



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: <ul style="list-style-type: none"> • light • water • mineral(s) / ions / salts <i>allow nitrate / magnesium / nitrogen / nutrients</i>
<i>allow space</i>
<i>ignore food</i>
<i>ignore carbon dioxide / oxygen</i>
<i>ignore heat</i> | 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: <ul style="list-style-type: none"> • keep temperature the same (for all dishes) <i>allow move equal distance or away from radiator or turn off radiator or use heat shield between lamp and seedlings</i> • use equal numbers of seedlings (in each dish) • use seedlings of the same (initial) height <i>allow use seedlings of the same (initial) size</i> • 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

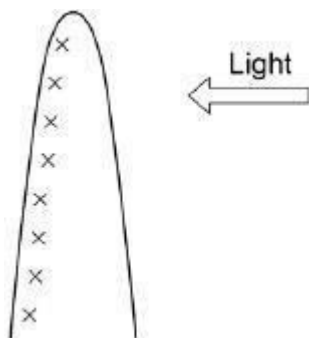
tip exposed / A / not covered / D bends (towards light)

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)

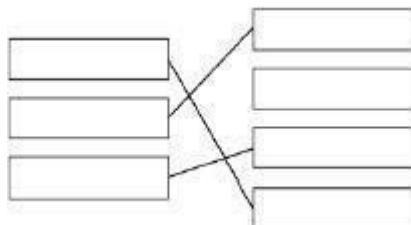
allow (more) cell elongation or cell

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]