

# 9.4 Reproduction in Plants

## Question Paper

|            |                            |
|------------|----------------------------|
| Course     | DP IB Biology              |
| Section    | 9. Plant Biology (HL Only) |
| Topic      | 9.4 Reproduction in Plants |
| Difficulty | Hard                       |

**Time allowed:** 60  
**Score:** /43  
**Percentage:** /100

### Question 1a

a)  
A group of insects called flower thrips includes the species *Frankliniella intonsa*, as shown in the image below.



Adult *F. intonsa* flower thrips pollinate flowers of the genus *Stellera* in central and southern Asia. In return for the pollination it receives, *Stellera* provides sites for *F. intonsa* to lay their larvae (young).

State how this differs from a more conventional insect-flower mutualistic relationship.

[2 marks]

[2 marks]

### Question 1b

b)  
Changes to abiotic conditions such as those caused by climate change can disrupt mutualism between pollinators and flowering plants.

Suggest the consequences of extinction of a pollinator on other species.

[2 marks]

[2 marks]

### Question 1c

c)  
A **symbiotic** relationship between two species is defined as any type of a close and long-term biological interaction between two different biological organisms.

The relationship between a bumblebee and the flowers it feeds from (and pollinates) is referred to as **mutualistic**.

Using this information, distinguish between symbiosis and mutualism.

[2 marks]

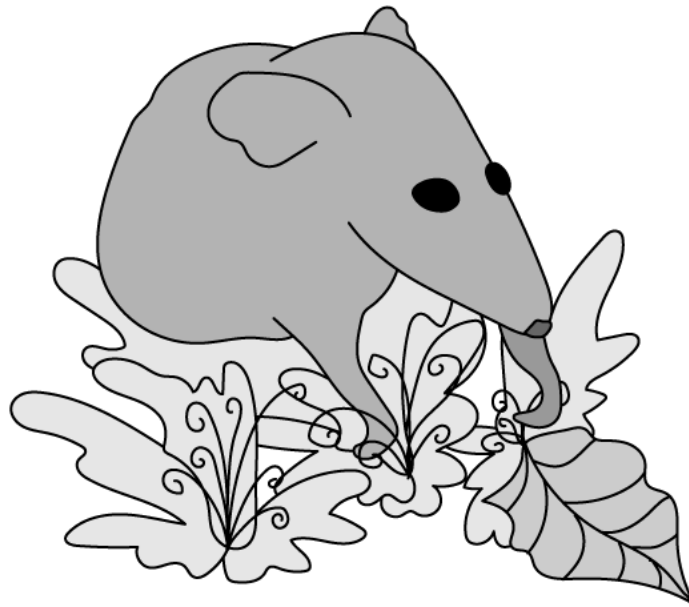
[2 marks]

### Question 1d

d)

The best-documented examples of animal pollinators include bees and other insects. However, some larger animals are very active pollinators.

One such animal is the honey possum (*Tarsipes rostratus*), a small marsupial native to southwestern Australia. Some of the pollen that a honey possum comes into contact with is used as a food, with all the available nutrients being used by the honey possum for its own dietary requirements.



Suggest **one** adaptation, from the image above, of the honey possum that hints at its role as a pollinator.

[1 mark]

[1 mark]

### Question 2a

a)

Complex control mechanisms exist to ensure that a flowering plant does not flower too early in the season.

Explain **one** disadvantage of flowering too early in the season.

[2 marks]

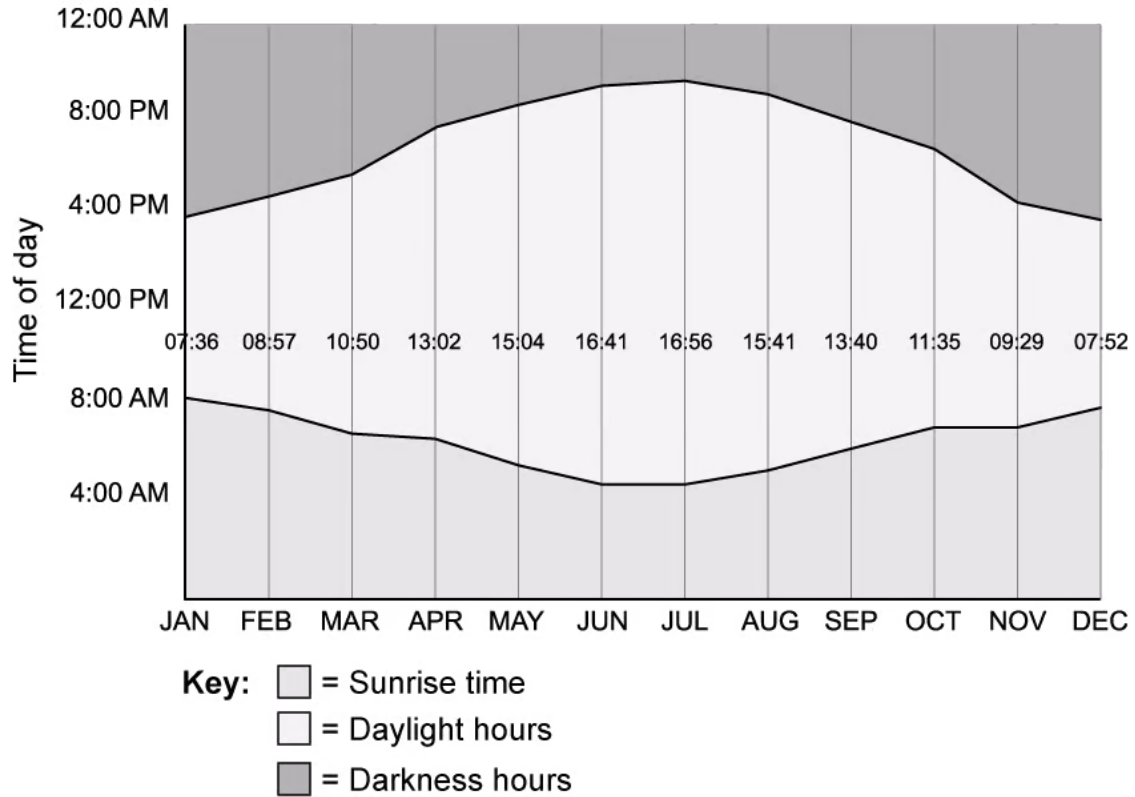
[2 marks]



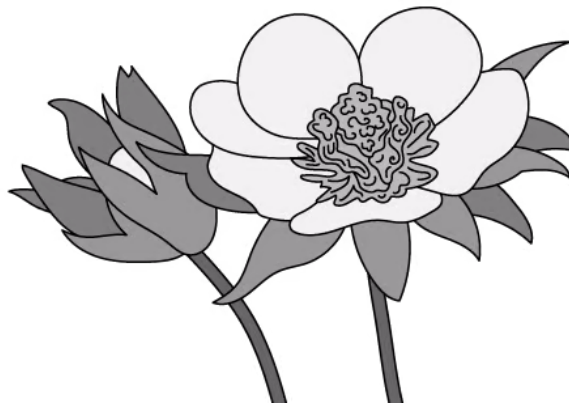
**Question 2b**

b)  
The graph shows the average sunrise, sunset and daylight times for a region of northern UK.

The figures along the **centre of the graph** are the duration of daylight hours in hours:minutes.



Strawberry plants flower with small, white flowers as shown in the image below.



Later on, the flowering body develops into the characteristic red, juicy fruits that the plants are grown for.

Using the data in the chart and the fact that the strawberry is a day-neutral plant, predict the month when flowers start to appear on strawberry plants in the northern UK. Give a reason for your prediction.

[2 marks]

[2 marks]

**Question 2c**

c)

Some flowering plants sense stimuli from air and soil temperature fluctuations and express flowering genes in response to changes in those stimuli.

Give **one** reason why flowering based solely on temperature stimuli would be disadvantageous to a plant.

[1 mark]

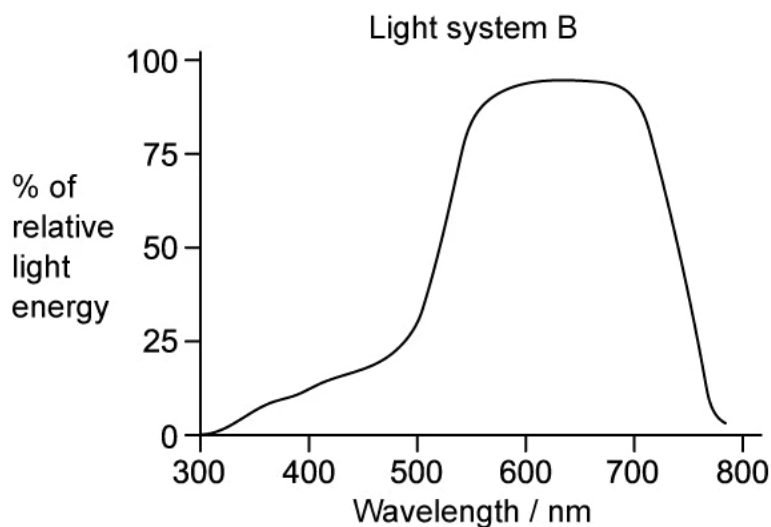
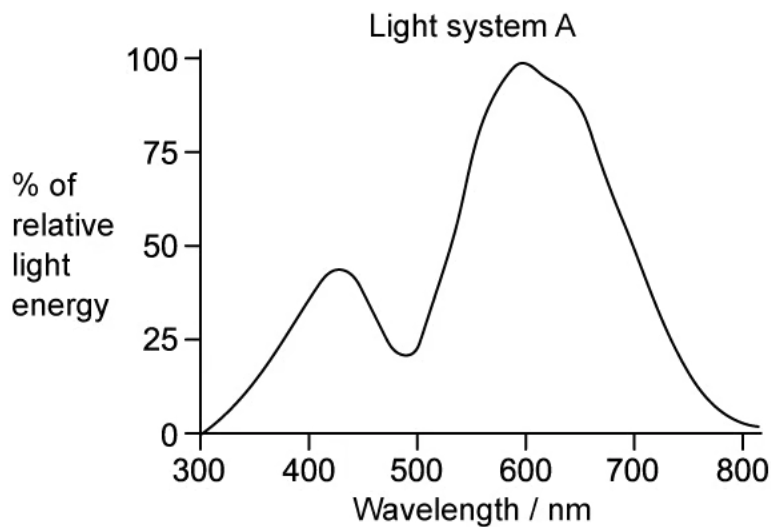
[1 mark]

**Question 2d**

d)

A floriculture company supplying florists shops with flowers uses large commercial growing sheds to cultivate flowers on a large scale. Artificial lighting is controlled to provide optimal lighting conditions.

Spectra **A** and **B** below are those produced by two separate lighting gantries inside the sheds.



Suggest which lighting system is used for the times when flowers are beginning to bloom and give a reason for your answer.

[2 marks]

[2 marks]



### Question 3a

a)

Studies of flowering in thale cress (*Arabidopsis thaliana*) have revealed that a gene called Flowering Locus T (or FT for short) is expressed when certain repressor proteins are absent.

The FT gene is expressed in the leaf but has its effect in the apical meristem.

Suggest the structure in which FT protein reaches the apical meristem.

[1 mark]

[1 mark]

### Question 3b

b)

Vernalisation is a term used to describe a prolonged period of low temperature, which acts as one environmental stimulus to ensure that flowering occurs in the appropriate season of the year – spring, in many species.

Species that rely on vernalisation are more commonly found in temperate regions of the Earth, as opposed to tropical regions.

Suggest why.

[2 marks]

[2 marks]

### Question 3c

c)

Research into vernalisation in cereal crops has identified differences in the genetic makeup of winter and spring varieties of important crops like barley and wheat.

Much of the research has uncovered epigenetic effects that govern the expression of important flower-producing genes.

Outline what is meant by 'epigenetic effects' in this context.

[2 marks]

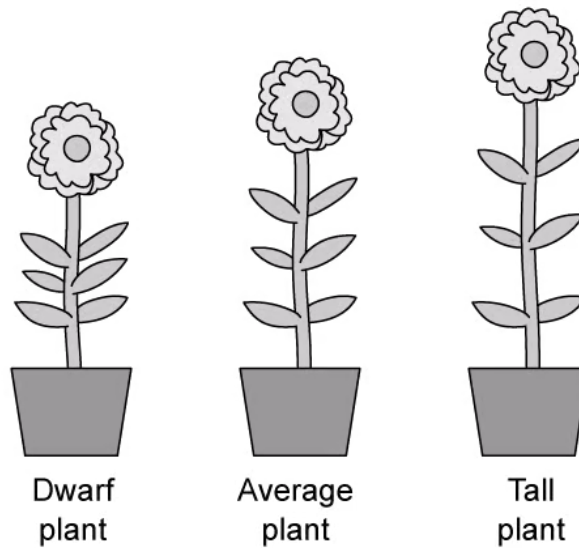
[2 marks]

### Question 3d

d)

The diagram shows an effect of the plant hormone gibberellin.

The level of gibberellin affects the internodal distance of a plant; this is the length of stem between each set of leaves.



Suggest how the levels of gibberellin may vary between each of the three plants shown. Give a reason for your suggestion.

[2 marks]

[2 marks]

### Question 4a

a)

Outline the events that take place during germination of a seed.

[4 marks]

[4 marks]

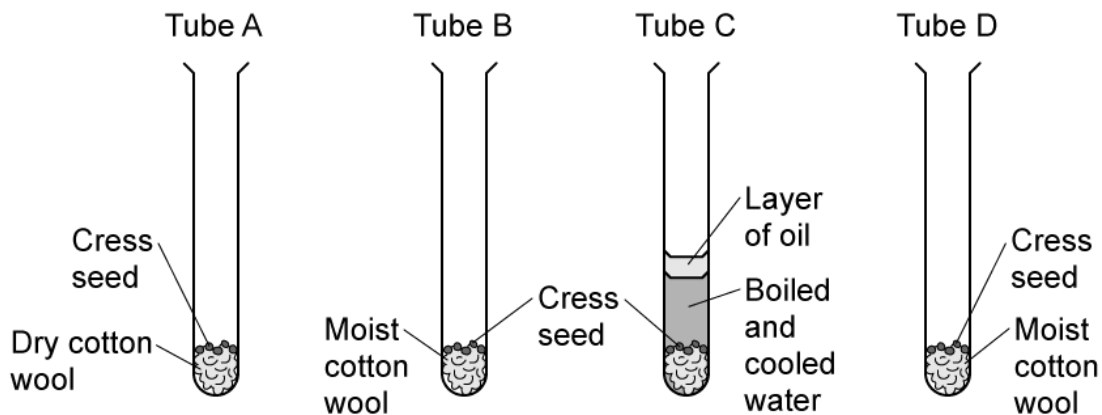
### Question 4b

b)

In exploring the effects of subjecting germinating seeds to different growth conditions, the following experiment was set up.

Method summary:

- Set up 4 test tubes, each containing cress seeds on cotton wool
- For test tube **A**, cotton wool left dry
- For test tube **B**, add enough water to the cotton wool so that it becomes moist
- For test tube **C**, add enough water to cover the cotton wool and seeds, then carefully add a layer of oil on top of the water
- For test tube **D**, add enough water to the cotton wool so that it becomes moist
- Leave tubes **A**, **B** and **C** at room temperature or incubated at a specific temperature e.g. 20 °C
- Place tube **D** in a fridge at approximately 4 °C
- Compare the results and see which tube has the greatest number of germinated seeds



Outline the control variables that the scientists would need to adhere to in order to produce valid data.

[2 marks]

[2 marks]

### Question 4c

c)

Rather than counting the number of seeds that had germinated at the end of the experiment, suggest a more accurate measure of the dependent variable.

[1 mark]

[1 mark]

### Question 5a

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

a)

Compare and contrast the methods employed by plants for pollen distribution and seed dispersal.

[5 marks]

[5 marks]

### Question 5b

b)

Explain the process by which phytochrome  $P_R$  and phytochrome  $P_{FR}$  control flowering in a typical long-day plant.

[5 marks]

[5 marks]

### Question 5c

c)

The cut-flower industry goes to great lengths to ensure that flowers reach their end-use customers in their best condition, showing vigour and bloom to maximal effect.

This presents particular logistical and scientific challenges at times of high demand such as Valentine's Day and Mothers' Day.

Summarise the methods used to ensure that cut flowers reach their end-use customers in the best possible condition.

**[5 marks]**

**[5 marks]**