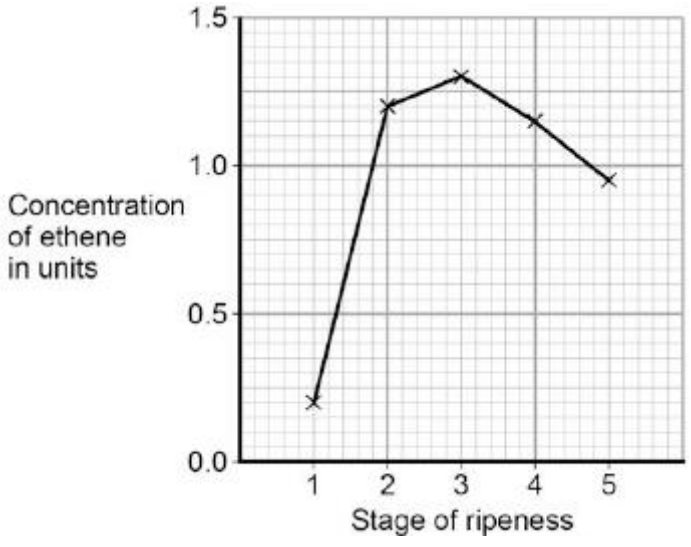
(c) Ethene is a plant hormone.

Ethene causes fruit to ripen.

Scientists measured the concentration of ethene found in fruit at different stages of ripeness.

Figure 2 shows the results.

Figure 2



At which stage of ripeness is there most ethene?

Tick **one** box.

Stage **1** ☐

Stage **2** ☐

Stage **3** ☐

Stage **4** ☐

Stage **5** ☐

(1)

(d) Suggest how the scientists can find out if the result for Stage **1** was an anomaly.

_____

_____

(1)

(e) Gibberellins are a different type of plant hormone.

Farmers growing cotton plants in cold climates sometimes soak their seeds in a solution of gibberellins before planting the seeds.

Suggest an advantage of soaking seeds in a gibberellin solution in cold climates.

_____

_____

(1)

(Total 7 marks)