Mark schemes

Q1.

(a) put all the dishes the same distance from the radiator

1

use equal numbers of seedlings in each dish

1

(b) the height of the seedlings

1

(c) any **two** from:

- light
- water
- mineral(s) / ions / salts

allow nitrate / magnesium / nitrogen / nutrients

allow space
ignore food
ignore carbon dioxide / oxygen
ignore heat

2

(d) side **P** has grown less than side **Q**

1

(e) phototropism

1

(f) auxin

1

[8]

Q2.

(a) to increase fruit size

1

to promote flower production

1

(b) any **two** from:

- keep temperature the same (for all dishes)

*allow move equal distance **or** away from radiator **or** turn off radiator **or** use heat shield between lamp and seedlings*

- use equal numbers of seedlings (in each dish)
- use seedlings of the same (initial) height

allow use seedlings of the same (initial) size

- use more seedlings in each dish
- give all dishes the same volume of water

allow give all dishes the same amount of water

- use seed(ling)s of the same species

  allow use seed(ling)s of the same type

- measure light intensity

  allow measure distance from lamp
  *allow put lamp above each dish and use different light intensity **or** power for each*

  *allow same concentration of mineral ions **or** named example*
  ignore nutrients / food

  *do **not** accept keep the same light intensity*

2

(c) any **one** from:

- use a piece(s) of thread / string **and** measure length of thread (with ruler)

  *allow use a piece of thread **and** (put the thread against) a ruler*

- straighten seedling / shoot **and** measure (with ruler)

  allow straighten seedling against a ruler

- measure with a flexible ruler **or** a tape measure

  *allow use a flexible ruler **or** a tape measure*

1

(d) (side nearest the lamp) receives more light (on side P)

reference to side only needed once

allow side Q receives less light
allow side Q is in the shade
ignore side P is in the light

1

(therefore) unequal distribution of <u>auxin</u>

allow more <u>auxin</u> on side Q

allow (so) more <u>auxin</u> present

on side away from the lamp

*do **not** accept more auxin on light side **or** side P*

1

(auxin causes) more growth on side away from the lamp

allow more growth on side Q
allow (auxin causes) cell elongation on side away from the light

ignore mechanism of auxin action

1

(e) ethene is released from bananas

allow ethylene is released from

bananas

allow the hormone is ethene / ethylene

1

[9]

Q3.

(a) named example of tropism – e.g. geotropism / gravitropism

*allow hydrotropism **or** chemotropism **or** thermotropism*

1

correct corresponding stimulus – e.g. gravity

*allow water **or** chemical **or** 'heat'*

1

(b) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

- several seedlings in each batch **or** one pot of seedlings in each batch
- measure heights of shoots
- leave some in dark with light from one side / direction in box with hole
- control(s) with all-round light **or** rotating on clinostat **or** in dark
- control variable(s) e.g. same temperature / water / soil type
- after suitable time (at least several hours)
- record appearance of seedlings re. light direction
- re-measure heights of shoots
- detail of how bent shoots were measured – e.g. use thread or straighten them out
- calculate mean height increase for each group
- use ruler / protractor to estimate angle of bending

for **level 3** a reference to comparing the growth of plants with light from one direction with plants either in darkness or in full light along with a control variable is required

(c) leaves / plant receive(s) / absorb(s) more light

1

(so) more photosynthesis

1

(so plant) produces more glucose

allow starch / carbohydrate / sugar / organic material / other named organic substance

*if no other mark awarded allow **1** mark for any two of the mark points with no reference to 'more'*

1

[11]

Q4.

(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

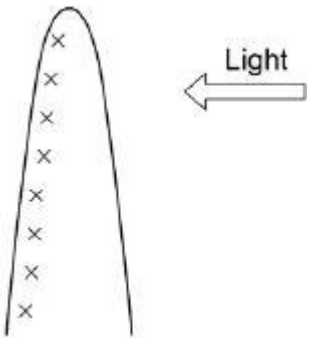
tip exposed / A / not covered / D bends (towards light)

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]

Q5.

(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

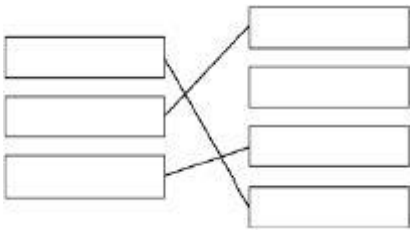
1

(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]

Q6.

(a) grown down

allow longer

1

towards gravity / gravitropism

allow geotropism

1

(b) grow up

1

towards the light

allow phototropism

1

(c) 3

1

(d) repeat the experiment

1

(e) seeds germinate sooner so growing season is longer

1

[7]