



Survival and Response

These practice questions can be used by students and teachers and is

Suitable for AQA A Level 7402 Biology Topic Question

Level: AQA A LEVEL 7402

Subject: Biology

Exam Board: AQA A Level 7402

Topic: Survival And Response



Similarity _____

Difference _____

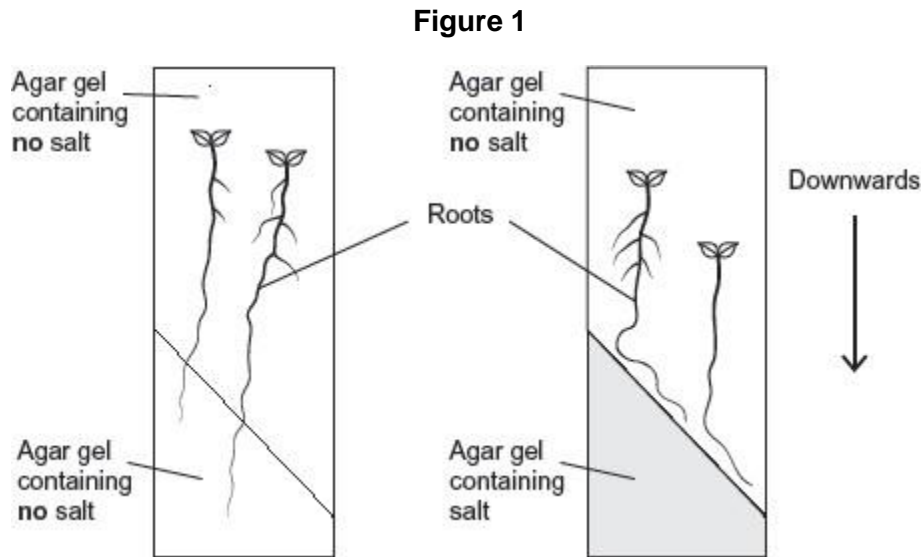
(2)



Scientists investigated tropisms in the roots of tomato plants. They grew tomato plants from seeds on vertical agar plates, as shown in **Figure 1**. The top of each plate was made of agar gel containing **no** salt. The bottom of each plate was made of one of the following:

- agar gel containing **no** salt
- agar gel containing salt.

Typical results for growth of the roots are shown in **Figure 1**.



(b) What do these results show about the responses of the roots of tomato plants to gravity and salt?

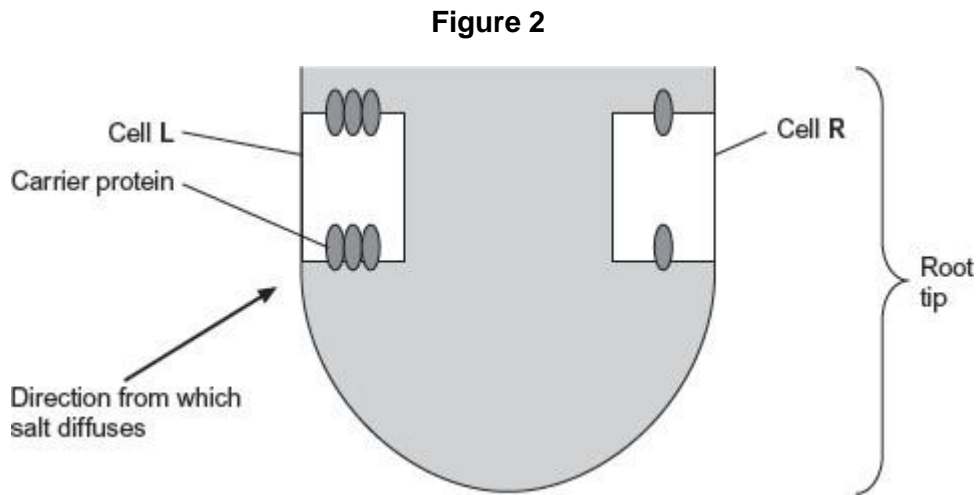
[Extra space] _____



- (c) In root tips of tomatoes, IAA is transported **out** of the cells by a carrier protein. In roots of tomatoes, high concentrations of IAA inhibit cell elongation.

The scientists' hypothesis was that salt causes a change in the number of IAA carrier proteins in cells in different parts of the root tip.

Figure 2 shows two cells, **L** and **R**, in the root tip of a tomato plant.



Explain why this root tip would grow away from salt.

[Extra space] _____

(3)

(Total 8 marks)

A biologist investigated the behaviour of a species of worm that lives in soil.



He cultured three samples of worms in three separate trays of soil for many days. Each culture:

- contained a food supply
- was kept at a different temperature.

The temperatures of the cultures were 17 °C, 20 °C and 23 °C.

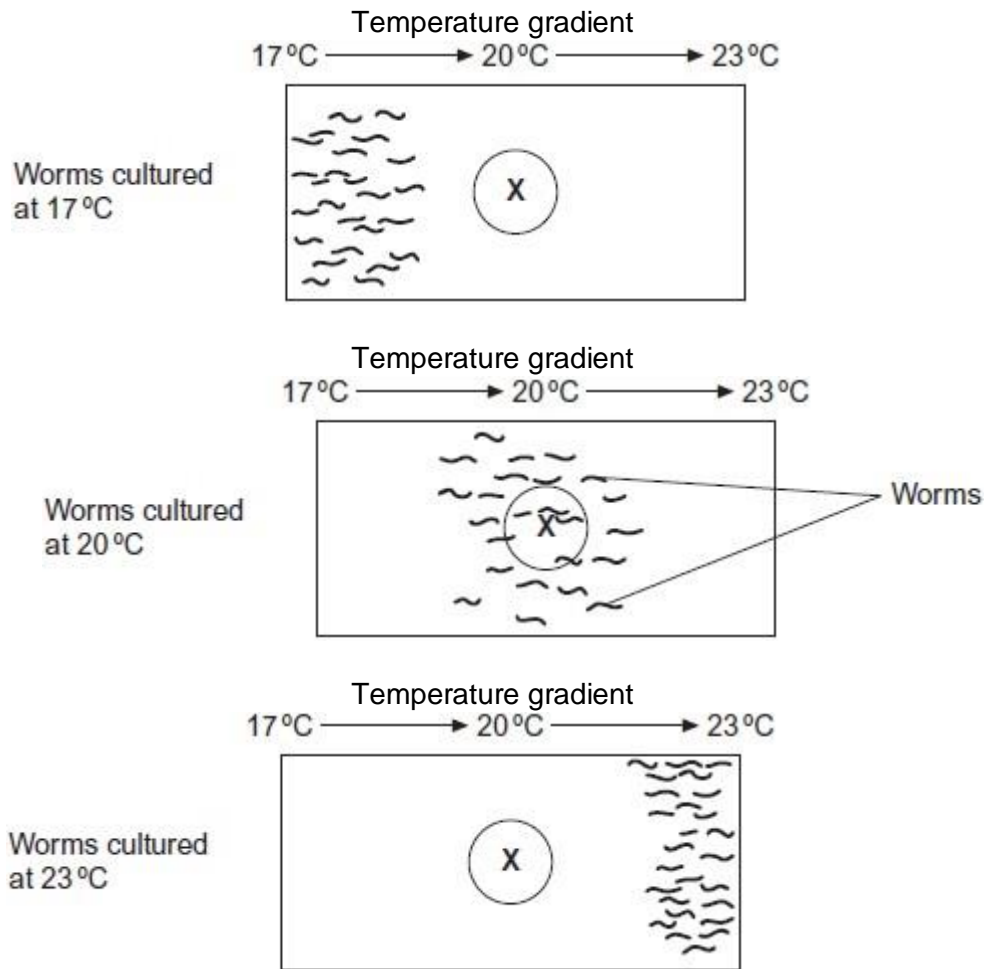
The biologist then removed food from the trays for several hours. Then he transferred each sample of worms onto a glass surface where there was **no food**. Each surface had a temperature gradient across it. After 1 hour, the biologist recorded the position of each worm.



The figure below shows his results. On each



diagram, marks where he released the worms onto the glass surface.



(a) The biologist concluded that the worms' behaviour demonstrated taxis. How do these results support this conclusion?

(2)

(b) Using the information provided, suggest an explanation for the worms' behaviour on the glass surfaces in the absence of food.



(Extra space)

(3)

(c) In each experiment, the biologist exposed the surfaces to light that was dim and even, sohe could see where the worms went.

Apart from seeing where the worms went, suggest **two** reasons why it was important that the light was dim and even.

1. _____

2. _____

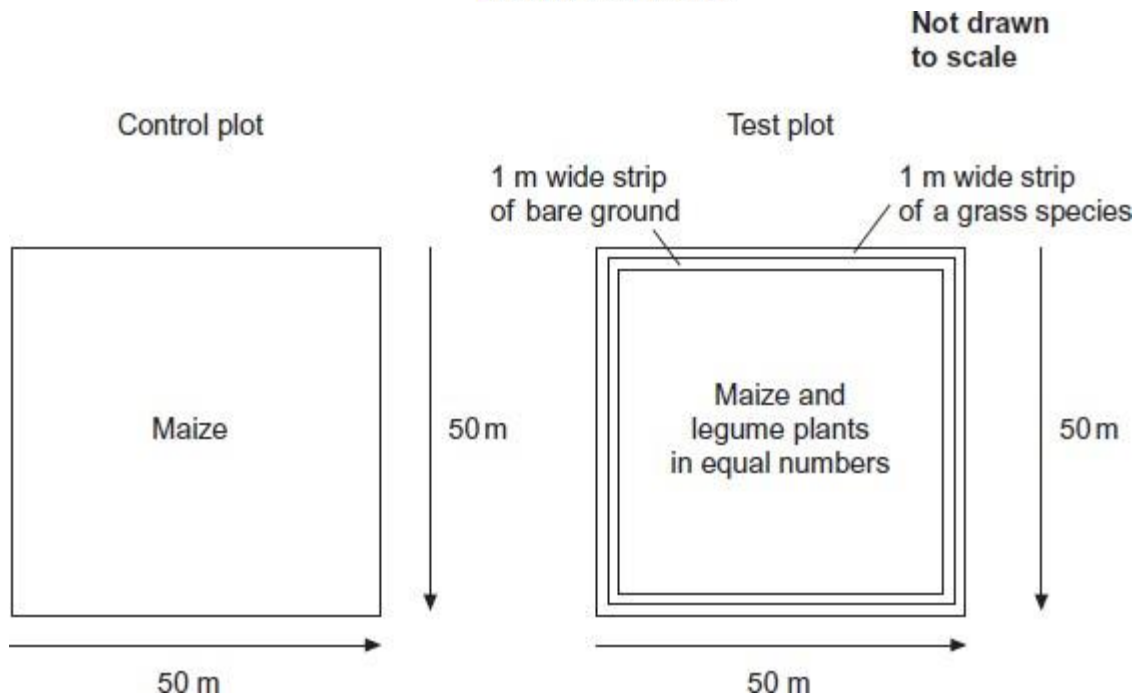
(2)

(Total 7 marks)

3

Stemborers are insect pests that feed on maize plants. Scientists investigated the effect of **push-pull** stimuli on the control of these pests.

For this investigation, the scientists divided a large field into plots measuring 50 m × 50 m. They then designated each plot as a control plot or a test plot. The following figure shows what they planted in each type of plot.



The legumes planted with the maize drive stemborers away.
The grass species attracts stemborers.

The table below shows the scientists' results.

Plots	Mean percentage damage to maize plants	Mean maize grain yield / tonnes per hectare (\pm standard deviation)	Mean production costs per farmer / \$ per hectare (\pm standard deviation)	Mean total income for farmer / \$ per hectare (\pm standard deviation)
Control	29.6	1.5 (± 0.2)	250 (± 0.7)	329 (± 5.9)
Test	6.7	3.7 (± 0.3)	278 (± 1.1)	679 (± 10.2)

(a) In the test plot of land, identify the push stimulus and the pull stimulus.

Push stimulus _____

Pull stimulus _____

(1)

(b) When measuring the mean percentage damage to maize plants, 60 plants from each testplot were selected at random and examined.



Describe how the maize plants could be selected at random.

(Extra space)

(3)

- (c) In the test plot, bare ground was left between the maize and the grass species. Suggest an explanation why.

(2)

- (d) The legume plants have nodules containing nitrogen-fixing bacteria on their roots. Explain how nitrogen-fixing bacteria could increase the growth of the maize.

(2)

- (e) A year after this investigation, the government of one country decided that their farmers should use these **push-pull** stimuli.
How do these data support this decision?

(Extra space) _____

(3)

(Total 11 marks)



Scientists investigated the response of lateral roots to gravity. Lateral roots grow from the side of

4

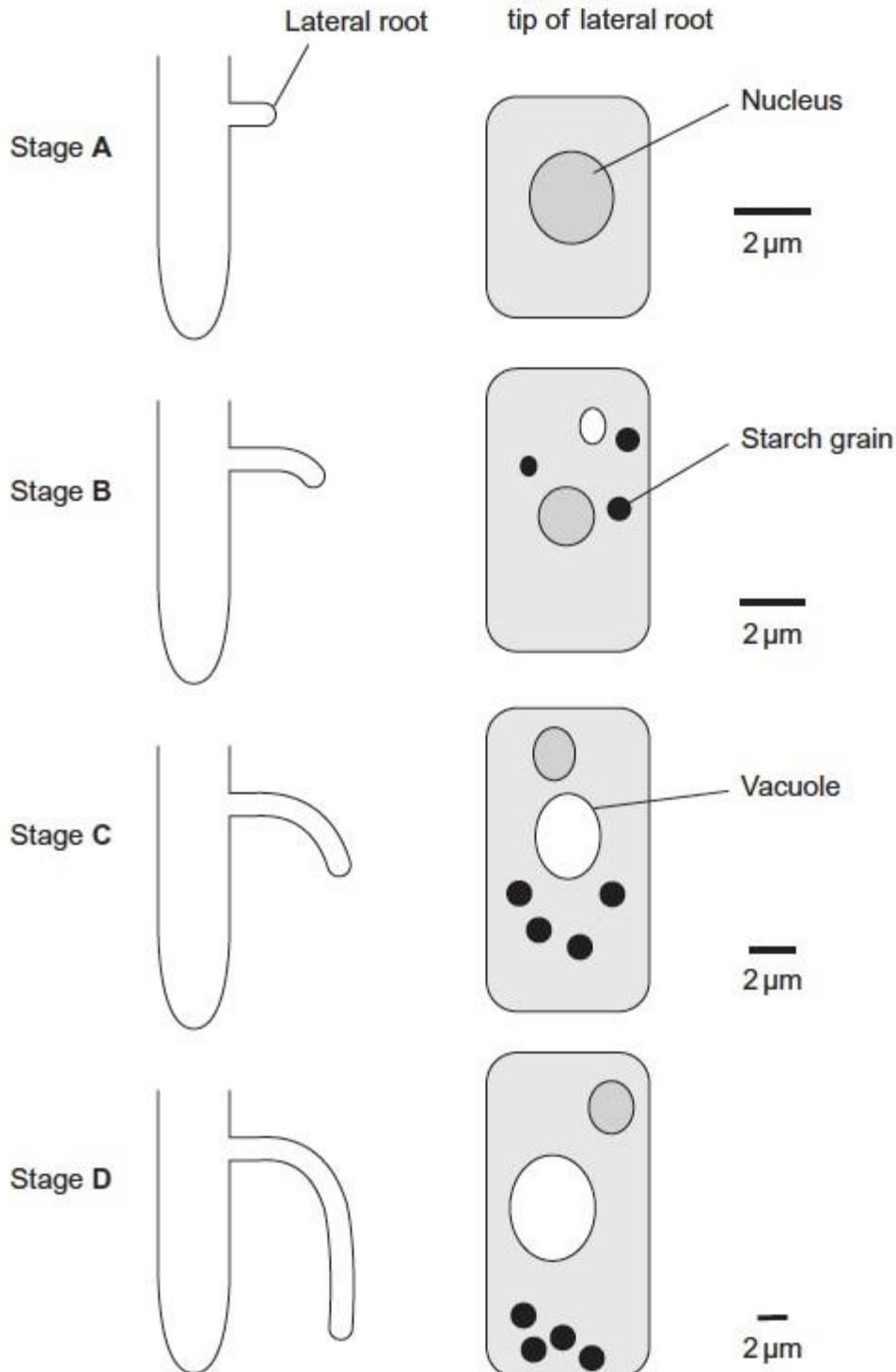
main roots.

The diagrams show four stages, **A** to **D**, in the growth of a lateral root and typical cells from the tip of the lateral root in each stage. All of the cells are drawn with the bottom of the cell towards the bottom of the page.



Cell from tip of lateral root

Downwards



(a) Describe **three** changes in the root tip cells between stages **A** and **D**.

1. _____



2. _____

3. _____

(3)

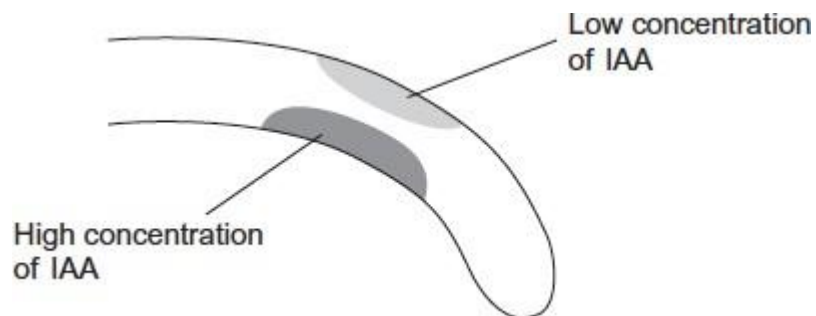
- (b) The scientists' hypothesis was that there was a relationship between the starch grains in the root tip cells and the bending and direction of growth of lateral roots.

Does the information in the diagram support this hypothesis? Give reasons for your answer.

(Extra space) _____

(3)

- (c) The diagram shows the distribution of indoleacetic acid (IAA) in the lateral root at Stage B.



Explain how this distribution of IAA causes the root to bend.



EXAM PAPERS PRACTICE




(2)
(Total 8 marks)



Scientists investigated the response of the roots of pea seedlings to gravity.

5

They took three samples of seedlings, **A**, **B**, and **C**, and placed them so that their roots were growing horizontally. The root tips of each sample had been given different treatments. After a set time, the scientists recorded whether the roots of the seedlings had grown upwards or downwards and the amount of curvature. The table shows the treatment they gave to each sample and their results.

Treatment	Results	
	Direction of growth	Mean amount of curvature / degrees
A None 	Downwards	60
B Root tip removed 	Continues to grow horizontally	0
C Upper half of root tip removed 	Downwards	30

(a) The pea seedlings were kept in the dark after each treatment. Explain why this was necessary.

(1)

(b) What conclusion can be made from the results for treatment **B**?

(1)

(c) Suggest how indoleacetic acid (IAA) could have caused the results for

(i) treatment **A**

(2)

(ii) treatment **C**.

(2)

(Total 6 marks)

IAA is a specific growth factor.

6

(a) Name the process by which IAA moves from the growing regions of a plant shoot to other tissues.

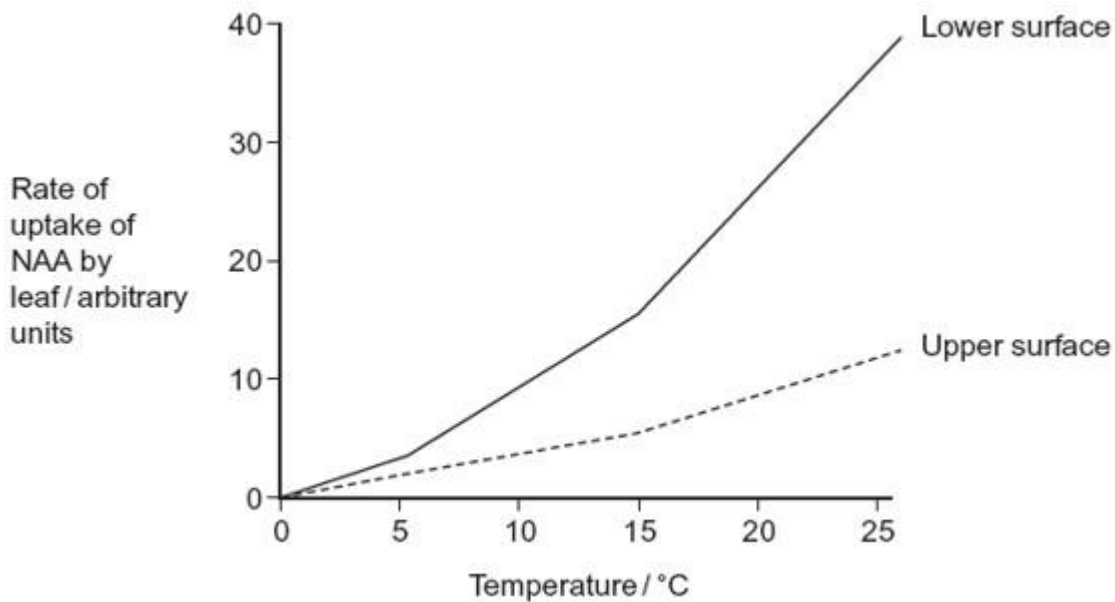
(1)



- (b) When a young shoot is illuminated from one side, IAA stimulates growth on the shaded side. Explain why growth on the shaded side helps to maintain the leaves in a favourable environment.

(2)

NAA is a similar substance to IAA. It is used to control the growth of cultivated plants. Plant physiologists investigated the effect of temperature on the uptake of NAA by leaves. They sprayed a solution containing NAA on the upper and lower surfaces of a leaf. The graph shows their results.



- (c) Explain the effect of temperature on the rate at which NAA is taken up by the lower surface of the leaf.

(2)

(d) There are differences in the properties of the cuticle on the upper and lower surfaces of leaves.

(i) Suggest how these differences in the cuticle might explain the differences in rates of uptake of NAA by the two surfaces.

(2)

(ii) In this investigation, the physiologists investigated the leaves of pear trees. Explain why the results might be different for other species.

(1)

(Total 8 marks)

7

Plant physiologists attempted to produce papaya plants using tissue culture. They investigated

the effects of different concentrations of two plant growth factors on small pieces of the stem tip from a papaya plant. Their results are shown in the table.

Concentration of auxin / $\mu\text{mol dm}^{-3}$	Concentration of cytokinin / $\mu\text{mol dm}^{-3}$		
		5	25



0	No effect	No effect	Leaves produced
1	No effect	Leaves produced	Leaves produced
5	No effect	Leaves produced	Leaves and some plantlets produced
10	Callus produced	Leaves and some plantlets produced	Plantlets produced
15	Callus produced	Callus and some leaves produced	Callus and some leaves produced

Callus is a mass of undifferentiated plant cells. Plantlets are small plants.

(a) Explain the evidence from the table that cells from the stem tip are totipotent.

(2)

(b) Calculate the ratio of cytokinin : auxin that you would recommend to grow papaya plants by this method.

Answer _____

(2)



- (c) (i) Papaya plants reproduce sexually by means of seeds. Papaya plants grown from seeds are very variable in their yield. Explain why.

(2)

- (ii) Explain the advantage of growing papaya plants from tissue culture rather than from seeds.

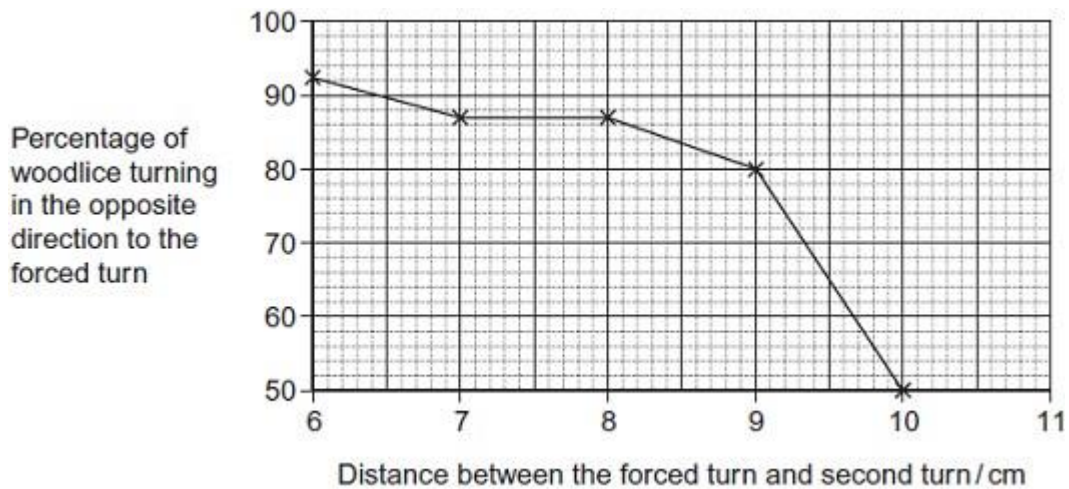
(1)

(Total 7 marks)

8

A student investigated the effect of distance from a forced turn on the direction woodlice turned

when next given a choice. The following figure shows her results.



- (a) Describe the response of woodlice to increased distance between turns.



(2)

- (b) Can you conclude that woodlice show turn alternation behaviour when the distance between the forced turn and the second turn was 10 cm? Explain your answer.

(2)

- (c) The student suggested that the difference in turning behaviour of the woodlice in her investigation was due to the distance between the first and second turn. Her friend suggested that it was due to the time taken to get from the first to the second turn and **not** the distance. Suggest how you could investigate which of these two possibilities is more likely.

(Extra space) _____

(3)

- (d) Woodlice usually live in areas where stones and twigs form obstacles. Obstacles in the path of woodlice cause them to make forced turns. The more obstacles there are in the path, the shorter the distance between the forced turns.

Use the data in the figure above to explain how the behaviour of woodlice results in them moving rapidly out of unfavourable areas.

(2)

(Total 9 marks)

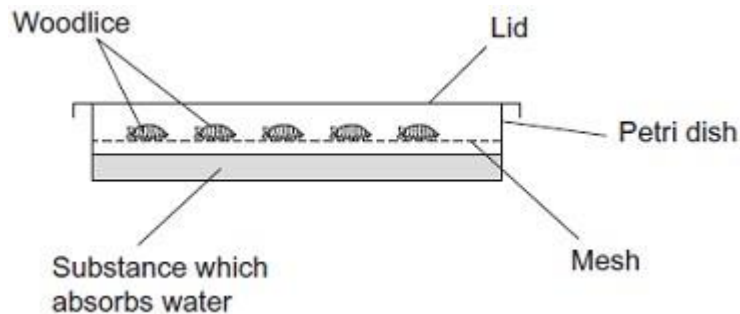
9

Scientists investigated the effect of relative humidity on the activity of woodlice. They set up a

Petri dish as shown in **Figure 1**.

In the bottom half they put a substance which absorbs water. Different concentrations of this substance produced different humidities in the air above the mesh.

Figure 1



The scientists

- placed 10 woodlice in the top half of the dish
- replaced the lid and left the apparatus for 15 minutes in the laboratory

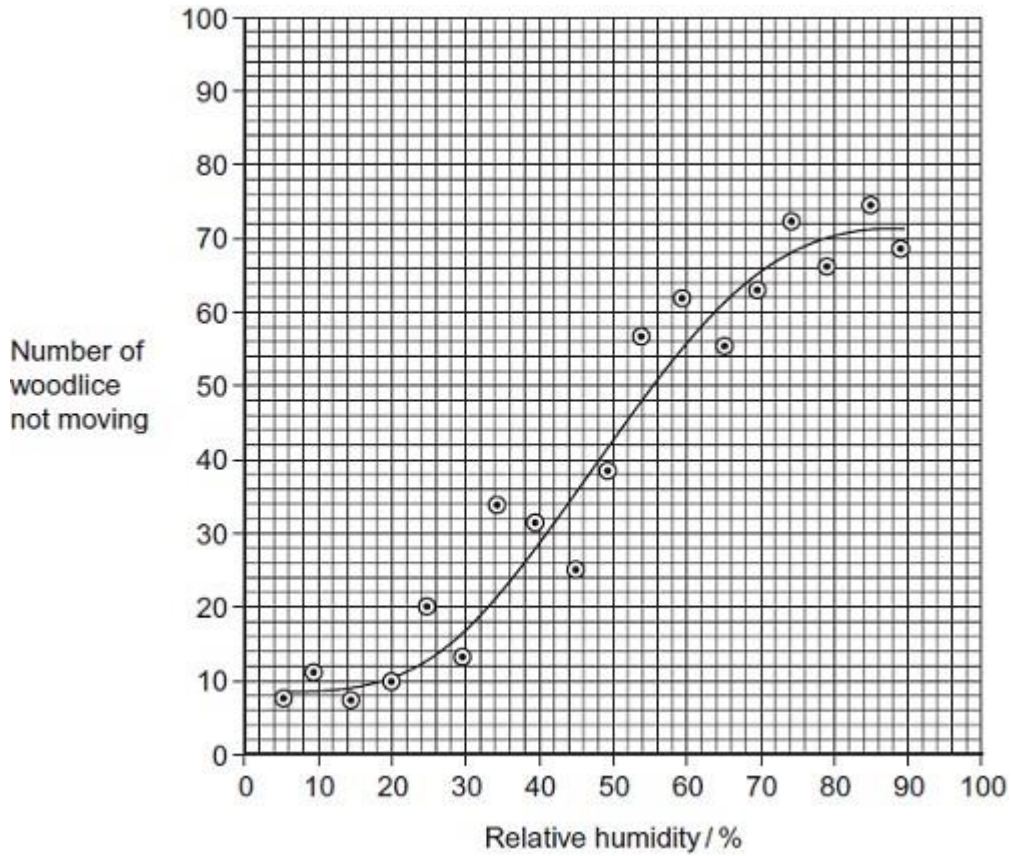


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- recorded the number of woodlice **not** moving during the next 30 seconds • repeated the experiment to obtain data for 100 woodlice
- repeated the experiment at different humidities.

The results are shown in **Figure 2**.

Figure 2



(a) The woodlice were left for 15 minutes before their movement was recorded. Give **two** reasons for this.

1. _____

2. _____

(2)

(b) It is **not** possible to conclude that the change in the behaviour of the woodlice shown in **Figure 2** is caused by changes in humidity. Explain why.

(2)

(c) The points in **Figure 2** do not all fall on the curve. Suggest why.

(Extra space)

(3)

(Total 7

marks) Woodlice use gills for gas exchange. These gills are situated on the outside of the animal so

10

water loss occurs from the gill surface. When a number of woodlice occur together they often form a 'clump' with individual woodlice touching each other.

A student investigated the effect of clumping on the rate of water loss from the woodlice. The student divided the 12 woodlice into two groups. He allowed the woodlice in group A to clump together, but kept the woodlice in group B separate from each other.

The following table shows the mean mass of the woodlice in each group.

Time / minutes	Mean mass of woodlice / g	
	Group A	Group B
0	0.180	0.175



20	0.170	0.130
40	0.165	0.110
60	0.160	0.090
80	0.160	0.080

- (a) (i) Calculate the percentage loss in the mean mass of the woodlice in Group **A** during the investigation. Show your working.

Answer _____

(2)

- (ii) Woodlice in Group **B** had a greater percentage loss in mean mass during the investigation than woodlice in Group **A**. Explain why.

(Extra space) _____

(3)

- (iii) It would be useful to give the loss in mean mass as a percentage in this investigation. Explain why.

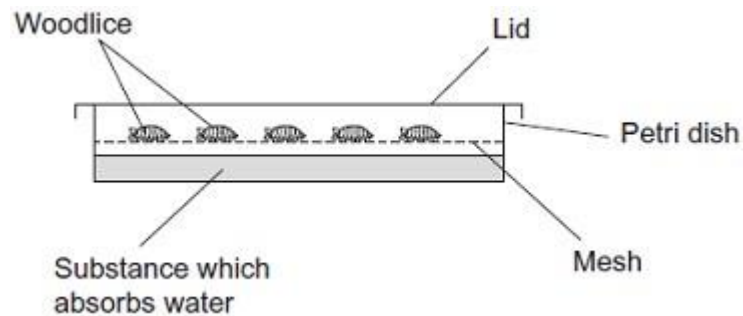
(1)
(Total 6 marks)

11

Scientists investigated the effect of relative humidity on the activity of woodlice. They set up a Petri dish as shown in **Figure 1**.

In the bottom half they put a substance which absorbs water. Different concentrations of this substance produced different humidities in the air above the mesh.

Figure 1

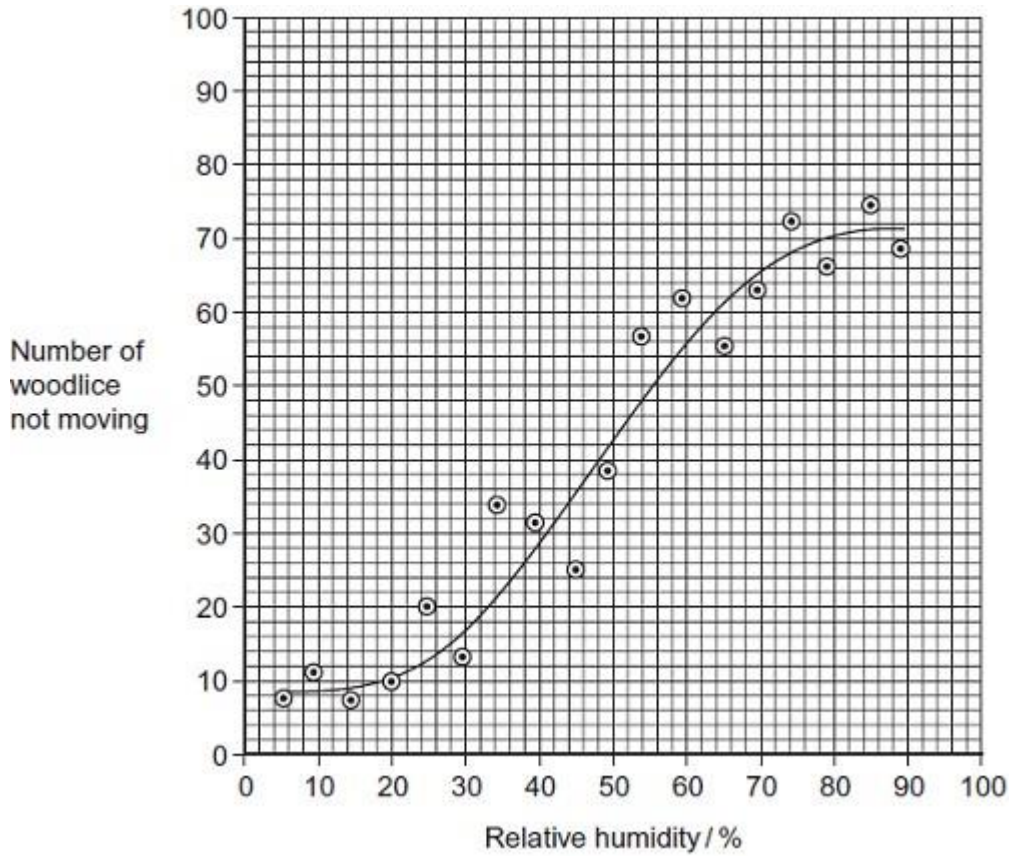


The scientists

- placed 10 woodlice in the top half of the dish
- replaced the lid and left the apparatus for 15 minutes in the laboratory
- recorded the number of woodlice **not** moving during the next 30 seconds • repeated the experiment to obtain data for 100 woodlice
- repeated the experiment at different humidities.

The results are shown in **Figure 2**.

Figure 2



The movement of the woodlice in low relative humidity is an advantage to their survival. Explain how.

(Total 2

marks) Termites are insects. Some species live in colonies in the soil. Although most termites are

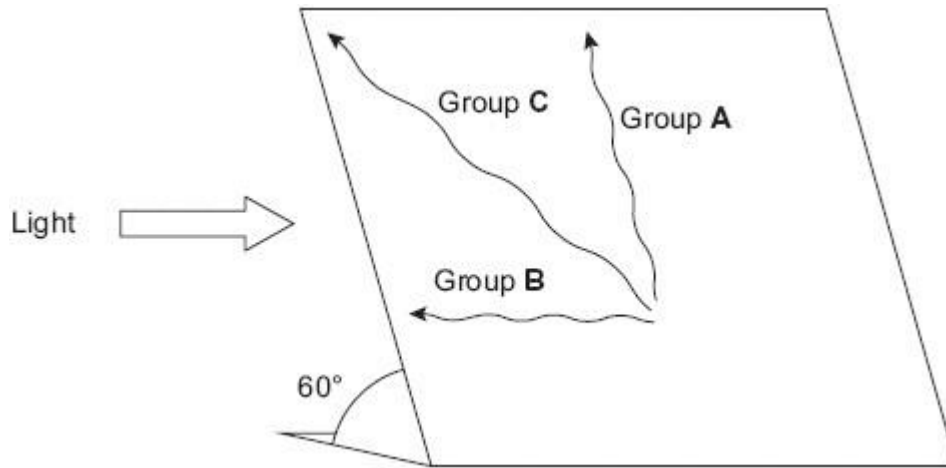
12

wingless, winged termites are sometimes produced. The winged termites fly from the soil, mate and start new colonies.

A scientist studied the behaviour of winged termites. He divided these termites into three groups.

- Group **A** had their eyes covered.
- Group **B** had their antennae removed.
- Group **C** was the control group.

He put individual winged termites on a sloping board that was illuminated from one side. The diagram shows the direction of movement of a typical termite from each of the three groups.



(a) (i) What type of behaviour was shown by the termite from group **B**?

(1)

(ii) Give the evidence for your answer.

(1)

(b) Explain what the results from group **A** suggest about the factors controlling the behaviour of winged termites.



(3)

(c) Suggest **one** advantage to the termites from group **C** of the behaviour shown in the investigation.

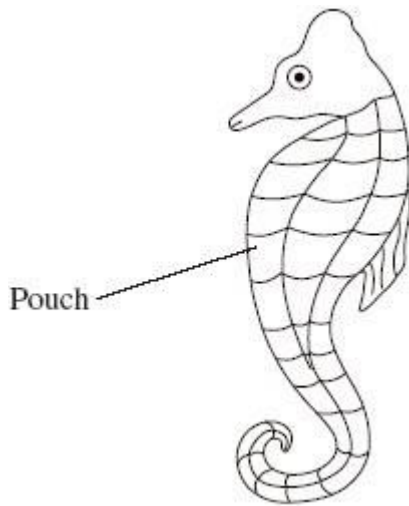
(2)

(Total 7 marks)

13

The diagram shows a seahorse. A seahorse is a fish. Mating in seahorses begins with courtship

behaviour. After this, the female transfers her unfertilised eggs to the male's pouch. Most male fish fertilise eggs that have been released into the sea. However, a male seahorse fertilises the eggs while they are inside his pouch. The fertilised eggs stay in the pouch where they develop into young seahorses.





(a) Give **two** ways in which courtship behaviour increases the probability of successful mating.

- 1. _____

- 2. _____

(2)

(b) Give **one** way in which reproduction in seahorses increases the probability of

(i) fertilisation

(1)

(ii) survival of young seahorses.

(1)

Scientists investigated the effect of total body length on the selection of a mate in one Australian species of seahorse. The scientists used head length as a measure of total body length.

(c) (i) Use the diagram to suggest why the scientists measured head length rather than total body length.

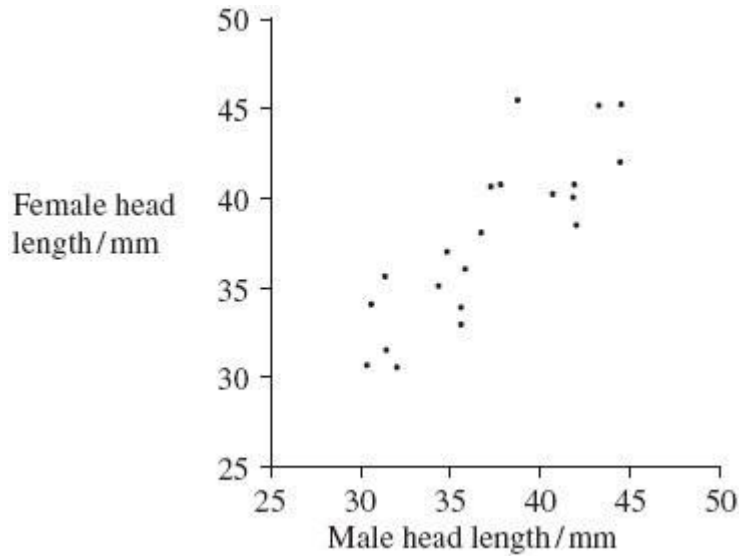
(1)

(ii) Suggest why the scientists were able to use head length as a measure of total body length.

(1)



The scientists measured the head lengths of the female and male of a number of pairs. The results are shown in the graph.



- (d) The scientists concluded that total body length affects the selection of a mate. Explain how the results support this conclusion.

(1)

- (e) A female with a head length of 50 mm selected a mate. Explain how you could use the graph to predict the total head length of the mate selected.

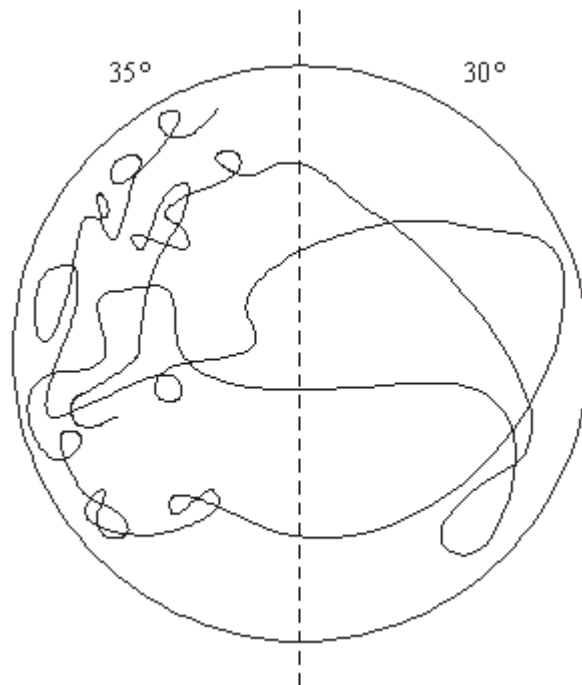
(2)

- (f) Scientists studied two species of North American seahorse. They thought that these two species are closely related. Describe how comparisons of biological molecules in these two species could be used to find out if they are closely related.

(6)
(Total 15 marks)

14

The human body-louse is an insect which lives and feeds on the surface of the skin. A louse was placed in a chamber, half of which was kept at 35 °C and half at 30 °C. The diagram shows the pattern of movement of the louse.





(a) Name the type of behavioural response shown by the body-louse in this investigation.

Give evidence for your answer.

(2)

(b) Suggest and explain **one** advantage of this behaviour to the human body-louse.

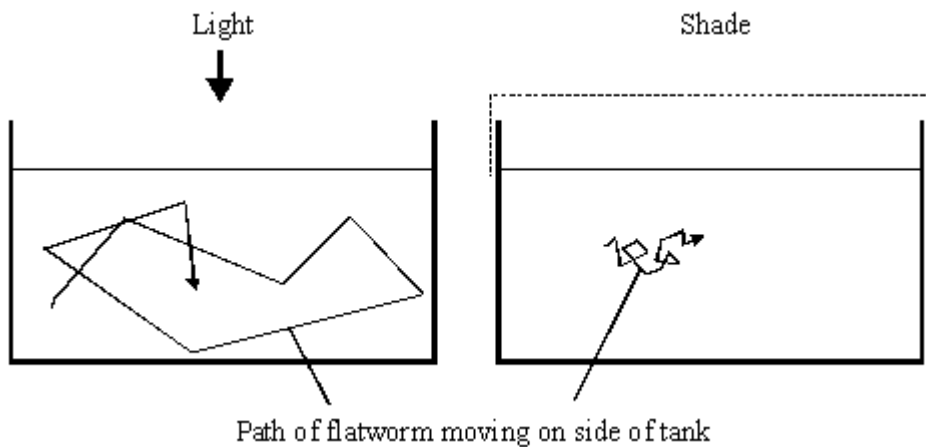
(2)

(Total 4

marks) A flatworm is a simple soft-bodied animal. The diagram shows the movements of an aquatic

15

flatworm in light and in shade. The path followed by the flatworm over a period of three minutes was traced on the side of a tank.



(i) Name the type of behaviour shown. Give a reason for your answer.

Type of behaviour _____

Reason _____

(2)

(ii) Suggest **one** advantage of the behaviour shown in the diagram.

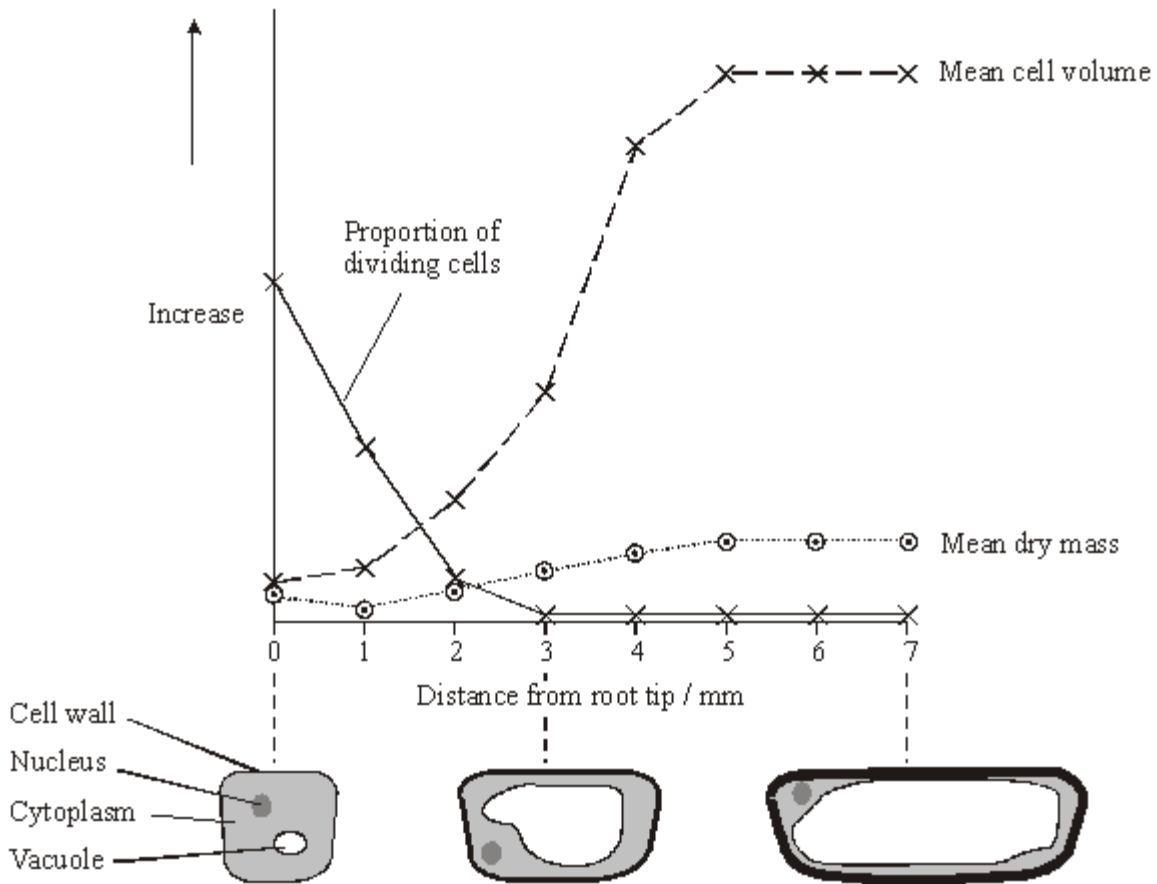
(1)

(Total 3

marks) **S** A large number of roots from many genetically identical bean plants were cut into short

16 pieces. The pieces were sorted into groups, depending upon their distance from the root tip. Some pieces from each group were used to find the mean dry mass of their cells. Thin sections cut from other pieces were examined with a light microscope to find the proportion of dividing cells and the mean volume of the cells.

The graph shows the results. The diagrams below the graph show the appearance of cells in light microscope sections at different distances from the root tip.



(a) Suggest **two** variables, other than genotype, which need to be controlled to ensure similar root growth in different plants. In each case give the reason for your answer.

1. _____

2. _____

(2)

(b) Suggest how the proportion of dividing cells in a thin section could be determined.



(2)

(c) Explain the change in the proportion of dividing cells with increasing distance from the roottip.

(2)

(d) Using the graph and diagrams, suggest how a root tip gets longer.

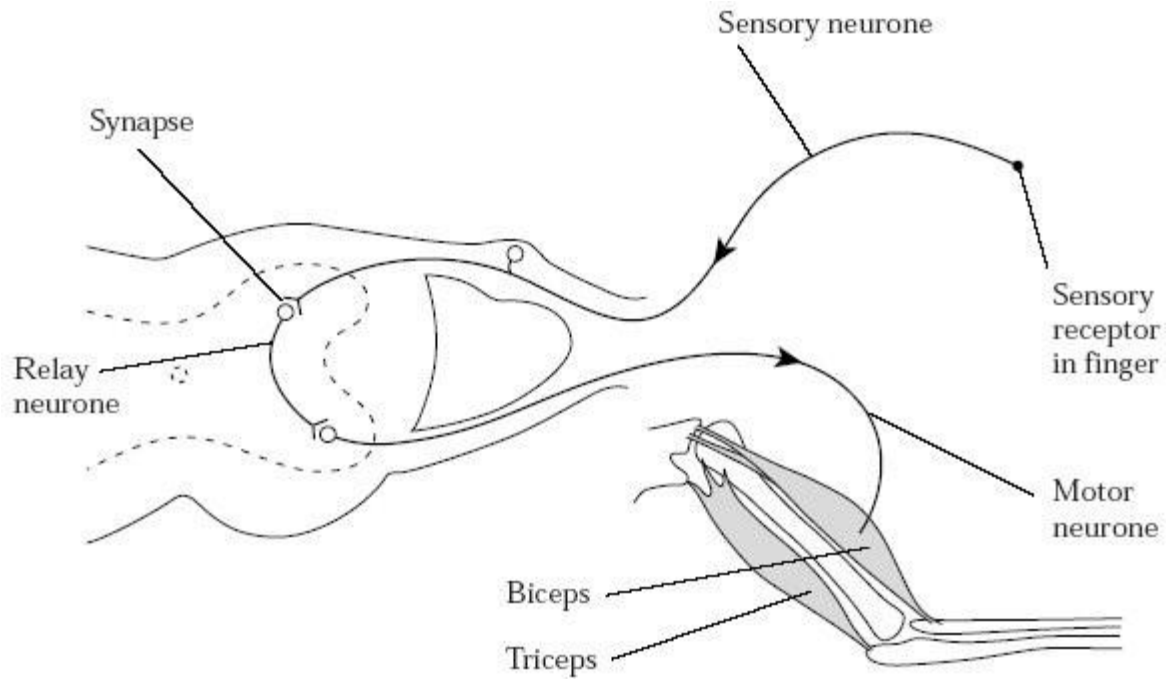
(3)

(Total 9

marks) When a finger accidentally touches a hot object, a reflex action occurs. The biceps muscle

17

contracts, causing the arm to be flexed and the finger is pulled away. The diagram shows the arrangement of the bones in the arm, the muscles used for flexing and straightening the arm and the nervous pathways associated with the contraction of these muscles.



(a) Explain the importance of reflex actions.

(3)

(b) (i) Describe the sequence of events which allows information to pass from one neurone to the next neurone across a cholinergic synapse.



(6)

(ii) Give **two** differences between a cholinergic synapse and a neuromuscular junction.

1. _____

2. _____

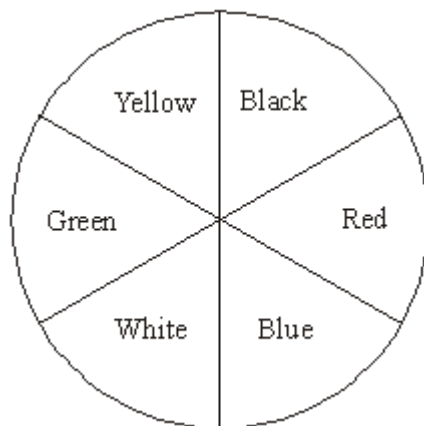
(2)

(Total 11 marks)

18

S In an investigation by a student into the responses of maggots, the bottom of a large box

was marked with six coloured segments, as shown in the diagram.



30 maggots were placed on each segment in the box. A transparent cover was put on the box and light bulbs were positioned so that the segments were evenly illuminated. The

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positions of the maggots were recorded after one hour. The intensity of the light reflected by each segment was measured.

The experiment was repeated three more times. The total number of maggots in each segment from the four experiments is shown in the table.

Colour of segment	Intensity of reflected light / arbitrary units	Total number of maggots
Black	4	154
Red	25	229
Blue	10	178
White	44	47
Green	25	48
Yellow	40	64

- (a) Give **one** conclusion about the responses of maggots which is supported by these results.

Give the evidence from the table for your conclusion.

(2)

- (b) The chi-squared test was used to analyse the data. For the results obtained, suggest **one** null hypothesis which might be analysed by a chi-squared test.

(1)

- (c) It was suggested that the movement of the maggots might have been influenced by the Earth's magnetic field. Suggest **one** simple way of repeating the investigation which would avoid this possibility.



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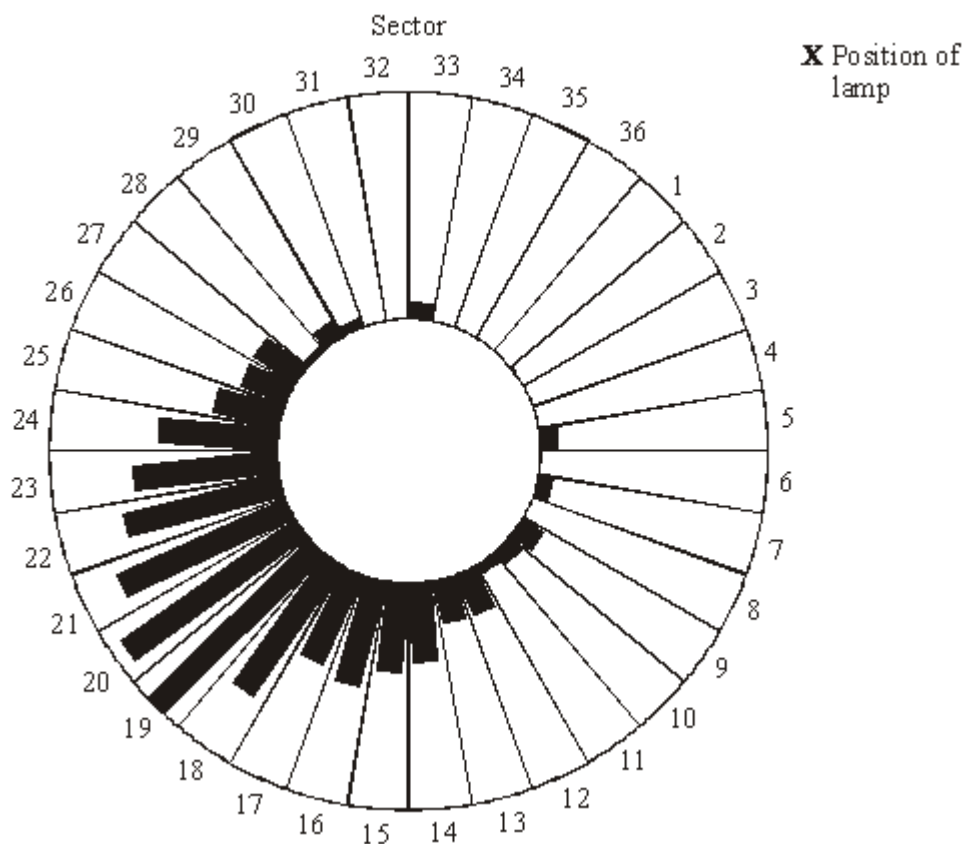
(1)

(Total 4 marks)



19 **S** Students investigated the response of beetle larvae to light. They marked sectors on a large circular sheet of cardboard. A lamp with a 100 W bulb was placed close to the cardboard sheet at position **X**. The larvae were released, one at a time, in the centre of the sheet. The direction in which each larva moved was determined by recording the sector into which it first crawled.

The results of 300 trials are shown in the diagram. The length of the bars indicates the number of larvae moving into each sector.



(a) The students concluded that the larvae respond by moving away from light.

(i) What is the evidence for this conclusion?

(1)

(ii) Suggest **one** precaution that would ensure the response really was due to light.

(1)

(iii) The larvae moved to a wide range of different sectors. Suggest an explanation for this.

(1)

(b) The sector which gave the median result was sector 20. Explain how the median result would be calculated.

(2)

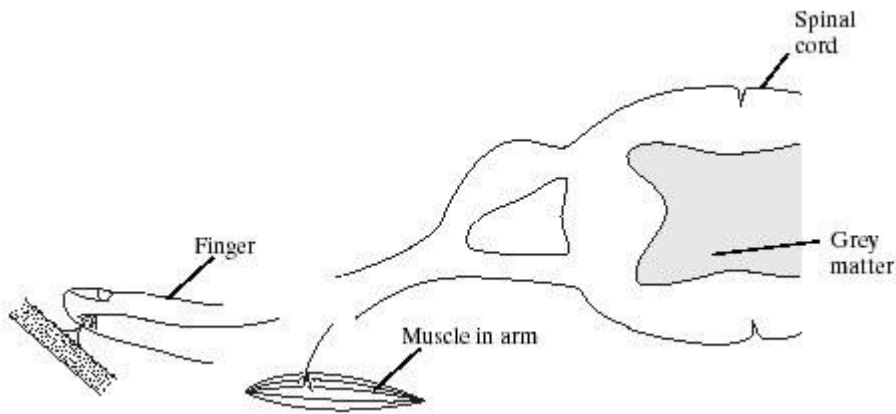
(Total 5 marks)

20

A gardener accidentally pricks a finger on a thorn. She quickly pulls the finger away. This reaction

results from a simple reflex arc involving three neurones.

The diagram shows part of the pathway involved in this reaction.



(i) Complete the diagram to show the rest of the simple reflex arc.

(1)

On your diagram

- (ii) name and label the **three** neurones;
- (iii) label the effector.

(2)

(Total 3 marks)

Mark schemes

1

- (a) 1. Similarity – directional response (to a stimulus) / movement towards / away from a stimulus;
- 2. Difference – taxis (whole) organism moves and tropism a growth (response).
Must be clear which one, taxis or tropism, they are referring to
Taxis occurs in animals / motile organisms and tropism occurs in plants

2

- (b) 1. Grow in direction of / towards (pull of) gravity;
Accept: tropism for growth
Ignore: pulled by gravity
Accept: positively geotropic / gravitropic
- 2. Grow away from salt;
Accept: negatively chemotropic / halotropic 1
and 2. Ignore: references to bends / moves
- 3. Salt has more effect (than gravity).
Accept: converse statement for gravity
Note: all three points may appear in one sentence

3

- (c) 1. More carriers in (cell) **L** / lower in **R**;
*Accept: left for **L** and right for **R** / side nearer salt for **L***
- 2. (So) less IAA in (cell) **L** / more IAA in (cell) **R**;
*Accept: more IAA moves out of **L** / less IAA moves out of **R***
- 3. (So) more (elongation) growth in **L** / less (elongation) growth in **R**.
*Accept: less inhibition of growth in **L** / more inhibition of growth in **R**;*

3

- [8] (a) 1. (Taxis is) movement towards / away from a stimulus / a directional response /
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2

movement (to a stimulus);

- (Move towards) temperature they were used to / cultured in;
Movement towards temperature they were used to = 2 marks

2 max

- (b) 1. Hungry, so seeking food / in absence of food respond to temperature;
Ignore references to temperature and enzymes
Must be stated not inferred from other statements

2. Move towards temperature they were used to / cultured in;

3. Associate (this temperature) with food;
Accept they think food is here
Stated not inferred

4. (Then) stay in this temperature;

3 max

- (c) 1. (Dim) worms live in soil / dark / affected by bright light / dim light is like normal environment / what they are used to;
2. (Even) because worms might move towards / away from bright light / to avoid creating light gradient / prevent worms showing phototaxis / all parts of surface exposed to same light;
Accept to avoid kinesis due to light

3. (Dim light) ensures heat from light not a variable / heat from lamp could kill / dry out worms;
Not just to control variables / factors

2 max

[7] (a) Push – legume

3

Pull – grass;

Both needed for mark

1

- (b) 1. Set up tape measures on two sides of the plot / make grid of plot;
Allow 'Number each plant'. With this approach mp3 cannot be awarded.



2. Use random number table / calculator / generator; Allow 'Select from a hat' idea.

3. To generate coordinates;

3

(c) 1. To prevent competition between the maize and the grass; 2. For light / nutrients / water;

OR

3. Idea of limits movement of pest (between grass and maize);

4. Only eating / damaging grass;

2 max

(d) 1. Nitrogen-fixing bacteria convert nitrogen (in the air) into ammonium compounds (in the soil) which are converted into nitrates / nitrification occurs;

Accept 'ammonia' for 'ammonium compounds'.

2. Maize uses nitrates (in soil) for amino acid / protein / ATP / nucleotide production;

2. Must be in the context of maize.

Ignore ionic formulae unless only these are given.

2

(e) 1. Reduced % damage to maize plants / increased maize grain yield;

2. Calculation to justify mp 1;

3. Standard deviation shows no overlap but need stats to show significance of this difference;

4. More profit / net income / greater income than additional cost (with push-pull);

5. \$322 extra / 408% more / \$401 v \$79 profit;

Accept '\$350 extra income compared to \$28 extra spend'.

Mp5 gains credit for both mp4 and 5

3 max

[11] (a) Three changes described;;;

4

Neutral nucleus shrinks, since it doesn't

Eg



1. Formation / growth of vacuole;
2. Formation of starch grains / amyloplasts;
2. *Accept starch grains get bigger*
3. Movement of grains / amyloplasts towards bottom of cell; *Note – list rule applies*
4. Cells get longer / wider / larger;

3 max

- (b) 1. Grows sideways before starch grains form;

Q

2. Bending starts when / as grains form;
3. More bending as grains increase in number;
3. *Ignore starch grain growth references*
4. More elongation (of cells) / growth (of roots) downwards as starch grains increase / move;
5. Bending starts before grains move down;
6. Could be related to vacuole;

6. *Ignore references to nucleus*

3 max

- (c) 1. (IAA) at bottom of root / where IAA concentration high inhibits expansion / elongation (of cells);

2 and 3 need reference to expansion / elongation, not just growth

2. (IAA) at top of root / where IAA concentration low leads to expansion / elongation (of cells);

2. *Accept less inhibition*

2

[8] (a) 1. (Seedlings) respond to light / are phototropic;

5

Reject: roots are positively phototropic / grow towards light

OR

Neutral: 'to control a variable'

2. (Only) measuring the effect of gravity / response to gravity;

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Neutral: light affects growth / results

1

- (b) 1. (Cells in) root tip detect gravity / respond to gravity;
Must refer to root tip and not just the root

OR

2. IAA / auxin is produced in the root tip;

1

- (c) (i) 1. IAA / auxin moves to lower side / more IAA / auxin on lower side;
Accept: references to 'cell elongation' instead of 'growth'
2. Lower side grows less / slower / upper side grows more / faster / inhibits growth on lower side;
Note: if auxin is placed at upper side, mark point 2 can still be awarded
Need idea of 'less / slower' or 'more / faster' for mark point 2

2

- (ii) 1. Less IAA / auxin (produced);
2. Lower side grows more / faster / less inhibition of growth on lower side;
Must refer to the lower side

2

[6] (a) Diffusion;

6

Ignore references to simple / facilitated
Accept active transport

1

- (b) 1. Causes plant to bend / grow towards light / positive phototropism;
2. (Light) required for photosynthesis;

2

- (c) 1. More kinetic energy / faster movement of molecules;
2. More diffusion;
Ignore references to opening stomata.
Answer should be in context of more but comparative statement only necessary once.

2



- (d) (i) 1. Thick cuticle on upper surface / thin cuticle on lower surface / few stomata on upper surface / no stomata on upper surface;
2. More diffusion / shorter diffusion pathway (on lower surface);
1. *Ignore cuticle only on upper surface. Ignore references to more or less waxy.*
2. *If candidate writes about stomata accept ref to greater area for diffusion.*

2

- (ii) Different species have different (qualified) properties;
- Eg cuticle thickness*
- Leaf size*
- Number of stomata*

1

[8]

7

- (a) 1. Gives rise to new plants / plantlets;
2. So must be able to develop into different tissues / other specialised cell types / differentiate;
1. *Ignore references to leaves / callus*

2

- (b) Two marks for 5 : 1/50 : 10/1 : 0.2;;
- One mark for ratio correctly identified but expressed incorrectly as 1 : 5 / 10 : 50 / 0.2 : 1;*

2

- (c) (i) 1. Meiosis / independent assortment / crossing over;
2. (Fusion of) genetically different gametes / random fertilisation;
- (ii) Will be clones / produced by mitosis / will be genetically identical / less variation / all plants will have desired characteristics;
- If the reference is to identical must be genetically identical, but allow less variation without the reference to genetical.*

2

1

[7]

-] (a) Decrease (woodlice turning in opposite direction to forced turn with increasing distance

8



between turns) then more rapid decrease;

(Rapid decrease) when distance between turns is 9cm / 80% woodlice turning in opposite direction;

Accept 'after 9cm' or between 9 and 10cm' but not at 10cm

2

(b) No (no mark)

Equal numbers / 50% turn each way;

(Would expect this) by chance / at random;

2

(c) 1. Keep distance same;

2. Increase time / delay woodlice / decrease speed of woodlice

3. (Increase time) between forced and second turns;

Allow one mark for measure time taken for stated / set distance

3

(d) Short distances result in more (woodlice showing) turn alternation;

Keeps woodlice going in one direction / stops them going round in circles;

2

[9]

9

(a) Time to establish humidity to that required / time for substance to absorb water;

So that behaviour typical of humidity;

Woodlice no longer affected by handling;

Allow acclimatisation idea

2 max

(b) Correlation does not show causal link;

May be due to other factors / named factor;

Do not accept casual

2 max

(c) 1. It is a line of best fit;

2. Variation in woodlice / a named difference in woodlice;

E.g. age, species, sex



- 3. Variation in environmental conditions / change in a named environmental condition;

E.g. Temperature / vibration / sound / light

3

[7] (a) 11.1;;

10

Allow one mark for calculating loss in mass as 0.02g and calculating a percentage;

Accept 11.11 / 11 but not 11.0

2

- (b) 1. (More mass loss) linked to losing more water;
- 2. Gills (more) exposed to air / covered (less) by other woodlice so greater surface area (exposed);
- 3. (Not clumped) so lower humidity (around each woodlouse) so greater evaporation / diffusion (of water);

Assume 'They' refers to woodlice in group B

3

- (c) Initial masses different;

1

[6] Low humidity results in more woodlice moving;

11

So increased movement increased chance of leaving dry / unfavourable environment so reduce water loss / reduce evaporation;

[2]

- (a) (i) Taxis;

12

Ignore references to positive and negative, and prefixes such as photo-

Accept taxes / tactic

Allow phonetic spelling

1

- (ii) Moves towards stimulus / towards light;

Direction must be correct.

1 (b) Gravity;

Antennae involved;



Doesn't show light is involved / doesn't respond to light as they are unable to see / as eyes are covered;

Accept geotaxis

3

(c) Helps them to leave the soil / ground / reach the surface;

Disperse / produce new colonies;

Avoid competition;

2 max

[7] (a) Recognition of same species;

13

Stimulates release of gametes;

Recognition of mate / opposite gender;

Indication of sexual maturity / fertility;

2 max

(b) (i) Internal fertilisation / fertilisation occurs in pouch / limited area;

Q The term fertilisation is not required in the answer but must be implied.

1

(ii) Protection from predators (developing in pouch);

1

(c) (i) Less stress caused to seahorse / quicker / more accurate method / body is curved / head is linear;

Q Do not accept "easier" unless qualified.

1

(ii) Head length proportional to body length / or described;

1

(d) Positive correlation between head / body lengths of male and female / female and male with similar head / body lengths pair together;

1

(e) Use line of best fit;

And extrapolate / extend line as required;

2

(f) (Compare) DNA;

Sequence of bases / nucleotides;

Compare same / named protein;

Sequence of amino acids / primary structure;

Immunological evidence – not a mark

Inject (seahorse) protein / serum into animal;

(Obtain) antibodies / serum;

Add protein / serum / plasma from other (seahorse) species;

Amount of precipitate indicates relationship;

Q The marks awarded for reference to DNA and sequence of bases / nucleotides must be in a different context to DNA hybridisation.

6 max

[15] (a) kinesis;

14

(ignore 'ortho-' / 'klino-', allow 'thermo-', reject 'photo-' / 'chemo-' / etc)

random movements = 1 mark, eg

/ degree of turning / number of turns depends on strength of stimulus / on temperature / allow specific ref. to more turning at 35° than at 30° / non-directional stimulus / response;

ignore 'speed'

2

- (b) stays longer in warmer area / at 35° / tends to leave cooler area / to leave 30° / stays in favourable conditions ;

remains near food source / on host;

2

[4]

- (i) kinesis;

15

movement is random / rate of turning changes / does not move towards / away from light;

2

- (ii) advantage related to light / shade; e.g. remains in shade so avoids predators

1



[3] (a) two environmental or developmental variables and explanation;

16

examples,

all plants of the same age, so same time for cell divisions / differentiation; all plants given the same watering, so same amount of water for cell expansion;

(reject reference to photosynthesis) all plants given same light, so same rate of photosynthesis; same temperature, so enzymes / named metabolic process at optimum temperature; same named ion / minerals in soil (e.g. nitrate), so same available for a named function, (e.g. amino acid / protein synthesis);

2 max

(b) count cells using microscope; count number of cells in cell division / where chromosomes visible; and then the total number of cells in field of view;

2 max

(c) only cells at tip have ability to divide / cells further back don't divide; cells further back differentiating / named example of *(accept reference to loss of totipotent cells)* differentiated tissue / too old / reduction in plant hormone; cell wall too thick / vacuole too large to allow division;

2 max

(d) new cells added at tip; cells increase in volume / larger; increase in length (of cells); as vacuoles get larger; due to uptake of water (by osmosis);

3 max

[9]

17

(a) 1. automatic (adjustments to changes in environment) / involuntary;

2. reducing / avoiding damage to tissues / prevents injury / named injury e.g. burning;

3. role in homeostasis / example;

4. posture / balance;

5. finding / obtaining food / mate / suitable conditions;

6. escape from predators;

(ignore 'danger' or 'harm' unless qualified)

3 max

(b) (i) 1. (impulse causes) calcium ions / Ca^{++} to enter axon;

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2. vesicles move to / fuse with (presynaptic) membrane;
3. acetylcholine (released);
4. (acetylcholine) diffuses across synaptic cleft / synapse;
5. binds with receptors on (postsynaptic) membrane;
(reject active sites, disqualify point)
6. sodium ions / Na⁺ enter (postsynaptic) neurone;
7. depolarisation of (postsynaptic) membrane;
8. if above threshold nerve impulse / action potential produced

6 max

- (ii) neurone to neurone and neurone to muscle; action potential in neurone and no action potential in muscle / sarcolemma; no summation in muscle; muscle response always excitatory (never inhibitory); some neuromuscular junctions have different neurotransmitters; *(penalise 'nerve' once)*

2 max [11]

- (a) *one mark for conclusion:*

18

maggots move to / respond to / prefer / like / red rather than green;
(reject 'most prefer red')

maggots move to / prefer / like areas of lower light intensity (except green);
maggots respond more to colour than light intensity / do not respond to differences in light intensity;
(reject conclusion relating to single result)

one mark for: evidence

matching conclusion:

more in red than green, but light intensity the same; more in segments with lower light intensity; more differences in different colours, little difference in light intensity; large difference in number of maggots on segments with 25 a.u. light intensity;

2 max

- (b) valid statement expressed as null hypothesis, i.e. in negative form, e.g. no difference in response to different colours / light intensities;

(must relate to a possible hypothesis)

1

- (c) rotate box (so segments in different direction) / change order of coloured segments;
place magnets around box / create alternative magnetic field;

1 max



[4] (a) (i) majority of larvae move to sectors on opposite side to lamp;

19

(reject largest number / most in sector 19)

1

(ii) use heat filter in front of lamp (*allow lamp not too close*); rotate card and lamp to eliminate magnetic field; alter direction of larval head when releasing;

(reject general references to keeping variables constant)

1 max

(iii) wide beam from lamp; variability of organisms; positioning of larvae variable;

1 max

(b) idea of middle value; method of determining middle value in rank order, e.g. sector in which 300 / 2 occurs;

2

[5] (i) arc shows 3 neurones;

20

(3 distinct neurones, one of which is in the grey matter, with correct route through dorsal and ventral roots and indication of synapses. Ignore position of cell bodies.)

1

(ii) neurones labelled sensory, relay / intermediate, motor;

1

(iii) muscle labelled as effector;

1

[3]