IB · HL · Biology

2 hours 13 questions

Structured Questions

Integration of Body Systems

Integration in Living Organisms / The Nervous System / Reflex Arc & Movement Control / Epinephrine & Melatonin / Control Mechanisms / Observing Tropic Responses: Skills (HL) / Phototropism (HL) / Plant Hormones (HL) / Regulating Plant Growth & Fruit Ripening (HL)

Easy (3 questions)	/17
Medium (4 questions)	/23
Hard (6 questions)	/56
Total Marks	**/96**

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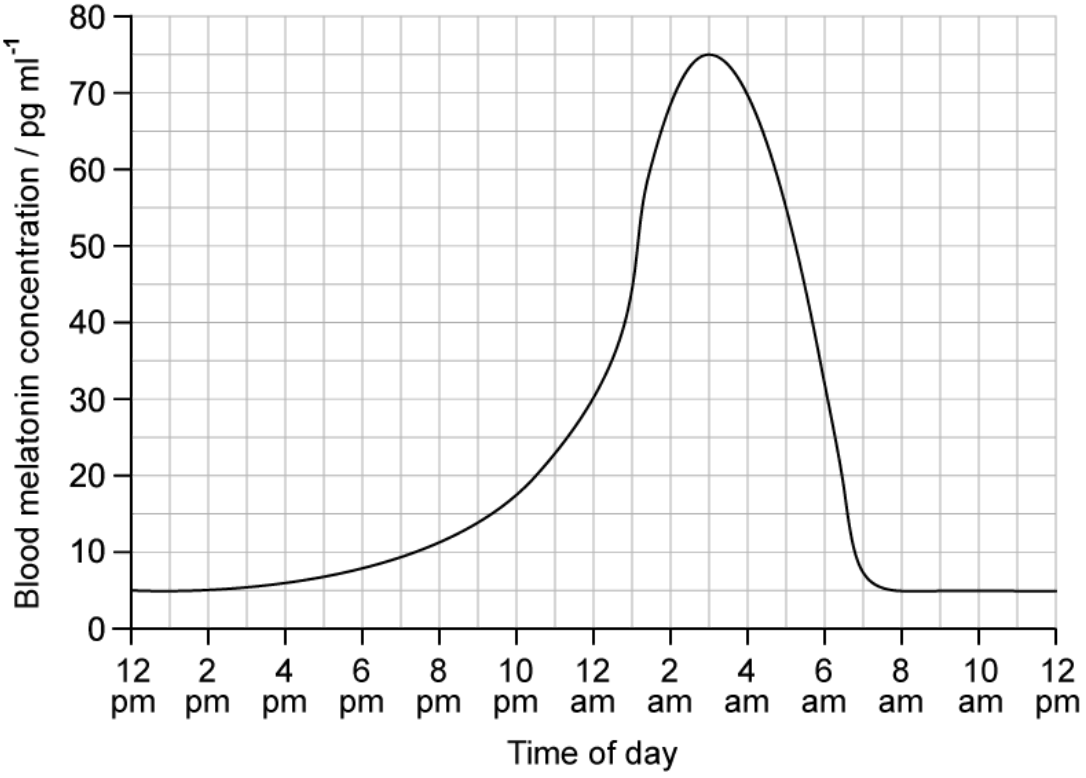
Easy Questions

1 (a) The graph below shows changes in levels of the hormone melatonin over a 24-hour period. Blood melatonin concentration is measured in picograms per ml.



Calculate the percentage increase in melatonin concentration between 2 pm and 12 am.

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(2 marks)

(b) Identify **one** physiological changes that would occur between 2 pm and 3 am in the body of an individual with the melatonin levels shown in part a).

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(1 mark)

(c) Another hormone is thyroxin.

Identify the gland that secretes thyroxin.

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(1 mark)

(d) Outline the part played by thyroxin in regulating body temperature.

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(2 marks)

2 (a) State the meaning of the term **tropism**.

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(2 marks)

(b) (i) Identify the tropic response of a plant to light.

[1]

(ii) Outline the benefit to the plant of the tropism identified in part i).

[2]

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(3 marks)

3 (a) Outline the role of auxin in the shoot response to light.

(3 marks)

(b) The diagram below lists three different phytohormones and their effects.

Using straight lines, join each phytohormone to its main effect.

Phytohormone	Effect
abscisic acid	promotes fruit ripening
cytokinins	suppresses plant growth
ethylene (ethene)	increase rate of cell division

(3 marks)

Medium Questions

1 (a) Outline how peristalsis ensures one way movement of food through the alimentary canal.

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(2 marks)

(b) An increase in blood CO_2 concentration was detected in the chemoreceptors of a person's medulla.

(i) State how this change in CO_2 concentration is detected.

(ii) This change caused the person's breathing rate to increase by 38.5% up to 18 breaths per minute.

Calculate the person's breathing rate before the increase in blood CO_2 concentration. State your answer to the nearest whole number.

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(3 marks)

2 (a) Describe the response the tip of a shoot would show if it received light from one side only.

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(2 marks)

(b) Explain the reasons for the response you indicated in part (a).

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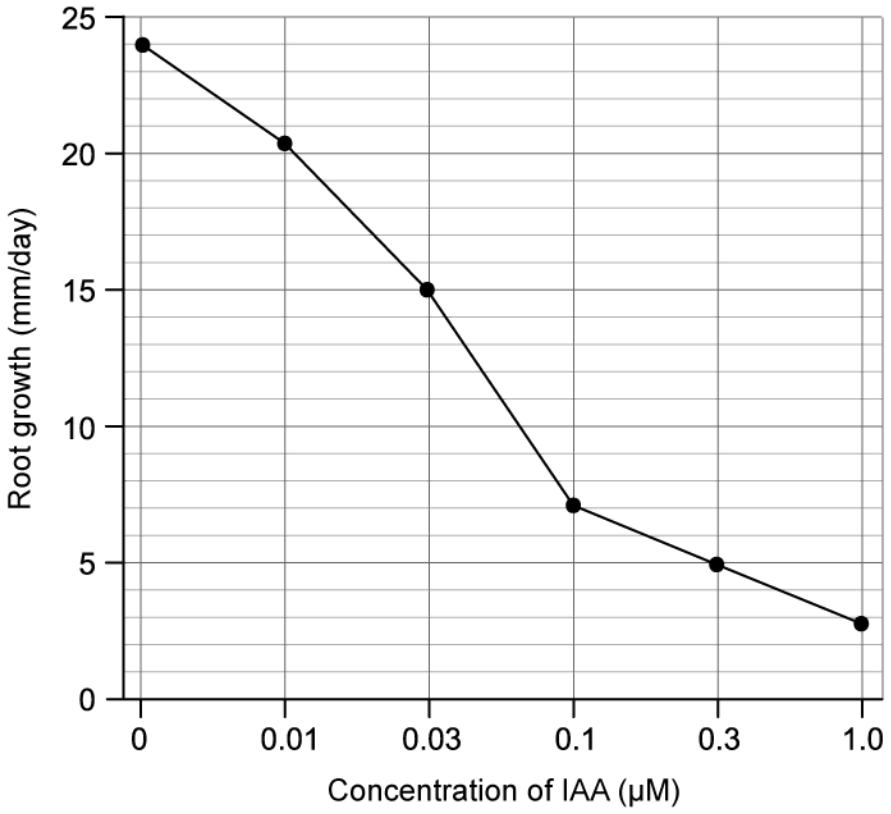
(2 marks)

3 (a) Indole-3-acetic acid (IAA) is a common auxin that affects the growth of plants. An investigation was done to determine the effect of different concentrations of IAA on the growth of young roots. The results of this investigation are shown in the graph.



State the conclusion that can be drawn from these results.

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(1 mark)

(b) Contrast the root growth observed at IAA concentrations of 0.03 μM and 0.3 μM.

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(2 marks)

(c) Calculate the rate of root growth per hour when roots are **not** exposed to IAA from the graph in part a).

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(2 marks)

(d) Explain the importance of gravitropism in roots.

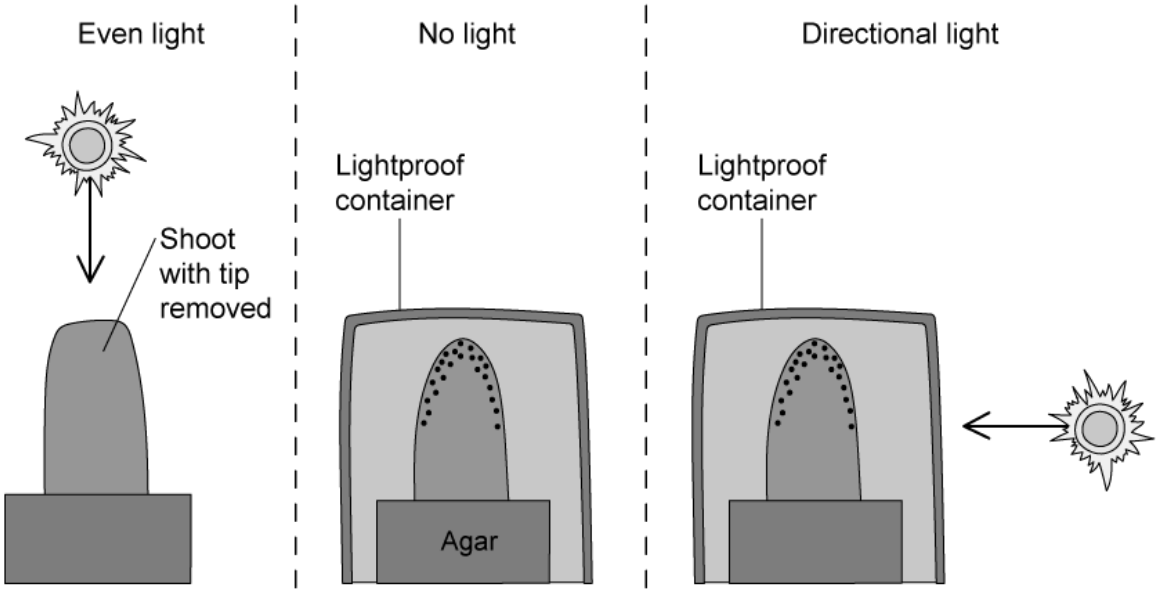
(2 marks)

4 (a) In an investigation to test the effect of auxin on shoot growth in seedlings, three different experiments were set up:

Group A = Shoot with the tip removed.

Group B = Shoot has been covered in a light proof container.

Group C = Shoot was grown under a directional light source.



Contrast the growth that would be seen in **group A** and **group B**.

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(1 mark)

(b) Explain how directional light in **group C** from the experiment in part a) will affect growth in the shoot.

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(3 marks)

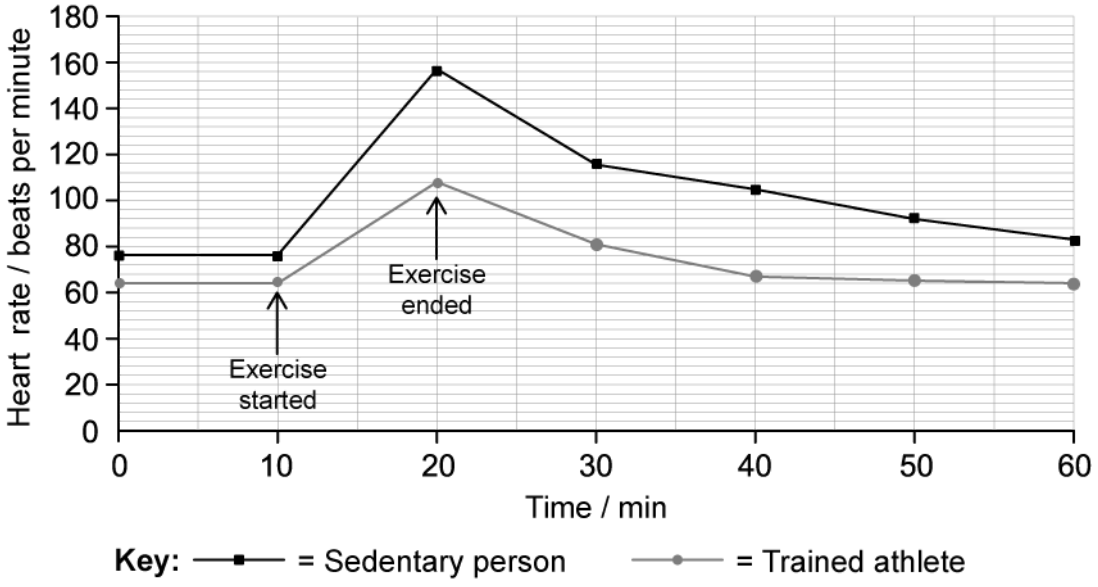
(c) Explain how being unable to respond to light stimuli would lead to reduced growth in a plant.

(3 marks)

Hard Questions

1 (a) A group of students investigated the effect of a person's fitness level on the heart rate before, during and after exercising. They measured the resting heart rate of an unfit person leading a sedentary lifestyle and that of a trained athlete. After monitoring their resting heart rate for 10 minutes, both participants were asked to run for a period of 10 minutes. Their heart rates were monitored during this time by a heart rate monitor that was attached to their wrists. After exercising, their heart rates were monitored for a period of 40 minutes.

The results of this investigation is shown in the following graph.



Contrast the results of the two participants.

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(3 marks)

(b) Explain the mechanisms that caused the change in heart rate that was observed after the exercise ended.

(3 marks)

(c) The group of students concluded that an increased fitness level enables the heart to recover more quickly after exercise.

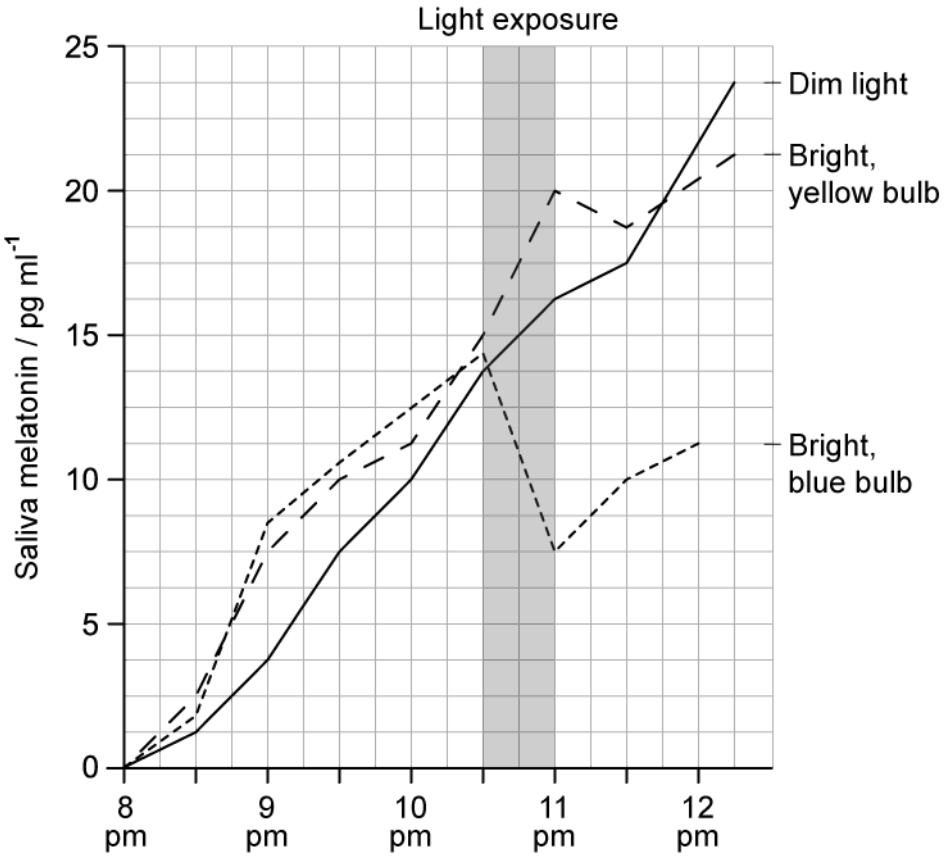
Evaluate the conclusion of the students.

(3 marks)

2 (a) A group of scientists studied the effect of exposure to bright bathroom lights late in the evening on melatonin levels. Subjects attended a sleep clinic where they were allocated to three different light exposure groups; dim light, bright yellow light, and bright blue light.

Over the course of a week, all of the subjects spent most of each evening carrying out normal activities under dim light, before each group was exposed to a 30 minute period of either continuing dim light, bright yellow light, or bright blue light between 10:30 and 11 pm to simulate exposure to bathroom light.

The saliva melatonin levels of all groups were measured at 30 minute intervals throughout the evening and an average is taken for each light condition. The results are shown below.



Describe the effect of the 30-minute period of light exposure on melatonin levels.

(3 marks)

(b) A student was changing the light bulb in their bathroom and concluded, after reading the data in part a), that the best bulb type for improving their sleep would be a bright, yellow bulb.

Evaluate the student's conclusion using information from part a).

(3 marks)

(c) One of the roles of melatonin is to bind to cell membrane receptors on pancreas cells and slow down the secretion of insulin.

(i) Describe the effect that the binding of melatonin to receptors on pancreas cells will have on the body.

[2]

(ii) Suggest a benefit of the effect described in part i) during the period at which melatonin levels are high.

[1]

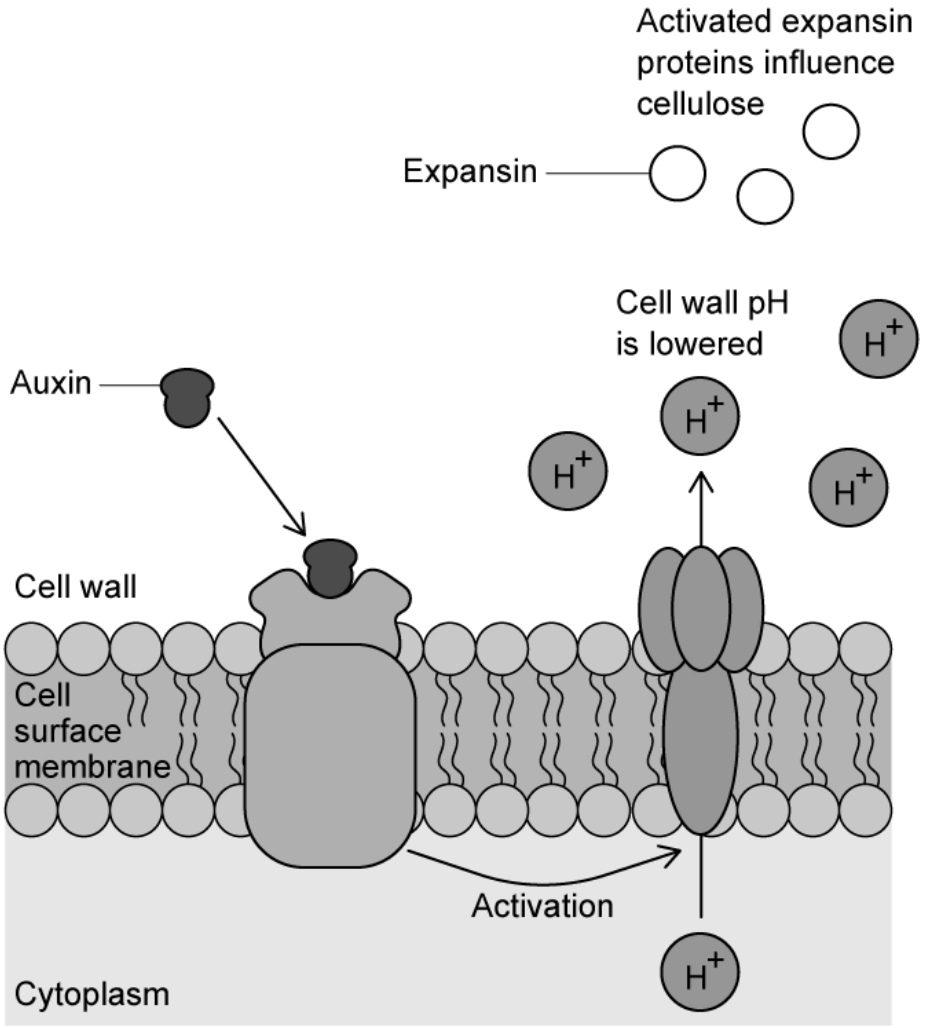
(3 marks)

(d) A mutation known as the G allele has been identified in some individuals. The G allele is thought to increase the sensitivity of cells to melatonin. Individuals who regularly undertake shift work at night and who also have the G allele are thought to be at particularly high risk of diabetes.

Use the information provided in parts c) and d) to suggest why individuals with the G allele who regularly work night shifts are thought to be at greater risk of type 2 diabetes.

(2 marks)

3 (a) The diagram below illustrates a theory of auxin action known as the acid growth hypothesis. In the acid growth hypothesis plant cell wall rigidity is reduced, allowing plant cells to expand and therefore elongate.



Suggest how activated expansin proteins could reduce the rigidity of plant cell walls.

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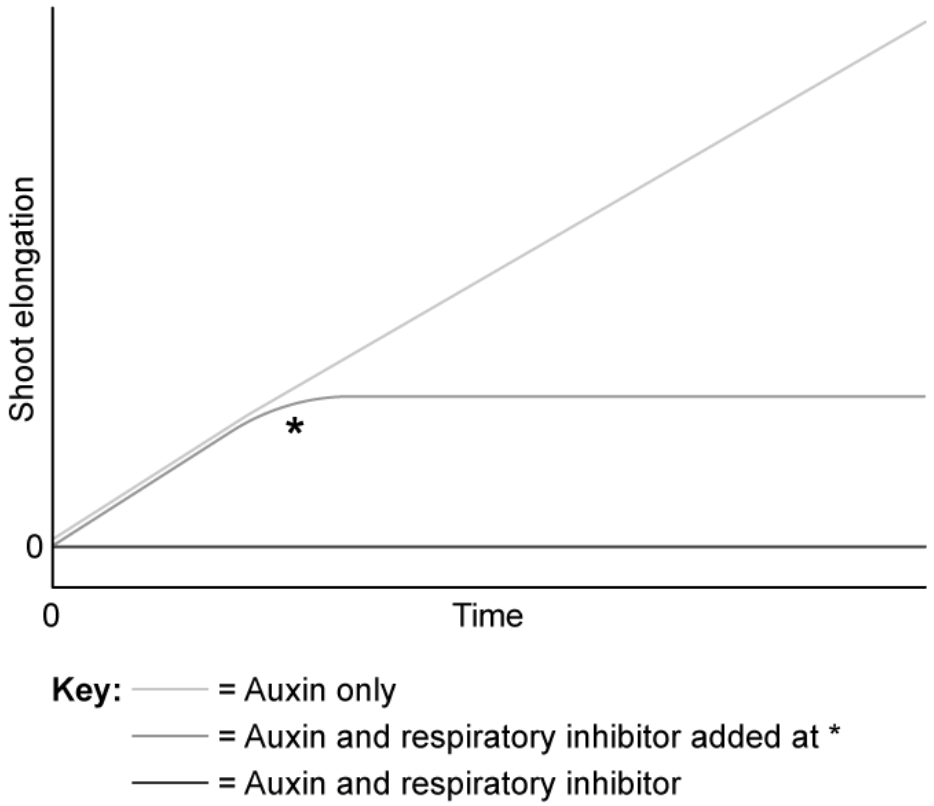
(2 marks)

(b) An investigation was carried out into the effect of a respiratory inhibitor on the elongation of wheat seedling shoots. The results of the study are shown in the graph below.



(i) Identify, with a reason, the condition that functions as an experimental control.

[2]

(ii) Use information provided in part a) to explain the results for the seedlings in the presence of auxin alone. Note that marks will not be awarded for content relating to the effect of expansins.

[3]

(5 marks)

(c) Suggest an explanation for the effect of the respiratory inhibitor in the graph in part b).

(2 marks)

(d) It is thought that auxin activates proton transporters by increasing expression of a gene from a group of genes known as the *SAUR* genes.

(i) Identify **one other** gene where expression is thought to be influenced by auxin. Note that you do not need to name the gene itself.

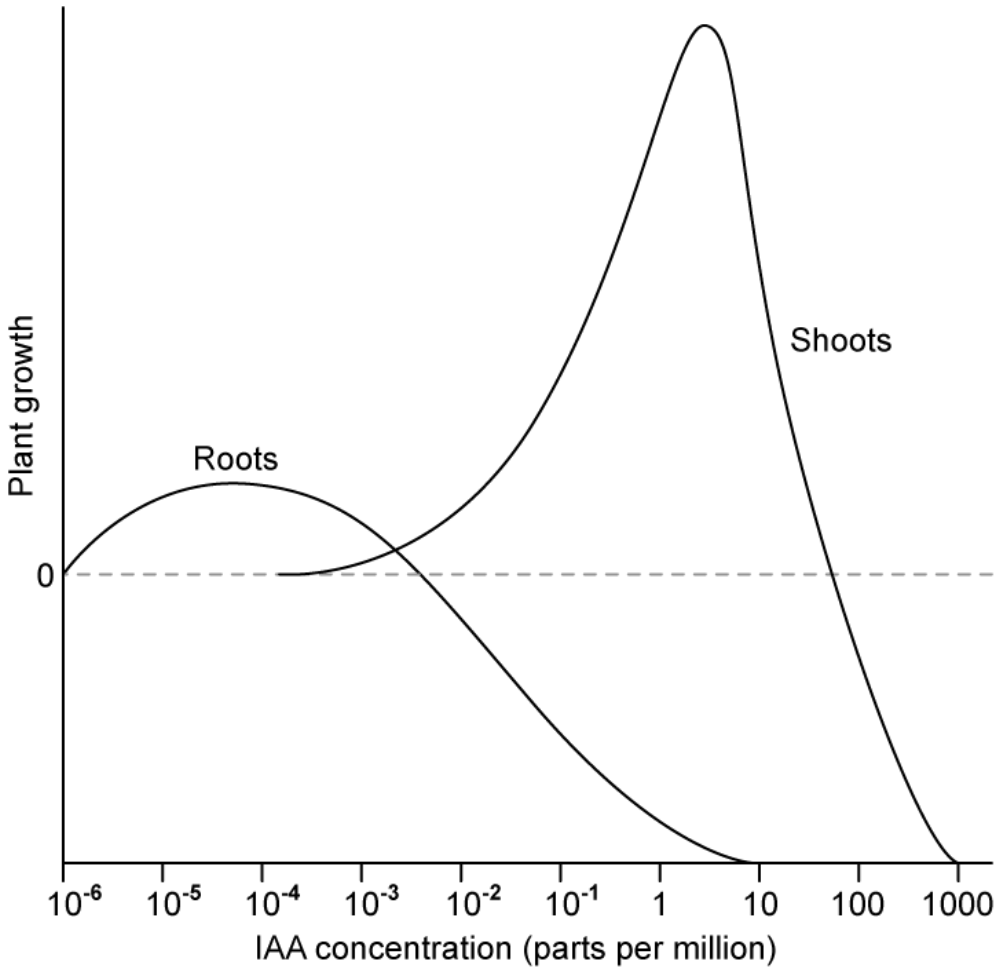
[1]

(ii) Outline the role of the proteins for which the gene identified in part i) codes.

[2]

(3 marks)

4 (a) The graph below shows the effect of increasing auxin concentration on the growth of plant roots and shoots. Note that auxin is also known as IAA.



Describe the effect of increasing auxin concentration on the growth of plant **shoots** shown in the graph.

(3 marks)

(b) Use the graph in part a) to suggest a possible auxin concentration for the following parts of a plant. Note that your value readings should be given to the nearest accurate value on the scale provided.

(i) The shaded side of a shoot.

[1]

(ii) The lower side of a root.

[1]

(iii) The upper side of a root.

[1]

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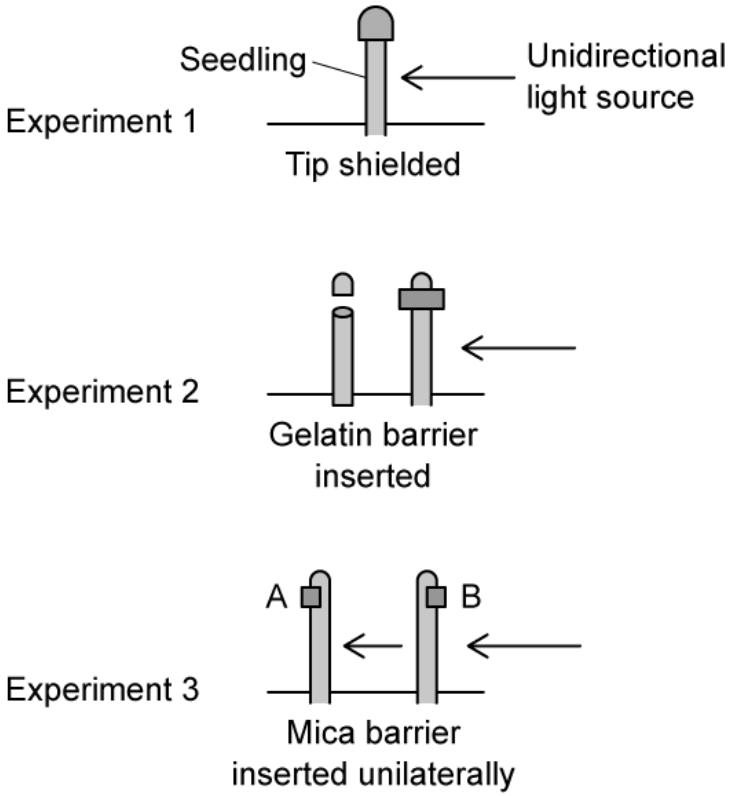
(3 marks)

5 (a) Current knowledge of plant tropisms has been gained from multiple experiments carried out on plant seedlings. For example, early experiments showed that a plant growth influence (now known as auxin) was produced in the growing tip of seedlings. The image below illustrates three more experiments. Note that gelatin is a permeable material while mica is impermeable.



Identify **three** control variables that would be required to ensure valid results from all of the experiments shown.

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(3 marks)

(b) Predict, with a reason, the seedling growth that would be seen in each of the following experiments shown in part a):

(i) Experiment 1

[1]

(ii) Experiment 2

[1]

(iii) Experiment 3A

[1]

(iv) Experiment 3B

[1]

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(4 marks)

(c) State **two** possible conclusions about phototropism that can be drawn from the experiments shown in part a).

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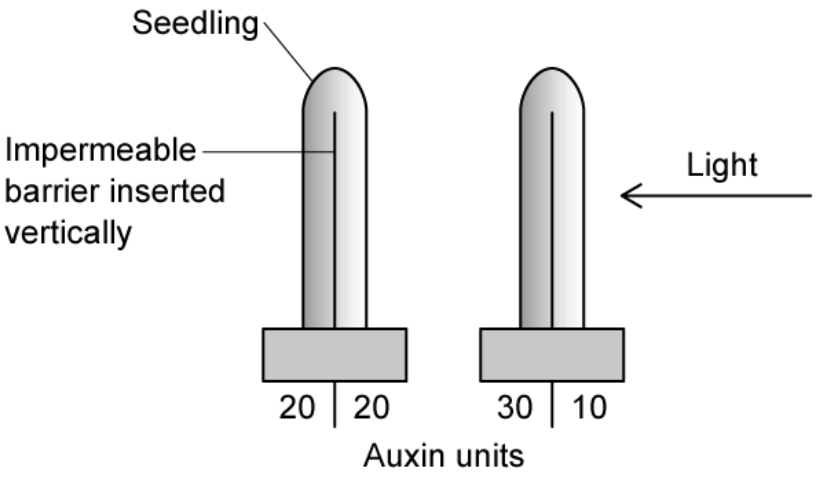
(2 marks)

(d) A fourth experiment was set up as shown below.



(i) Predict the growth of the seedling in this experiment.

[1]

(ii) Identify **one** additional conclusion that can be drawn from this experiment that can **not** be drawn from experiments 1-3 in part a).

[1]

(2 marks)

6 Compare and contrast animal and plant hormones.

(7 marks)