

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

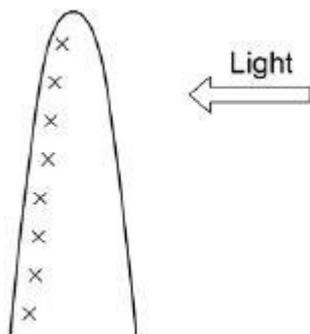
tip exposed / A / not covered / D bends (towards light)

*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*

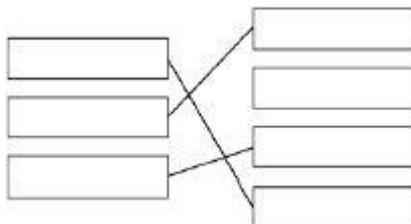
1

(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]