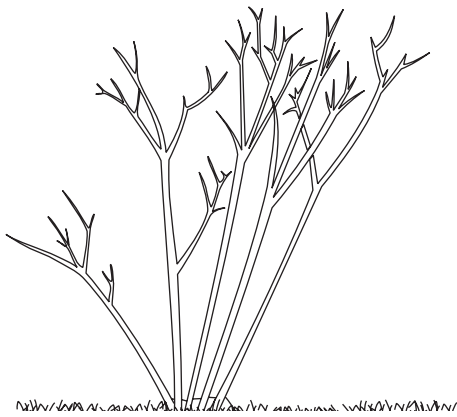


Answer ALL questions in the spaces provided.

1. The diagram below shows a tree that is being managed to give a supply of wooden poles.



- (a) State the name given to the woodland management technique shown in the diagram above.

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(1)

- (b) Describe how this technique could be used in a woodland to give a sustainable supply of wooden poles.

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(c) Explain how this technique can lead to the maintenance of high biodiversity within a woodland.

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(Total 7 marks)

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Q1



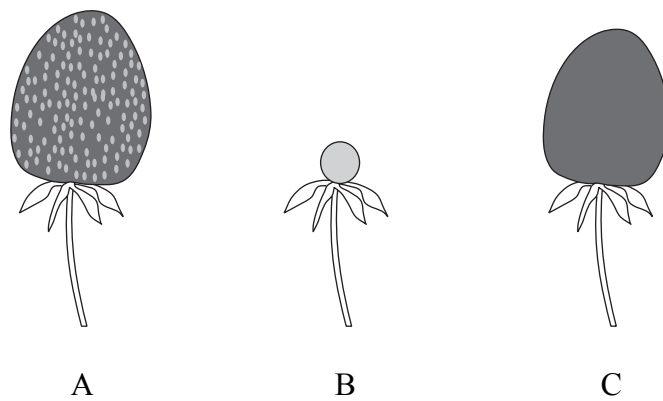
2. Following pollination and fertilisation, strawberry plants will form ripe strawberries. A strawberry is formed from a swollen flower base covered by small, dry achenes that contain the seeds.

In an investigation, three sets of strawberry plants, A, B and C, were treated as follows:

- A – immature strawberries left intact
- B – achenes removed from immature strawberries
- C – auxin paste applied to immature strawberries after removal of achenes.

The plants were then left to form ripe strawberries.

The typical appearance of the ripe strawberries produced by each set of plants is shown in the diagram below.



(a) State the name given to chemicals, such as auxin, that can affect the development of plants.

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Leave blank

(b) (i) Describe the difference in appearance of the ripe strawberries produced in the three sets of plants in this investigation.

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(ii) Suggest an explanation for the differences in the development of the strawberries in this investigation.

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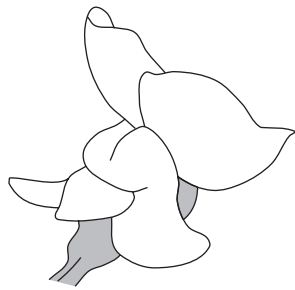
Q2



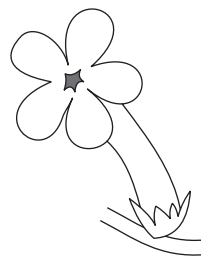
3. The snapdragon, *Antirrhinum majus*, is a common garden plant grown for its colour and characteristic bilateral flower shape.

A radial variation of the snapdragon flower shape also exists.

The appearance of these two flower shapes is shown in the diagrams below.



Bilateral shape



Radial shape

Both the colour and the shape of snapdragon flowers are each examples of single gene inheritance that show independent assortment.

A snapdragon with red, bilateral flowers was crossed with a snapdragon with white, radial flowers. Both plants came from pure-breeding stock populations, homozygous for both characteristics.

All of the F₁ offspring of this cross produced pink, bilateral flowers.

(a) Explain what is meant by **single gene inheritance**.

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(b) Suggest an explanation for the results of the cross between the snapdragon with red, bilateral flowers and the snapdragon with white, radial flowers.

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(c) Using suitable symbols and a genetic diagram, suggest the expected outcome of a cross between one of the F₁ snapdragons and one of the pure-breeding snapdragons with white, radial flowers.

(4)

Q3

(Total 9 marks)



Synoptic Section

The questions in this section are designed to give you the opportunity to make connections between different areas of biology and to use skills and ideas developed throughout the course in new contexts. You should include in your answers any relevant information from the whole of your course.

4. In an investigation, the concentration of photosynthetic pigments in the leaves of mahogany bean and tonka bean plants was measured. These two plants grow in the forests of Brazil.

Measurements were taken from the leaves of plants growing in full sun during the day and from the leaves of plants growing in shaded conditions.

Two different sets of measurements were taken. In Table 1, the concentration of the pigments is given in relation to the mass of leaf tissue. In Table 2, the concentration of the pigments is given in relation to the leaf surface area.

Table 1

Pigment	Pigment concentration in leaves / $\mu\text{mol g}^{-1}$			
	Mahogany bean		Tonka bean	
	Sun	Shade	Sun	Shade
Chlorophyll a	1.16	2.12	1.77	2.94
Chlorophyll b	0.62	1.03	0.68	0.99
Carotenoids	2.06	3.89	0.86	1.21

Table 2

Pigment	Pigment concentration in leaves / $\mu\text{mol cm}^{-2}$			
	Mahogany bean		Tonka bean	
	Sun	Shade	Sun	Shade
Chlorophyll a	0.93	0.79	1.46	1.09
Chlorophyll b	0.33	0.33	0.29	0.37
Carotenoids	0.57	0.46	0.54	0.47



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(a) Magnesium ions are required for the formation of chlorophyll. Explain the significance of each of the following in the uptake of magnesium ions by plants.

(i) ATP

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(ii) Root hairs

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(b) (i) Using the data in Table 1 and Table 2, compare the effect of different light conditions on the concentration of photosynthetic pigments in the leaves of mahogany bean and tonka bean plants.

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(ii) Suggest why the concentrations of the photosynthetic pigments in these plants may differ in sun and shade conditions.

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Q4

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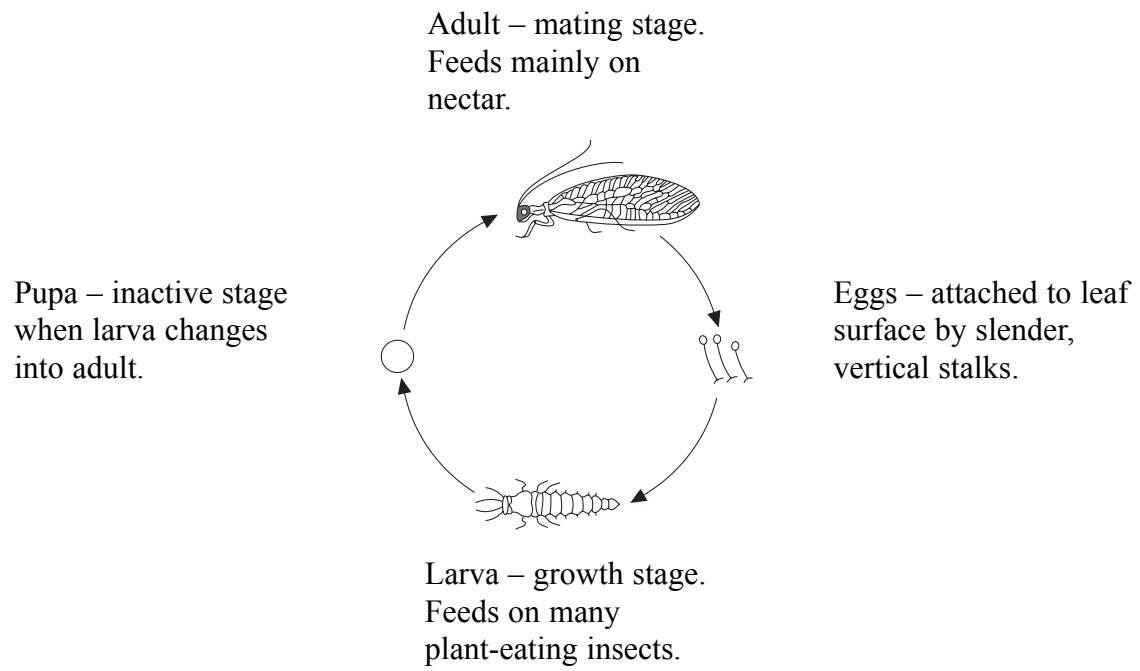


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5. Adult green lacewings, *Chrysoperia* sp., are insects that can be seen as they fly in search of nectar and mates.

The life cycle of the green lacewing has four distinct stages as shown in the diagram below.



(a) (i) One of the main constituents of nectar is sucrose. Suggest how the adult lacewing digests the sucrose that it feeds on.

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(ii) Suggest why the diet of the adult lacewing contains less protein and more carbohydrate than the diet of the larva.

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- (b) Lacewing larvae can be used to control insect pest populations of glasshouse crops. State the term that describes this method of pest control and give **two** advantages of this method.

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- (c) Adult male lacewings attract females by using high-pitched songs. They produce their songs by vibrating their wings against other parts of their body.

Analysis of these songs has found that within a population of lacewings, sub-populations exist, each with its own distinct sound pattern in their song.

Female lacewings are physically capable of mating with any males from the population. However, female lacewings will usually only mate with males producing the song characteristic of their own sub-population.

Explain how the lacewing songs may eventually lead to the formation of separate species within large lacewing populations.

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6. Many crops, such as sugar cane, rape seed and palm seed, can be used in the production of biofuels as alternatives to fossil fuels. Two of the most important biofuels are ethanol and biodiesel.

In many countries, the clearance of natural forests has increased in order to grow these crops.

- (a) Explain why the combustion of fossil fuels, rather than biofuels, is considered to have a greater effect on global warming.

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- (b) Explain how ethanol is used in the production of gasohol.

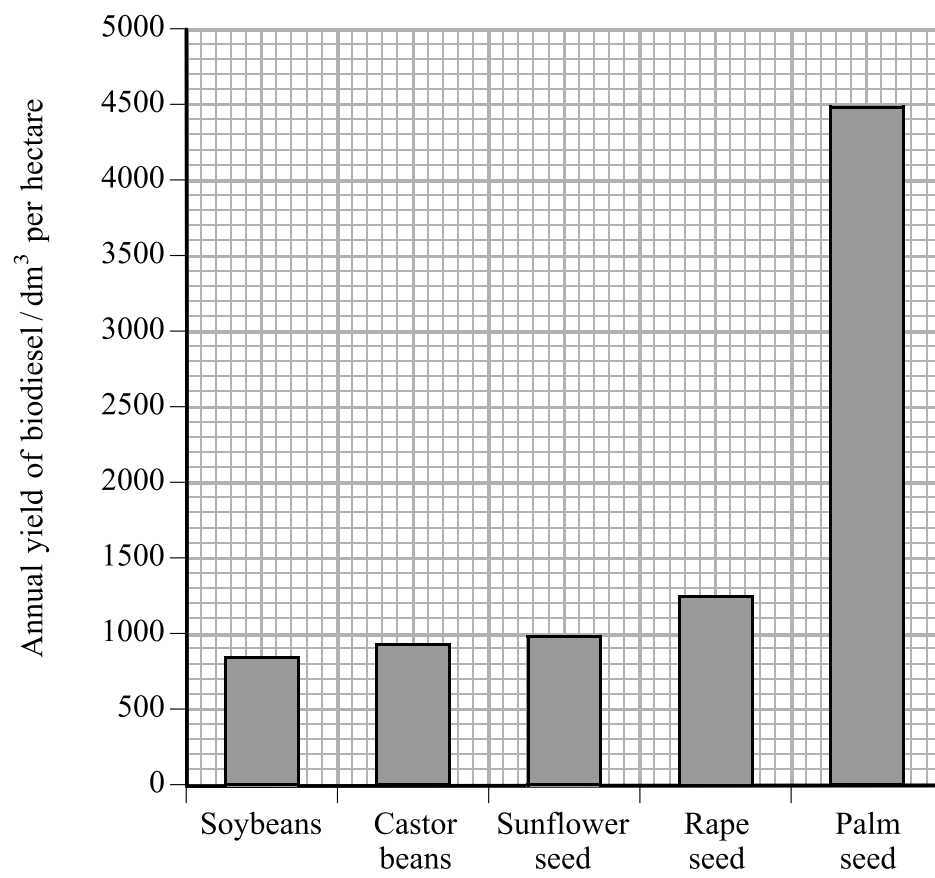
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(c) The graph below shows the annual yield of biodiesel per hectare from some crops.



(i) Compare the annual yield of biodiesel per hectare from palm seed with the mean annual yield of biodiesel from the other crops.

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(ii) Suggest **two** reasons why some countries might encourage the clearance of natural forests to grow palm seed for biodiesel production.

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(d) Suggest why the clearance of natural ecosystems to create land for biodiesel production might be restricted in Europe.

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Q6

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7. The distribution of organisms can be affected by biotic and abiotic factors.

(a) Explain the difference between biotic and abiotic factors.

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(1)

(b) Describe how you carried out an investigation into the influence of an abiotic factor on the distribution of a **named** animal in a **named** habitat.

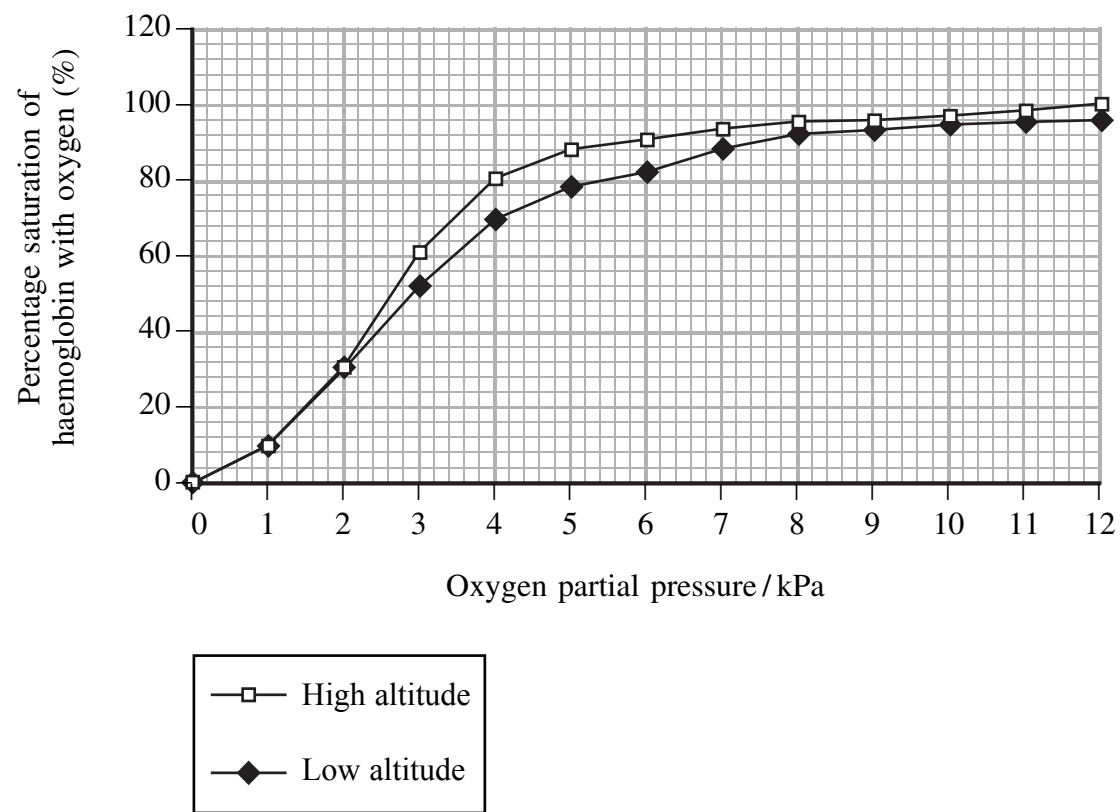
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(c) Deer mice (*Peromyscus maniculatus*) populations can be found throughout the United States. Studies have found distinct differences between the uptake of oxygen by haemoglobin in populations of deer mice at high altitudes compared with those at low altitudes.

The graph below shows the oxygen dissociation curves of high-altitude deer mice and low-altitude deer mice.



(i) Describe how haemoglobin is involved in oxygen transport in mammals such as deer mice.

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- (ii) The partial pressure of oxygen at high altitudes is lower than that at low altitudes. Explain how the data shown in the graph indicate that the distribution of the two types of deer mice is influenced by environmental oxygen availability.

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Q7

(Total 11 marks)

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