



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 auxin
allow more auxin on side Q
allow (so) more auxin 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

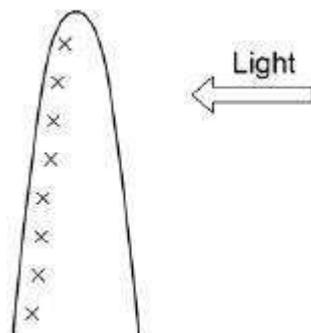
tip exposed / A / not covered / D bends (towards light)

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)

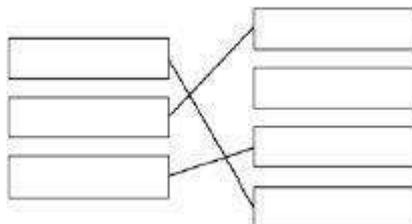
allow (more) cell elongation or cell

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]