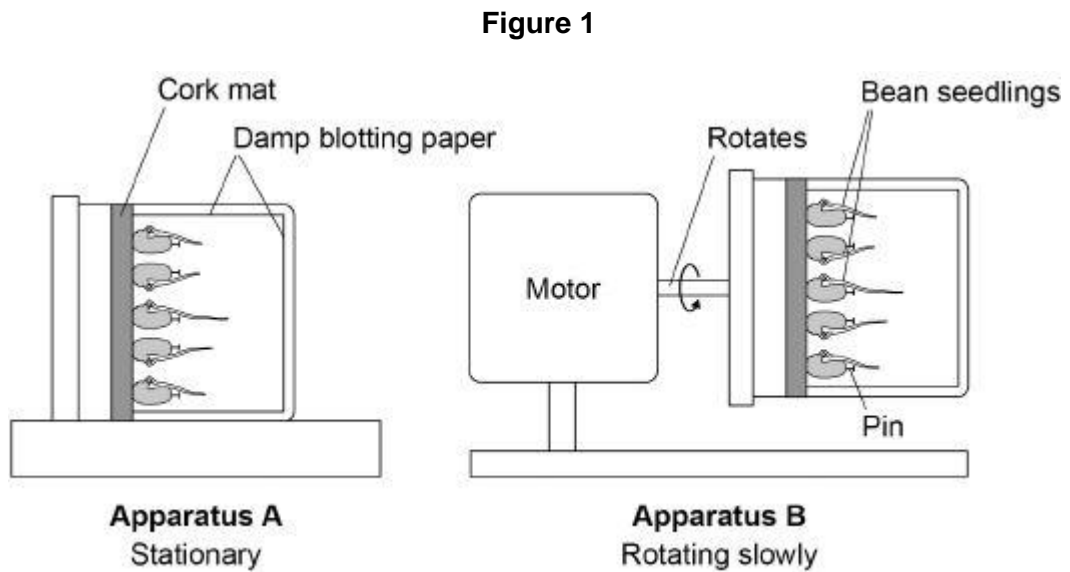


Q1.

Some students investigated geotropism in the roots of bean seedlings.

Figure 1 shows the apparatus used.



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**.

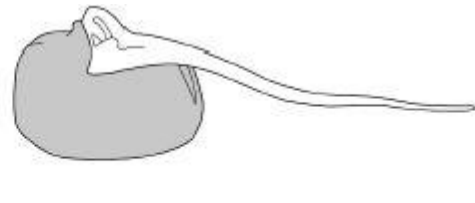
(1)

(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

Auxin

Ethene

Use of hormone

To reduce the time taken for tomatoes to ripen

To slow down the growth of plant stems

To promote seed

Gibberellin

germination

To stimulate root growth in plant cuttings

(3)
(Total 10 marks)

Q2.

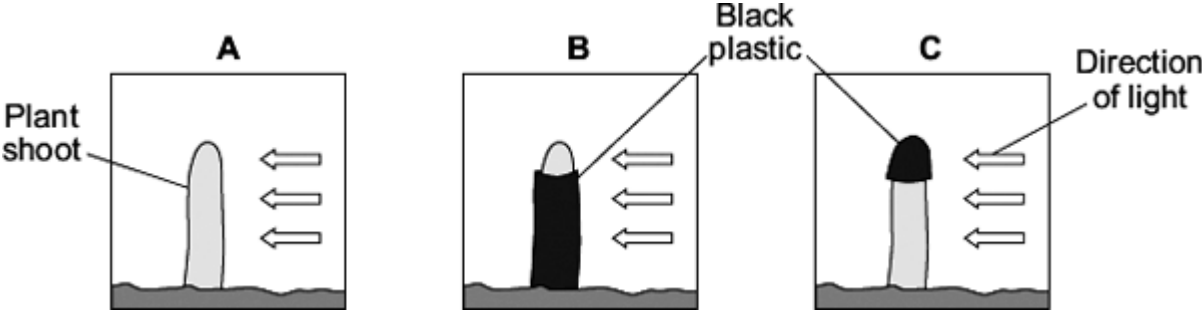
Charles Darwin investigated tropisms in plants.

Some students did an investigation similar to Darwin's investigation.

The students:

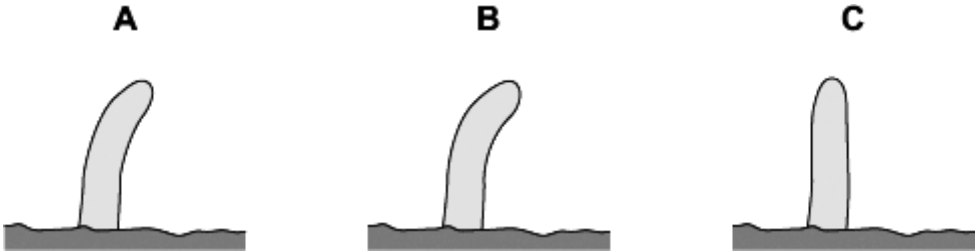
- grew seeds until short shoots had grown
- used black plastic to cover parts of some of the shoots
- put the shoots in light coming from one direction
- put boxes over the shoots to keep out other light.

The diagrams show how the investigation was set up.



Two days later the students took off the black plastic covers and looked at the shoots.

The diagrams show the results.



(a) Give **two** variables that the students should control in this investigation.

(2)

(b) Shoot **A** bent towards the light as it grew.

Explain how.

(4)

(c) What conclusions can be drawn from the results about:

(i) the detection of the light stimulus

(1)

(ii) where in the shoot the response to the light takes place.

(1)

(Total 8 marks)

Mark schemes

Q1.

(a) to prevent water affecting the direction of root growth 1

(b) gravity acts evenly on all sides
allow cancel out the effect of gravity
*do **not** accept there is no gravity* 1

(c) (mean) includes the (anomalous) result for seedling 4
allow (mean) includes the (anomalous) result
which only grew 1 mm 1

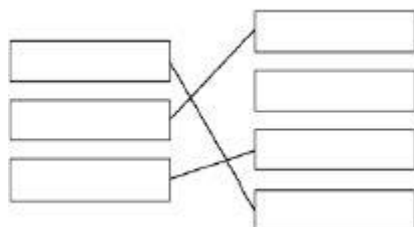
(d) calculate (mean) from just seedlings 1, 2, 3 and 5
or
 repeat the investigation **and** recalculate (a new mean)
allow omit seedling 4 from (mean) calculation 1

(e) uneven distribution of hormone in (root / seedling of) A
allow reference to auxin
allow more hormone at bottom
*do **not** accept more hormone at the top* 1

even distribution of hormone in B
allow B does not have an uneven distribution of
hormone 1

(so) top grows fast(er) (than bottom) in (root / seedling of) A (and equal growth in B)
allow (more) cell elongation or cell division on top
of A
allow converse for lower surface 1

(f)



extra line for a hormone cancels mark for that hormone

1
1
1

[10]

Q2.

(a) any **two** control variables for **1** mark each:

- age / size of shoots
- species **or** type of plant / seeds
- light intensity
accept amount of light / colour of light
- (other) named condition eg temperature / water

2

(b) *ignore reference to phototropism*

ref to auxin / hormone

1

unequal (lateral) distribution

1

more hormone on dark side

1

causes growth on dark side

1

(c) (i) (detection) in tip / top / end

1

(ii) (response) behind tip

allow at tip / end / top half

1

[8]