

AS91603 Demonstrate understanding of the responses of plants & animals to their external environment

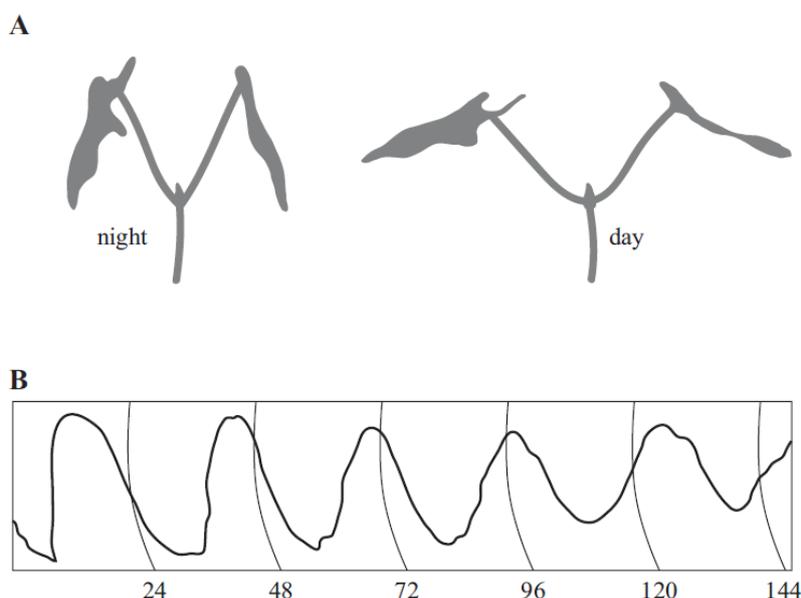
Plant Responses

(2014, 3)

'Sleep Movements'

Some plants show regular changes in movement over time. 'Sleep movements' may involve the nightly folding of leaves, as in the case of many legumes, such as beans, or the nightly closing of flowers, such as tulips.

The diagrams below show the pattern of leaf folding in a runner bean (*Phaseolus coccineus*).



In diagram **A**, the position of the primary leaves of a seedling at night is shown at the left, and during the day is shown at the right.

In diagram **B**, the peaks of the curve represent the night-time leaf position. The vertical lines indicate 24-hour intervals. The period for this trace is about 27 hours, and was recorded whilst the plant was kept in constant light conditions.

Discuss both the pattern of this behaviour and the underlying response that causes it, and evaluate the adaptive advantage this behaviour provides some plants and their flowers.

In your answer you should:

- describe the type of response shown by the runner bean and what causes it (detailed physiology and structure **not** required)
- explain why the rhythm or pattern shown by the runner bean would be endogenous and what is happening to the rhythm over time
- evaluate the adaptive advantages this pattern of behaviour provides some plants and their flowers with, such as the runner bean.

(2013, 3)

When a bean seed germinates, a combination of factors ensures that the shoot grows upwards and the root grows downwards, regardless of the way the seed has been planted.

Explain the roles of gravity, light, and auxin in the growth of a **shoot** from germination into a mature plant.

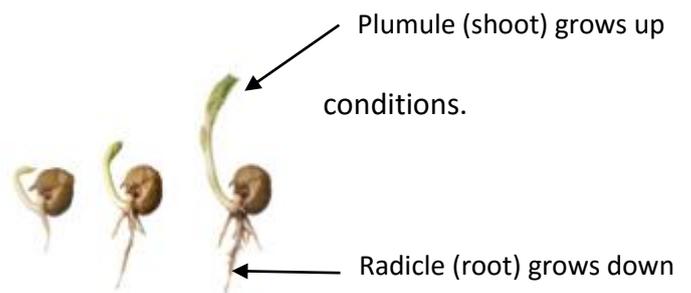
In your answer:

- describe the response of the shoot within its environment as it germinates AND as it continues to grow
- describe the role of auxin in shoot growth
- link the effects of gravity and light with the action of auxin through the different stages of shoot growth to maturity
- discuss any adaptive advantages the shoot gains from these responses, as it develops, in relation to its ecological niche.



(2012, 1)

Plant roots and stems demonstrate different responses when grown in constant environmental



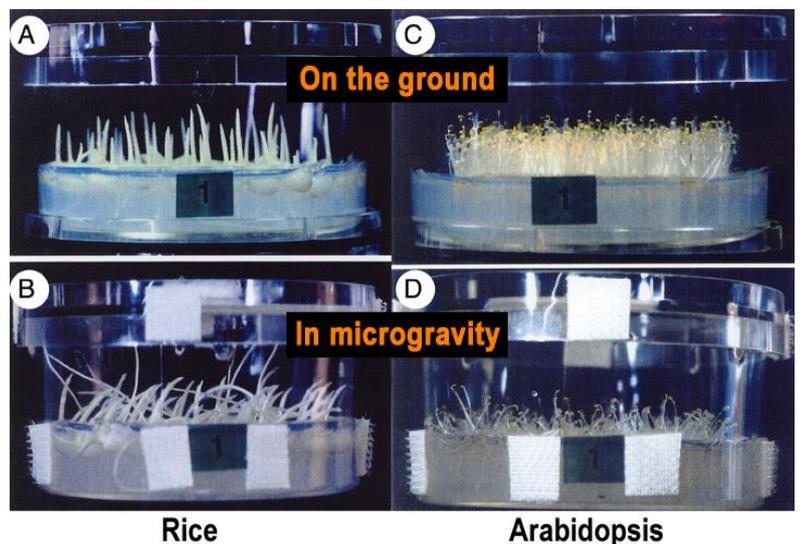
In microgravity conditions (very weak gravity, such as in orbit), plants can be grown, but may exhibit unusual growth patterns, such as some roots growing up and stems down, less growth, and non-vertical growth.

This can be seen in the growth of the seedlings opposite.

Analyse the growth responses of roots and shoots in relation to gravity.

In your answer you should include:

- a description of the responses of the root and shoot
- the mechanism responsible for the responses
- the adaptive advantage of the responses
- why the plants in microgravity tend not to thrive.



You may use diagrams to assist with your explanations.

The questions below are collated from the now expired AS90716 Describe animal behaviour & plant responses in relation to environmental factors.

However they may still be useful for **AS91603** Demonstrate understanding of the responses of plants & animals to their external environment.

(2011:2)

The sensitive plant *Mimosa pudica* has leaves composed of small leaflets. When a leaf is exposed to a sudden short shock, it rapidly collapses and its leaflets fold together. The response takes only a few seconds, and is quite different to the plant's growth response to a constant directional light source.



Mimosa pudica before (left) and after (right) being touched.

Discuss the response of *Mimosa pudica* to the sudden shock stimulus, and compare it to the plant's growth response under a constant directional light source.

In your answer:

- identify and describe **both** the rapid leaf response and the slower growth response
- explain how **both** the rapid leaf response and the slower growth response happen
- compare and contrast both responses in terms of their significance to the plant's survival.

(2012, 3)

Both plants and animals need to carefully time annual activities, such as reproduction. Many species will reproduce at the same time each year, regardless of climatic (weather) conditions.

For example, tūi begin breeding in late September and the New Zealand tree fuchsia flowers between August and September, when the young tūi are seeking food.



Discuss the importance of the timing of annual responses in plants and animals. You may use the examples of the New Zealand tree fuchsia and tūi to help you.

In your answer you should include:

- the probable environmental cues for reproduction to begin in plants and animals
- the importance of accurate timing for reproduction
- the mechanisms used for keeping time in plants and animals.

(2008:2 c)

- (c) *Mimosa pudica* is also called the 'sensitive plant' because its leaves fold inwards when touched. This is an example of a nastic movement.



Discuss the possible significance of this nastic movement in mimosa.

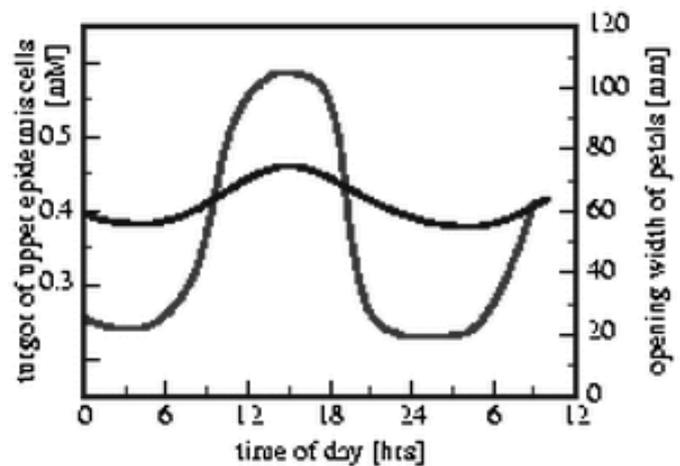
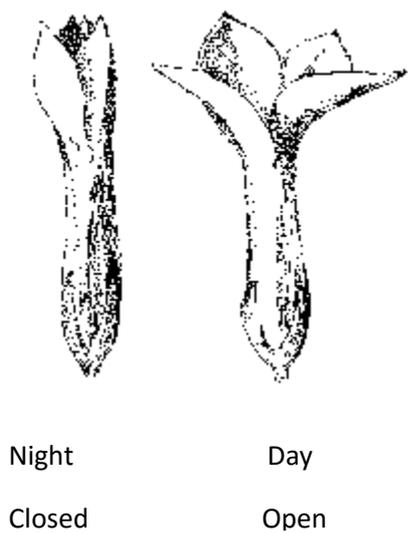
(2007: 2c,d)

(c) Petal movement in *Kalanchoe* is a nastic response.

Explain the **difference** between a nastic response and a tropism, using responses in *Kalanchoe* as an example.



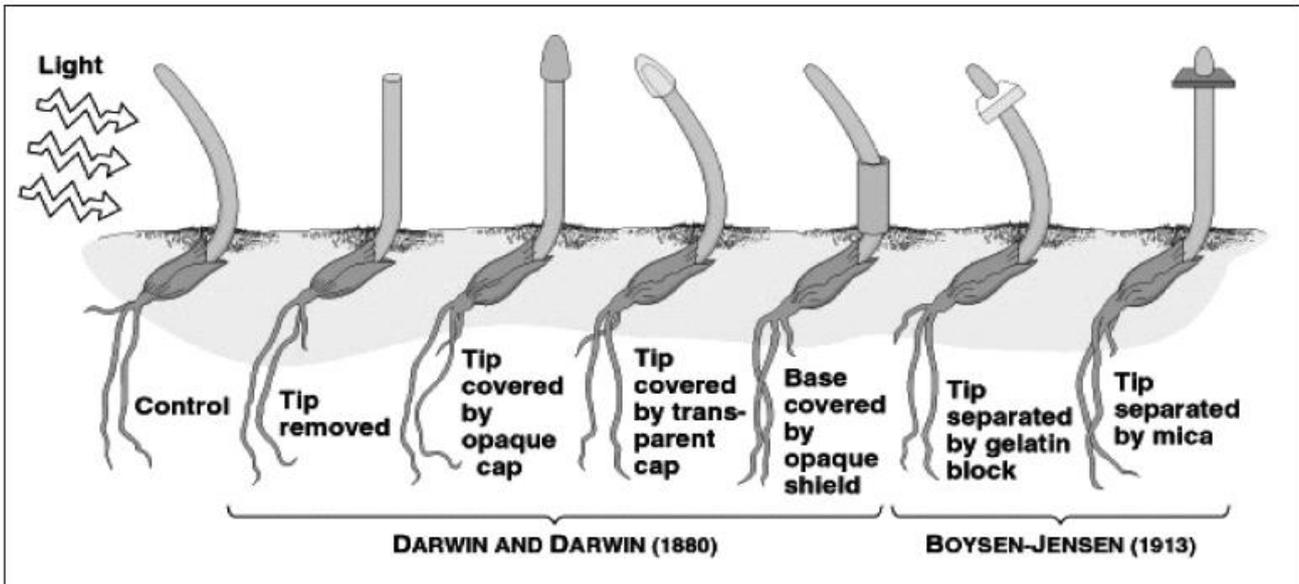
Kalanchoe has small flowers with petals that open and close in response to changes in turgor pressure within the petals (below).



(d) Discuss how this regular movement of the petals is produced by changes in turgor pressure, **and** how this movement enhances the plant's reproductive success.

(2006:1)

The diagram shows the response of recently germinated wheat shoots (coleoptiles) to a directional light source. The coleoptiles have been treated in several different ways.



Growth of wheat coleoptiles in response to a directional light source.

- (a) Name the **response** shown by the bent coleoptiles AND identify the **hormone** that regulates plants' growth responses to light.

Response:

Hormone:

- (b) Give a reason, based on evidence from the diagram, for concluding that this hormone is produced by cells at the tip of the coleoptile.
- (c) Explain how this hormone causes the control coleoptiles to bend toward the light. Your answer **must** include a diagram showing a few cells in a cross section of the bent part of the shoot.
- (d) Explain how this response to light would be useful to plants.

Plants exhibit a number of other growth responses to environmental stimuli. One of these, **thigmotropism**, occurs in response to touch and is common in climbing plants, eg beans, young rata seedlings.

- (e) Discuss the advantages of **thigmotropism** to a climbing plant.