Survival and Response: AQA A Level Biology Exam Questions by Topic

14 questions · 39 marks · about 51 minutes. Answer in the spaces, then check the mark schemes at the end.

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0 3 A student investigated the effects of indoleacetic acid (IAA) on the growth of oat seedlings (young plants).

The student:

- removed the shoot tip from each seedling and cut out a 10 mm length of shoot
- placed 10 lengths of shoot into each of 5 Petri dishes
- added to each Petri dish an identical volume of 5% glucose solution
- added to each Petri dish 40 cm^3 of a different concentration of IAA solution
- left the Petri dishes at 20 °C in the dark with their lids on for 5 days
- removed the shoots after 5 days and measured them
- determined the mean change in length of shoot at each concentration of IAA.

Table 1 shows her results.

Table 1

IAA concentration added to Petri dish / parts per million	10^{-5}	10^{-3}	10^{-1}	1	10
Mean change in length of shoot / mm	0.0	0.1	1.3	2.4	3.1

0 3 . 1 Explain why the student removed the shoot tip from each seedling.

[2 marks]

[Extra space]

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Question 2 · A level Paper 2 · June 2019 · Q03.4 · 3 marks

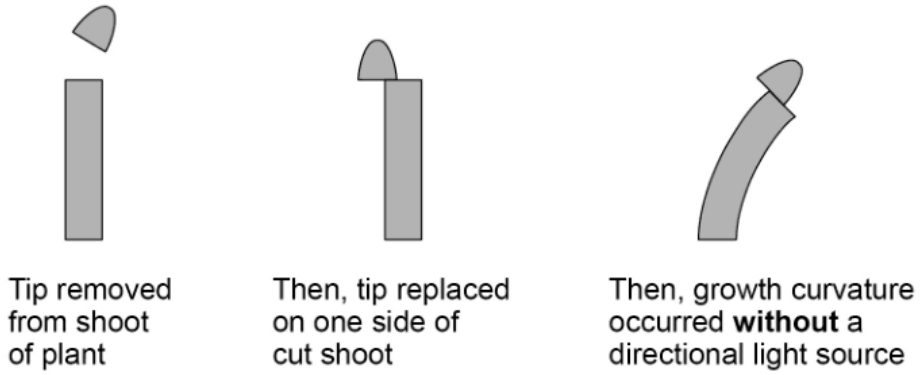
0 3 . 4 Describe and explain the results shown in **Table 1** and suggest how the results might have differed if lengths of **root** had been used.

[3 marks]

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0 3 **Figure 1** shows an investigation into growth factors in plants.

Figure 1



0 3 . 1 Use your knowledge of indoleacetic acid (IAA) to explain the growth curvature shown in **Figure 1**.

[3 marks]

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Question 4 · information from earlier in the question

A bioassay is a method to determine the concentration of a substance by its effect on living tissues.

Figure 2 shows the practical procedure used in a growth curvature bioassay to determine the concentration of IAA in shoot tips.

Figure 2

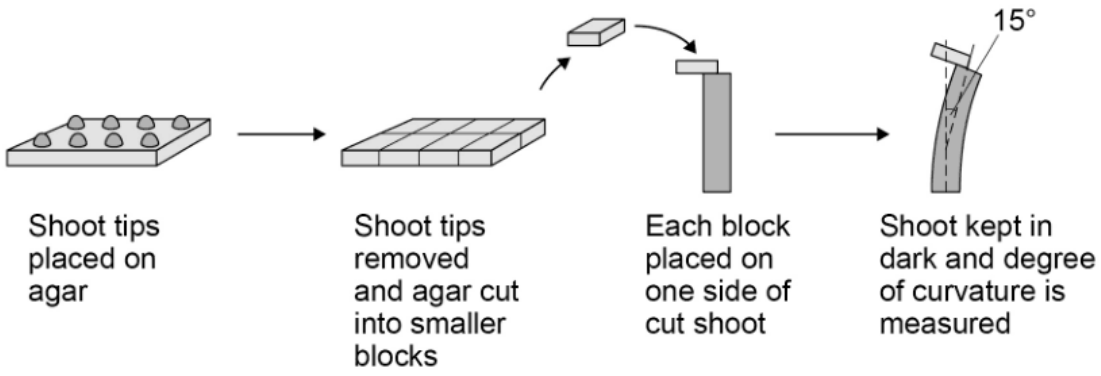
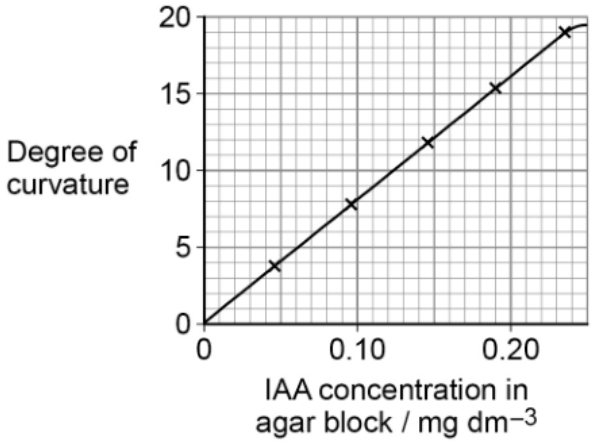


Figure 3 shows the calibration curve for this growth curvature bioassay.

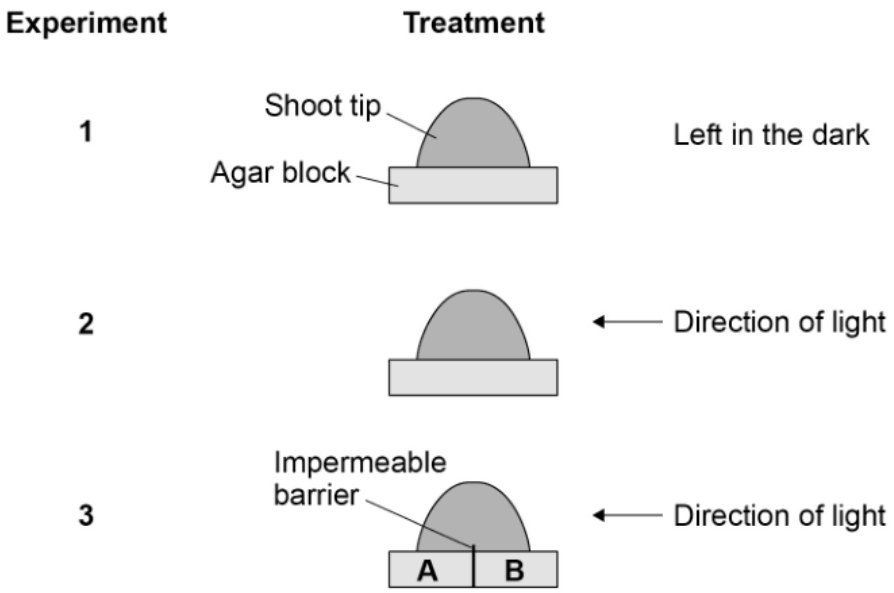
Figure 3



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A scientist investigated the effect of a directional light stimulus on the distribution of IAA in shoot tips. The scientist set up three experiments as shown in **Figure 4**. All variables were controlled apart from exposure to light.

Figure 4



She then used the growth curvature bioassay to compare the IAA concentrations in the agar blocks from:

- experiment **1**
- experiment **2**
- experiment **3** section **A**
- experiment **3** section **B**.

Table 1 shows the scientist's results.

Table 1

Experiment	Degree of curvature in Bioassay / degrees
1	17.69
2	17.61
3A	11.22
3B	6.50

0 3 . 3 State **two** conclusions about IAA that you can make from the results shown in **Table 1**.

[2 marks]

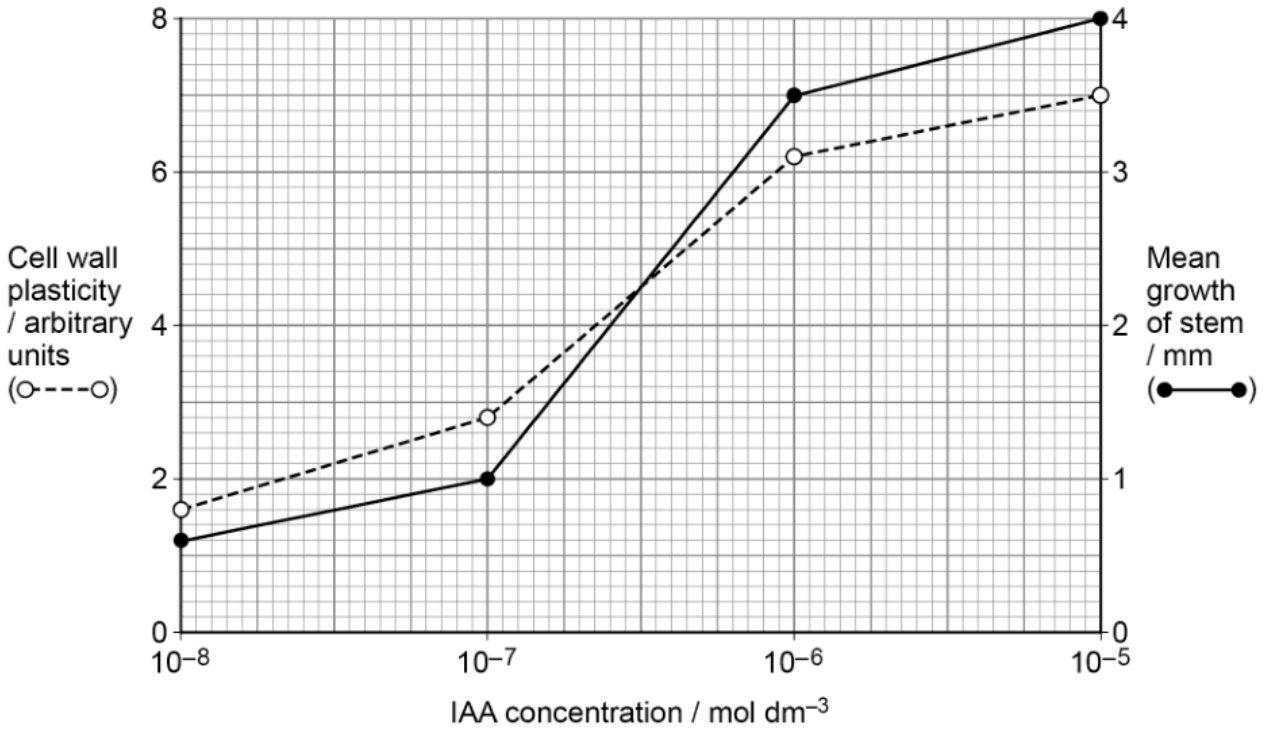
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0 8 Plant cells are surrounded by a rigid cell wall. Cell wall plasticity refers to the ability of a cell wall to stretch permanently. IAA is a growth factor which can activate enzymes that loosen the cell wall.

Scientists investigated the effect of IAA concentration on cell wall plasticity and the growth of stem segments.

Figure 6 shows some of the scientists' results.

Figure 6



0 8 . 1 Use the information provided to explain the relationship between IAA concentration, cell wall plasticity and mean growth of the stem segments.

[2 marks]

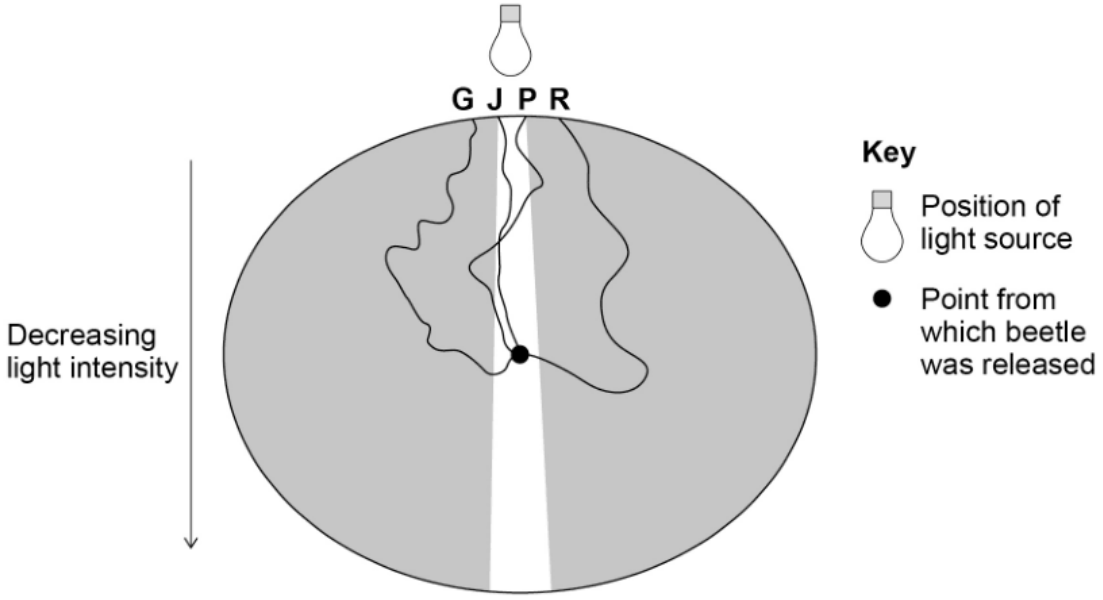
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0 3 Scientists investigated movement in adult pine beetles. Adult beetles emerge from cracks in tree bark.

The scientists released a newly emerged adult beetle, **G**, from the centre of a sample area that had a single light source coming from one direction. They made a drawing of the beetle's path of walking. They repeated this with three more beetles, **J**, **P** and **R**.

Figure 2 shows the scientists' results.

Figure 2



0 3 . 1 Name the type of behaviour shown by beetles **G**, **J**, **P** and **R**, and suggest **one** advantage to adult beetles of the type of behaviour shown.

[2 marks]

Behaviour _____

Advantage _____

_____

_____

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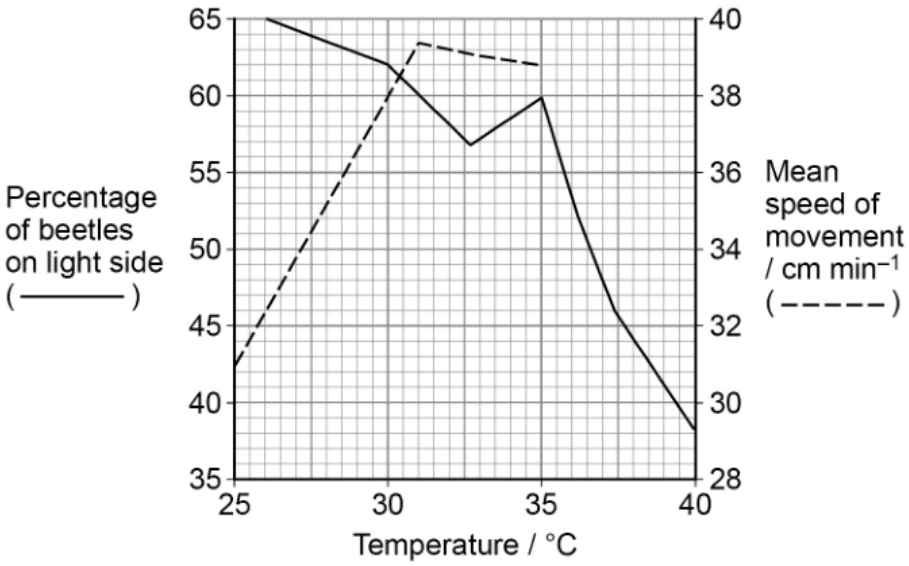
At higher temperatures and higher light intensities, adult pine beetles normally

- move more
- fly rather than walk.

When preparing to fly, these adult beetles walk slowly. The scientists investigated the movement of adult beetles at different temperatures, and in the light and the dark. They created a box that was half in the light and half in the dark. They released an adult beetle at the midpoint of the central dividing line between light and dark areas. They recorded the path of the beetle's movement and its location after 5 minutes. From this, they calculated the mean speed of movement. They repeated the experiment with many beetles and at several temperatures.

Figure 3 shows the scientists' results.

Figure 3



0 3 . 2 After studying these experiments, a student concluded:

- there is a significant change in movement between 35 °C and 37.5 °C
- between 35 °C and 37.5 °C, more beetles move away from the light
- between 35 °C and 37.5 °C, more beetles have a slower walking speed.

Suggest reasons why these conclusions might **not** be valid.

[3 marks]

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0 7 . 2 **Table 3** shows the student's results.

Table 3

Segment of choice chamber	Percentage light intensity	Number of *G. pulex* counted after 10 minutes
A	0	15
B	25	8
C	50	4
D	100	3

The student observed directional movement by *G. pulex*.

Name the type of behaviour shown by *G. pulex* **and** suggest an advantage to *G. pulex* of this behaviour.

Use the information in **Table 3** in your answer.

[2 marks]

Type of behaviour _____

Advantage _____

_____

_____

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Question 9 · information from earlier in the question

0 5 The crown-of-thorns starfish (COTS) is one of the main causes of the decline of the world's coral reefs.

Marine biologists used a choice chamber to investigate the effects of flashing and constant light on the behaviour of COTS.

Table 1 shows their results as they presented them. The P values show results from a statistical test.

Table 1

Behaviour of COTS	Type of light used in choice chamber	
	Flashing	Constant
COTS moving towards the stimulus	22	12
COTS moving away from the stimulus	28	38
P value	0.69	0.02

Question 9 · A level Paper 3 · June 2019 · Q05.3 · 3 marks

0 5 . 3 A journalist studying **Table 1** suggested that **either** type of light could be used to cause COTS to move away from coral reefs.

Evaluate the journalist's suggestion.

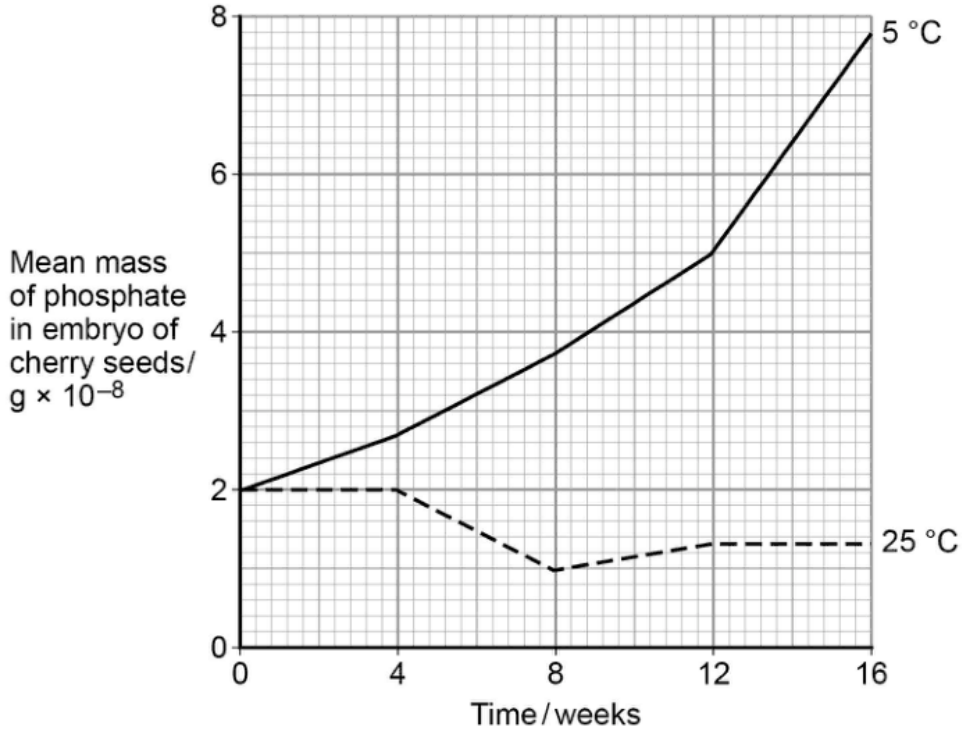
[3 marks]

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0 5 The seeds of some plant species require chilling (exposure to low temperatures) before the embryos they contain grow into plants. During chilling, storage molecules in the seed that contain phosphate are broken down and phosphates are transported to the embryo. Scientists investigated the change in the mass of phosphate in the embryos of cherry seeds exposed to two different temperatures for 16 weeks.

Figure 6 shows their results.

Figure 6



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Question 10 · AS Paper 2 · June 2016 · Q05.4 · 3 marks

0 5 . 4 The chilling requirement of seeds of certain plant species is considered to be an adaptation for survival in countries with seasonal changes in environmental conditions.

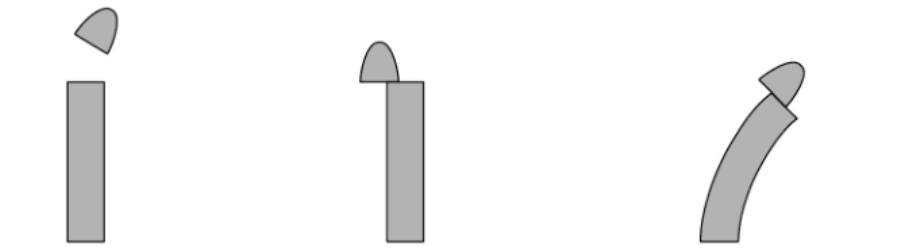
Suggest how this adaptation may enable these plant species to survive and respond to seasonal changes.

[3 marks]

Question 11 · information from earlier in the question

0 3 **Figure 1** shows an investigation into growth factors in plants.

Figure 1



Tip removed from shoot of plant

Then, tip replaced on one side of cut shoot

Then, growth curvature occurred **without** a directional light source

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A bioassay is a method to determine the concentration of a substance by its effect on living tissues.

Figure 2 shows the practical procedure used in a growth curvature bioassay to determine the concentration of IAA in shoot tips.

Figure 2

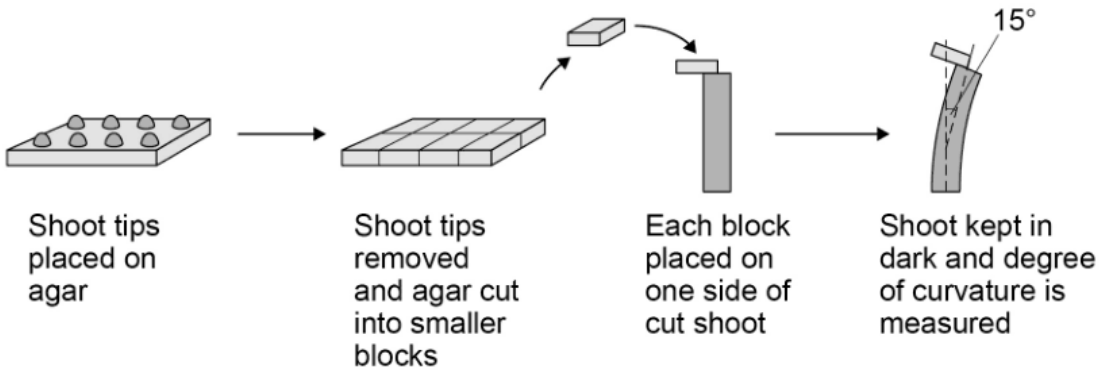
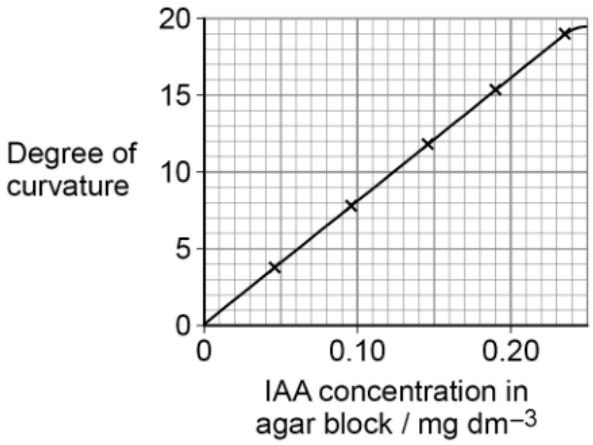


Figure 3 shows the calibration curve for this growth curvature bioassay.

Figure 3



0 3 . 2 Using the procedure in **Figure 2** and the calibration curve in **Figure 3**, describe how you could compare the IAA concentration in shoot tips from two different plant species.

In your answer you should refer to all the variables that should be controlled to produce a valid comparison.

[5 marks]

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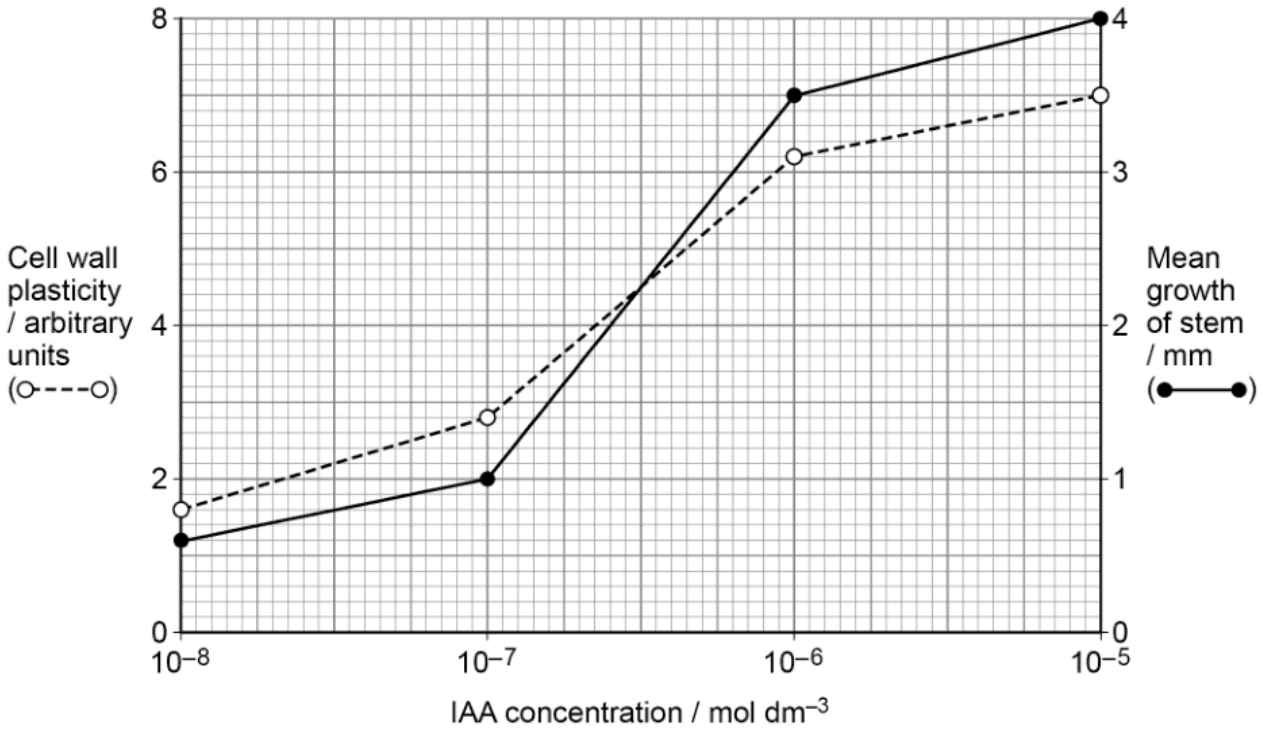
Question 12 · information from earlier in the question

0 8 Plant cells are surrounded by a rigid cell wall. Cell wall plasticity refers to the ability of a cell wall to stretch permanently. IAA is a growth factor which can activate enzymes that loosen the cell wall.

Scientists investigated the effect of IAA concentration on cell wall plasticity and the growth of stem segments.

Figure 6 shows some of the scientists' results.

Figure 6



Question 12 · A level Paper 2 · June 2024 · Q08.2 · 2 marks

0 8 . 2 Use **Figure 6** to calculate the percentage increase in mean growth of the stem segments when the IAA concentration was increased from 10^{-8} mol dm^{-3} to 10^{-5} mol dm^{-3}

Give your answer to 2 significant figures.

Show your working.

[2 marks]

Answer _____ %

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Question 13 · information from earlier in the question

Gibberellic acid (GA) is another plant growth factor. A student was asked to design and carry out an investigation into the effect of different concentrations of GA on the growth of stem segments.

The student was provided with:

- 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4} and 10^{-5} mol dm^{-3} concentrations of GA solution
- distilled water
- 6 Petri dishes and access to glassware
- 60 stem segments of different lengths.

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Question 13 · A level Paper 2 · June 2024 · Q08.4 · 5 marks

0 8 . 4 Describe a suitable procedure the student could follow to investigate the effect of different concentrations of GA on the growth of stem segments.

In your answer, you should include the variables that should be controlled in this investigation.

[5 marks]

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Question 14 · information from earlier in the question

0 5 The crown-of-thorns starfish (COTS) is one of the main causes of the decline of the world's coral reefs.

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Table 1 shows their results as they presented them. The P values show results from a statistical test.

Table 1

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P value	0.69	0.02

Question 14 · A level Paper 3 · June 2019 · Q05.4 · 2 marks

0 5 . 4 One of the reasons COTS can destroy coral reefs in a short time is because COTS move quickly, allowing them to move from one reef to another.

Table 2 shows the maximum speeds recorded of COTS in constant light.

Table 2

Response to light	Maximum speed / mm min^{-1}
COTS moving towards constant light	259
COTS moving away from constant light	564

Calculate the shortest time one COTS would take to move up a coral reef from 66 m under water to 18 m under water in hours of daylight.

Give your answer to the nearest hour.

[2 marks]

Answer = _____ hours

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Mark schemes

Question 1 · A level Paper 2 · June 2019 · Q03.1 · 2 marks

03.1	2 max 1. Tip produces IAA; 2. Affects concentration of IAA **OR** Affects (shoot) length/growth/elongation; 3. Mitosis/division occurs in shoot tips; 4. Affects (shoot) length/growth/elongation;	**Mark in pairs** 1 and 2 or 3 and 4. 1 and 2. Accept auxin for IAA. 1. Ignore contains/stores IAA. 1. Accept affects amount of IAA. 2. Accept affects independent variable. 2 and 4. Ignore affects results.

Question 2 · A level Paper 2 · June 2019 · Q03.4 · 3 marks

03.4	3 1. Increase in IAA concentration the higher/greater the mean (change in) length; 2. (High) IAA stimulates cell elongation; 3. In roots, growth/elongation less/inhibited;	1, 2 and 3. Accept auxin for IAA. 3. Accept decrease in (mean) change in length but reject 'decreases length' on its own.
		3. Accept 'opposite results or 'negative correlation'.

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Question 3 · A level Paper 2 · November 2021 · Q03.1 · 3 marks

03.1	1. Tip produces IAA; 2. IAA diffuses (into shoot); 3. (More) elongation of cells on one side (than other);

3	1. Accept source/release for produces but ignore contains/stores IAA. 1 and 2. Accept auxin for IAA. 2. Accept IAA diffuses down. 3. Accept (more) elongation of cells on left side. 3. Reject any reference to shaded/dark side or away from light.

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Question 4 · A level Paper 2 · November 2021 · Q03.3 · 2 marks

03.3	1. (IAA) is not broken down by light **OR** (IAA) is produced in the dark **OR** Light/dark does not affect (IAA) production; 2. (IAA) moves away from light **OR** (IAA) moves to shaded side;	2	2. IAA accumulates on shaded side is not enough on its own, idea of movement is required.

Question 5 · A level Paper 2 · June 2024 · Q08.1 · 2 marks

08.1	1. Increasing IAA concentration increases (cell wall) plasticity **OR** IAA activates enzymes which increases (cell wall) plasticity; 2. Increase in (cell wall) plasticity results in <u>cell</u> elongation;	2 (2 x AO2)	1 and 2. Accept 'stretching' for plasticity, Reject 'elasticity' **once** only. 2. Idea of <u>cell</u> elongation or increase in <u>cell</u> length must be conveyed. 2. IAA causing cell elongation on its own is not enough.

Question 6 · A level Paper 3 · November 2021 · Q03.1 · 2 marks

03.1	Behaviour 1. (Positive photo) taxis; Advantage 2. Accept any suitable suggestion, eg to avoid competition, to find a mate, increase dispersal, to avoid predators;	2	1. Reject negative (photo) taxis 2. Neutral – to move into the open or to move out of the tree bark

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03.2	1. No stats test, so do not know if change (in movement away from light) is significant; 2. Between 35 °C and 36.5 °C more than half of beetles are still found on the light side; 3. (At higher temperatures/above 35 °C) beetles might be flying (not walking) **OR** (Y-axis) states speed of movement, might not just be walking speed; 4. Slowing of movement happens before 35 °C; 5. Slowing of movement could be due to beetles preparing to fly (and not temperature); 6. Speed (of movement) not recorded above 35 °C/ between 35 and 37.5 °C/between 35 and 40 °C; **OR** Speed (of movement) not recorded at 37.5 °C 7. (Mean speed could mean) some might walk very quickly **and** others stay still/not move;	3 max

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Question 8 · A level Paper 2 · June 2025 · Q07.2 · 2 marks

07.2	1. (Negative photo) taxis; 2. Predation less likely **OR** Less visible to predators/prey **OR** Less likely to be prey **OR** Move away from heat **OR** Move towards food;	2 (2 x AO2)	2. Accept 'consumers' for 'predators' 2. Accept 'stops predation' 2. Accept 'hides from predator/prey' 2. Accept descriptions of reduced predation e.g. 'fewer are eaten' 2. Accept 'move to cooler place /conditions'

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05.3	Yes (no mark) 1. Movement is away from either type/both types of light **OR** Negative (photo) taxis to both types/either types of light; 2. Significant movement away from constant light **as** p=0.02/<0.05/=2%/<5% **OR** Movement away from constant light is not due to chance **as** p=0.02/<0.05/=2%/<5%; No (no mark) 3. Movement away from flashing light is not significant **as** p=0.69/>0.05/=69%/>5% **OR** Movement away from flashing light is due to chance **as** p=0.69/>0.05/=69%/>5%;

3	2. and 3. Ignore '**results**' in the context of significance or chance

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05.4	1. Seeds/embryo remain dormant/inactive in winter/cold **OR** Growth/development of seed/embryo during winter/cold; 2. Seeds/plants develop in spring/summer **OR** Seeds/plants develop when temperature/light increases; 3. Plant photosynthesise (in spring/when warm); 4. Produce (more) seeds/offspring in spring/growing season;

3 max	1. Ignore: hibernate. 1. Accept: 'seed survives winter/cold'. 1. Reject: plant develops or seed germinates during winter/cold. 2. Accept: seeds/plants develop when more light or when temperature is higher.

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03.2	1. Size of shoot/tip; 2. Number of shoot tips; 3. Size/type of agar (block); 4. (Shoots) at same stage of growth/development; 5. Time (period) tips kept on agar **OR** Time (period) agar/block kept on (cut shoot) **OR** Time (period shoots) kept in dark; 6. Temperature; 7. (Repeat several times and) calculate a mean; 8. Compare/read degree of curvature (on calibration curve) to determine (IAA) concentration **OR** Higher the degree of curvature the higher the IAA concentration;

5 max	**Mark points 1 to 6 = max 3.** 1 to 6. Ignore pH, species, carbon dioxide, humidity, nutrients, water and light. 3. Accept 'amount of agar'. 4. Accept (Shoots/plants) are same age.

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08.2	Correct answer of 570 (%) = **2 marks**;; (**However**, if working shows plasticity values used, e.g. 8 and 1.2 (or difference of 6.8) **and** answer of 570 (%) = **1 mark**) Answer or working shows 560 / 566 / 567 (%) **= 1 mark** (**However**, if working shows plasticity values used, e.g. 8 and 1.2 (or difference of 6.8) **and** answer of 560 / 566 / 567 (%) = **0 marks**) Answer of 120 (%) = **1 mark** **OR** Answer of 230 (%) = **1 mark** **OR** Answer of 340 (%) = **1 mark** **OR** Answer of 780 (%) = **1 mark** **OR** Answer of 1200 (%) = **1 mark;**	2 (2 x AO2)

Accept 566 recurring for one mark.

Ignore any numbers after 560 or 566 or 567.

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08.4	**Max 3 marks from mark points 3 to 8.** 1. (Use distilled) water (control) **and** different (GA) concentrations **and** 10 (stem) segments in each; 2. Measure (length of) stem/segments at start **and** at end (of investigation) **OR** Determine increase/change in length **OR** Determine percentage change in length; 3. (Place stems in same) volume of solution/GA; 4. (Leave for same period of) time; 5. (Same) temperature; 6. (Same) species/type (of plant); 7. (Same) age (of plant); 8. (Same) diameter/thickness of stem/segments;	5 max (5 x AO2)

1. Accept use of specified number of segments in each dish with repeats, if total used = 60.

2. Accept 'cut to same length' = measure at start.

2. Accept 'growth in length' as 'increase/change in length'.

3 to 8. Ignore pH, carbon dioxide, humidity, nutrients, and light

4. Accept any 'named

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05.4	Correct answer of 3 hours = 2 marks;; Allow 1 mark for distance of 48 000 mm in working 1 max for answer of 185 minutes/3 hours and 5 minutes/3.09 hours 1 max for answer of 1 hour (ie answers that use 564 in their calculation);	2 max

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