

9.3 Growth in Plants

Question Paper

Course	DP IB Biology
Section	9. Plant Biology (HL Only)
Topic	9.3 Growth in Plants
Difficulty	Hard

Time allowed: 80
Score: /60
Percentage: /100

Question 1a

a)
The microscope image below shows a cross section of part of a stem of a herbaceous (non-woody) plant.

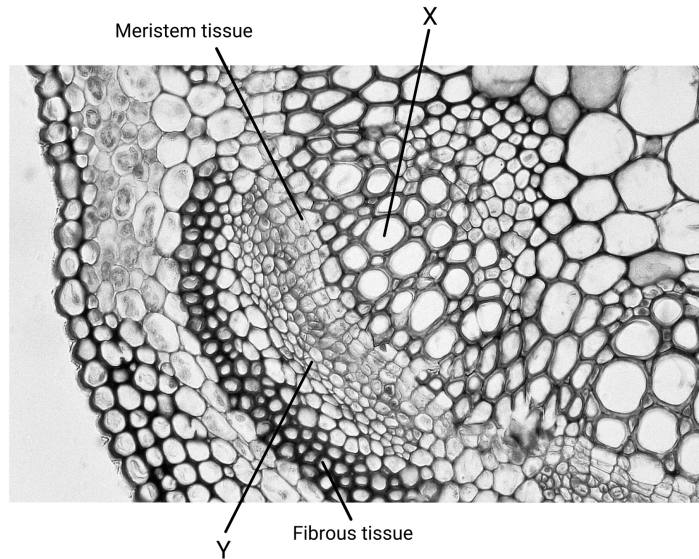


Image courtesy of Berkshire Community College Bioscience Image Library. Adapted and redistributed under a Creative Commons CC0 1.0 Universal Public Domain Dedication license under conditions found at <https://creativecommons.org/publicdomain/zero/1.0/deed.en>

Identify tissue types **X** and **Y** in the image.

[2 marks]

[2 marks]

Question 1b

b)
The region of tissue between structures **X** and **Y** in the image in part a) is a type of meristem tissue.

i)
Identify the meristem tissue in part a).

ii)
State **two** roles of the meristem identified in part i).

[3 marks]

Question 1c

c)

The fibrous tissue shown in the image in part a) is known as sclerenchyma tissue, and has an important structural role in plants. Other tissue types include parenchyma, sometimes known as pith, which is involved with photosynthesis and storage, and collenchyma, which also has a structural role.

Describe how this range of different tissue types can arise in plants. Avoid repetition of ideas covered in part b).

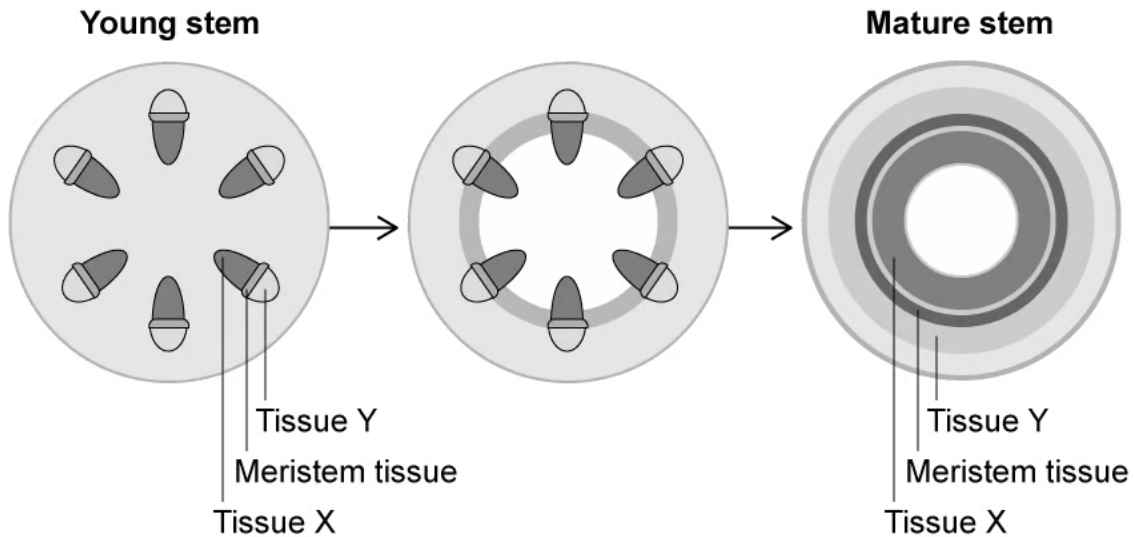
[3 marks]

[3 marks]

Question 1d

d)

The stem section shown in the image in part a) is taken from a young plant stem. The diagram below shows how the arrangement of tissue in a plant stem can change as the stem matures. Some of the tissues shown in part a) are also labelled below for comparison.



The change in tissue arrangement is in part triggered by increased expression of a gene known as HCA2, which codes for a transcription factor.

i) Suggest how increased expression of HCA2 might alter the distribution of tissue within the plant stem.

[3 marks]

ii) Suggest how scientists could determine the expression levels of HCA2 at any given stage in a plant's life cycle.

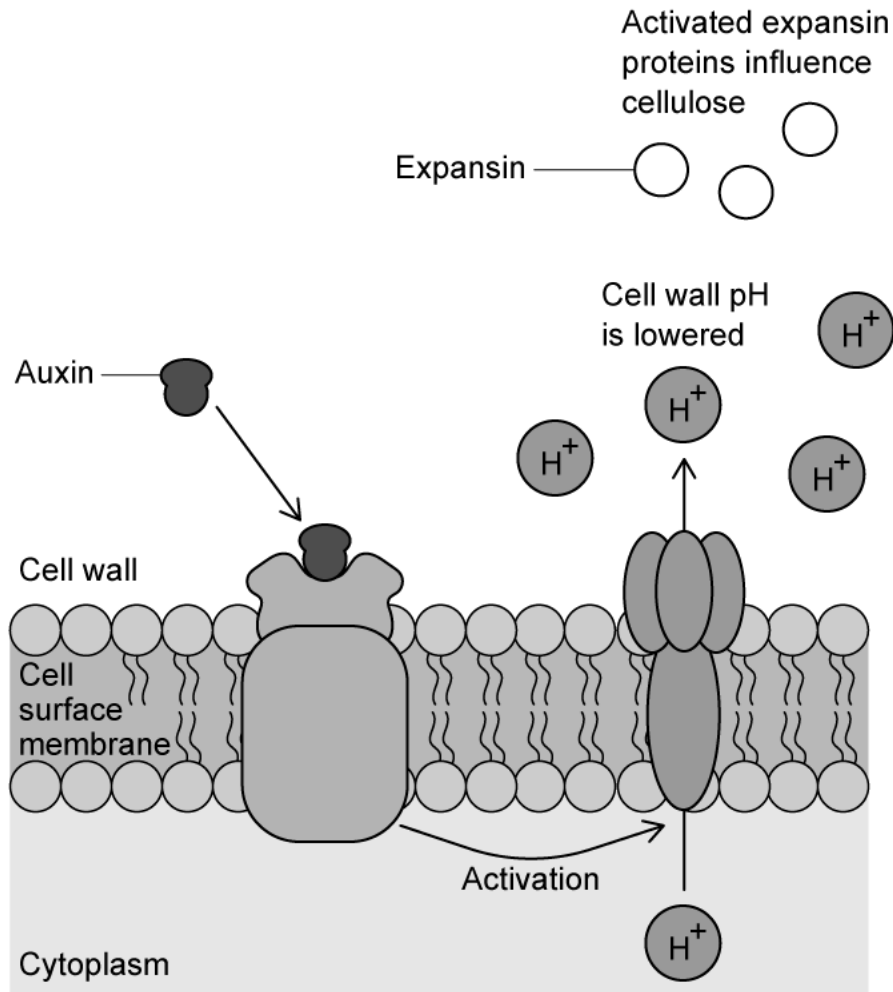
[2 marks]

[5 marks]

Question 2a

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.

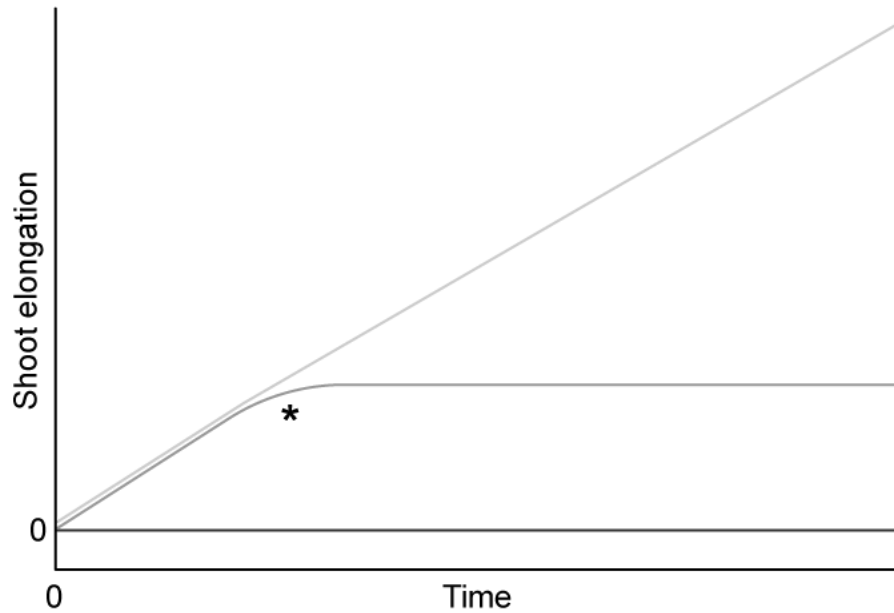
[2 marks]

[2 marks]

Question 2b

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.



Key: — = Auxin only
 — = Auxin and respiratory inhibitor added at *
 — = Auxin and respiratory inhibitor

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

[2 marks]

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 marks]

[5 marks]

Question 2c

c)

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

[2 marks]

[2 marks]

Question 2d

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 mark]

ii)

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

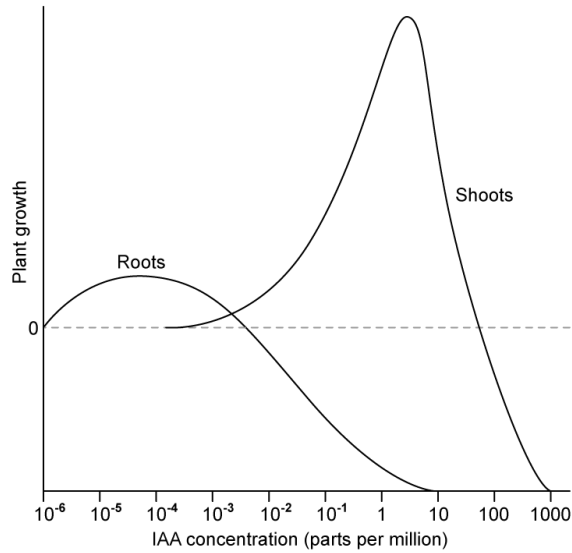
[2 marks]

[3 marks]

Question 3a

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]

[3 marks]

Question 3b

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 mark]

ii)

The lower side of a root.

[1 mark]

iii)

The upper side of a root.

[1 mark]

[3 marks]

Question 3c

c)

As implied by the questions in part b) there is often an auxin concentration gradient across a plant stem or root.

Explain how light falling on one side of a plant shoot can generate an auxin gradient across that shoot.

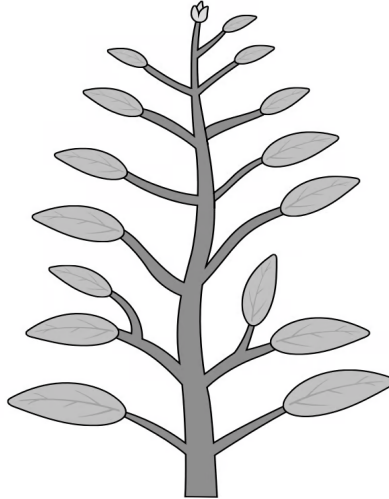
[3 marks]

[3 marks]

Question 3d

d)

In addition to regulating shoot and root elongation, auxin is involved with other aspects of plant growth. The image below shows the appearance of a plant that has been influenced by auxin.



Explain how auxin and any other relevant plant hormones can cause the plant appearance shown in the image.

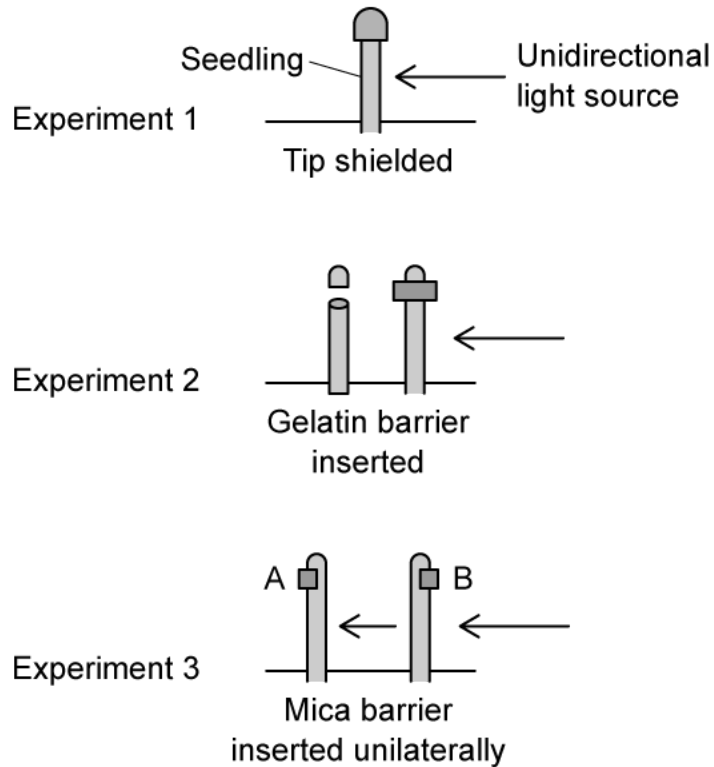
[3 marks]

[1 mark]

Question 4a

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.

[3 marks]

[3 marks]

Question 4b

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 mark]

ii)
Experiment 2 [1 mark]

iii)
Experiment 3A [1 mark]

iv)
Experiment 3B [1 mark]

[4 marks]

Question 4c

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

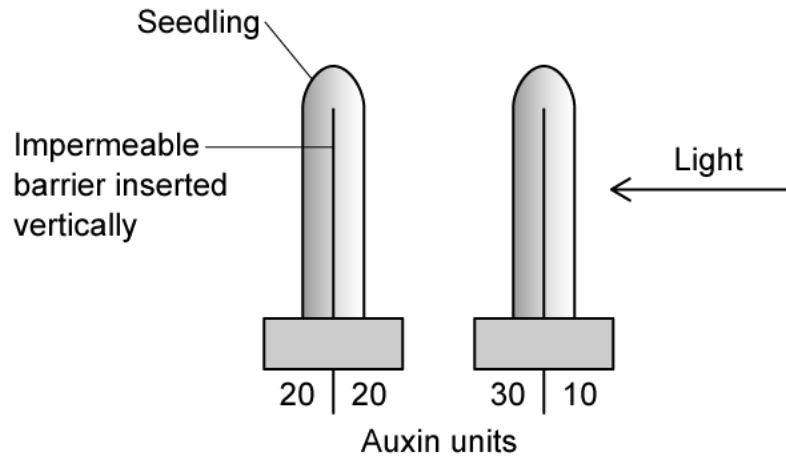
[2 marks]

[2 marks]

Question 4d

d)

A fourth experiment was set up as shown below.



i)

Predict the growth of the seedling in this experiment.

[1 mark]

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 mark]

[2 marks]

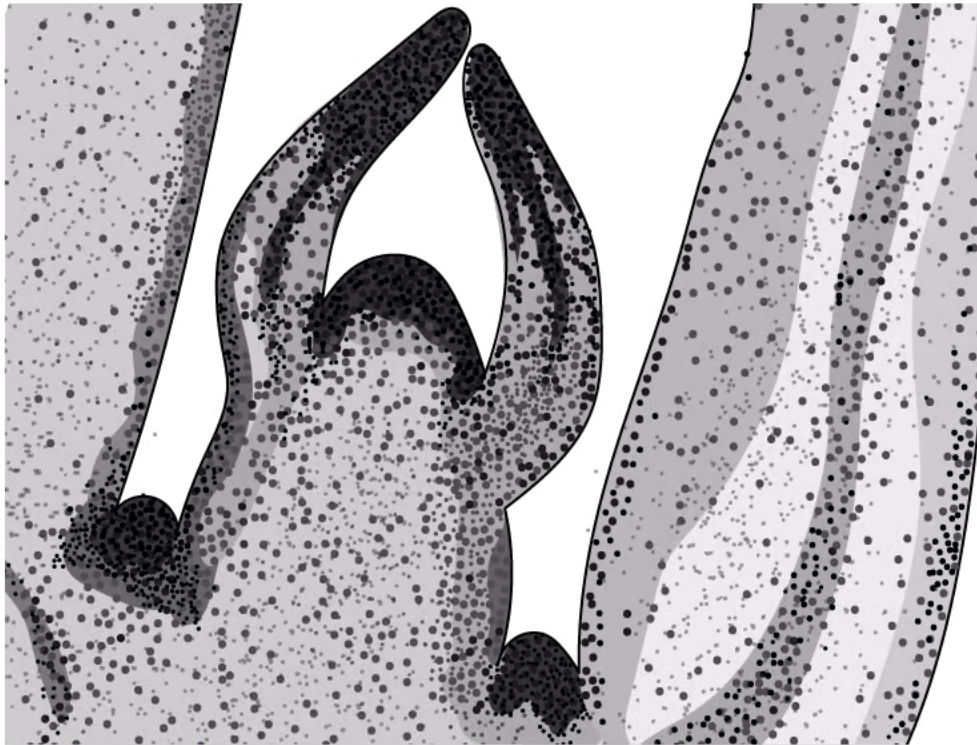
Question 5a

One mark is available for clarity of communication throughout this question.

a)

The image below is a micrograph showing a cross-section through part of a plant. The areas of dark stain represent the presence of cell nuclei.

Annotate the micrograph below:



[7 marks]

[7 marks]

Question 5b

b)

Compare and contrast animal and plant hormones.

[7 marks]**[7 marks]**