1. (a) the temperature

1

the volume of water added to the soil

1

(b) to stop light reaching the shoot

1

(c) piece of thread (along shoot and mark length)

allow straighten the shoot

1

transfer to ruler / mm-scale

*allow use of (flexible) tape measure for **2** marks*

1

(d) tip covered / B / removed / C grows straight up **or** does not bend (towards light)

allow tip covered / B / removed / C does not respond (to light)

1

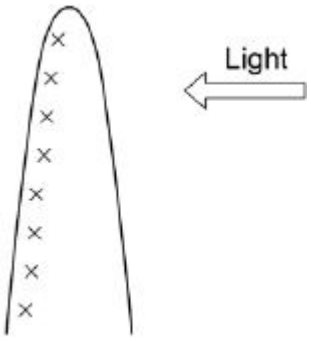
tip exposed / A / not covered / D bends (towards light)

tip exposed / A / not covered / D does respond (to light)

*allow only the ones with exposed tips or only A **and** D bend towards the light for **2** marks*

1

(e)



1

[8]

2. (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

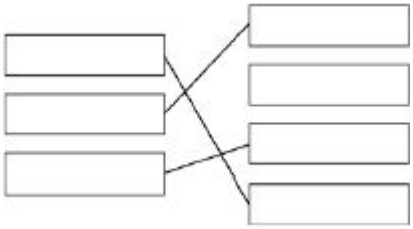
(so) top grows fast(er) (than bottom) in (root / seedling of) A (and equal growth in B)

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]

3. (a) (i) in the direction of the force of gravity

1

(ii) against the force of gravity

1

(b) (i) diagram completed to show stem bending / leaning towards the window

the bend / lean can be at / from any point above pot level

ignore any leaves

1

(ii) more light (for leaves)

ignore heat **1**

more photosynthesis / biomass / glucose

ref to 'more' needed once only, eg 'more light for photosynthesis' = 2 marks

if no other marks given allow 1 mark for 'to get light for photosynthesis'

1

[5]

4. (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]

5. (a) (i) any **one** from:

ignore references to same lawn / weather / soil, which are not given in the question.

- (same) (type of) weed killer
- (same) volume / 5dm ^{3} of solution used (on each area)

allow amount of solution used

*do **not** allow amount / volume / concentration of weed killer*

*do **not** allow number of daisy plants*

- effect on daisies (not other weeds / plants)
- (same) area / 10m ^{2}
- (same) time **or** (effect after) two weeks.

1

(ii) more (daisies) growing after use of weed killer **or** after two weeks

allow it does not fit pattern (of other results)

1

(iii) any **one** from:

ignore to see if it / water has an effect

- as a control

*do **not** allow as a control variable*

- to compare (to the other areas)
- to check other factor(s) are not affecting the results / daisies.

1

(iv) 80 (arbitrary units of weed killer) also killed all the daisies

allow ref to possible experimental design flaws such as 'only tested once' or 'not repeated' or 'different number of daisies in each area at first'

allow idea that other weed species may not respond in the same way as daisies

allow idea that 100 (units) may also kill wanted species / grass

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1−2 marks)
Reference to at least one environmental factor plants respond to
or
at least one response
or
a named hormone

Level 2 (3−4 marks)
Reference to at least one environmental factor plants respond to
and
at least one associated response
or
reference to a named hormone
and
at least one associated response

Level 3 (5−6 marks)
Reference to at least one environmental factor plants respond to
and
at least one associated response
and
reference to a named hormone

Examples of biology points made in the response:

environmental factors

- light

  allow phototropism
- (direction of the force of) gravity

  allow gravi / geotropism
- moisture / water.

  allow hydrotropism

effects on direction of growth

- shoots grow upwards
- shoots grow towards light
- shoots grow against (the force of) gravity
- roots grow downwards
- roots grow towards moisture
- roots grow towards (the force of) gravity.

  allow reference to 'positive' and 'negative' in terms of tropisms as indicating direction of growth

hormone

- reference to auxin

  allow other named hormone(s)
- unequal distribution of hormone causes unequal growth (rates).

  allow higher concentration of hormone causes faster growth in shoots

  allow higher concentration of hormone causes slower growth in roots

6

[10]