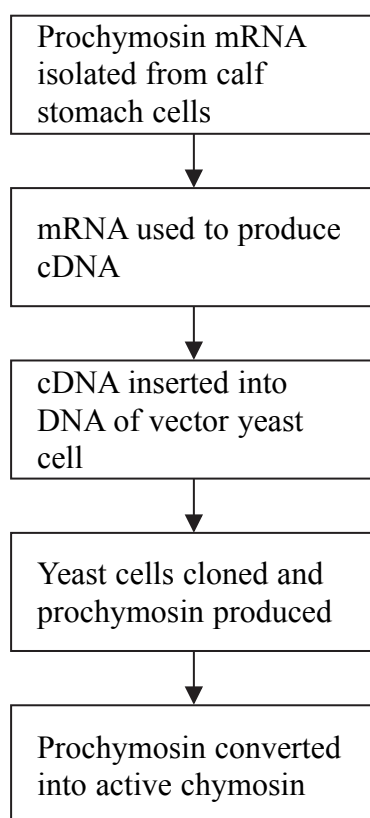




**Answer ALL questions in the spaces provided.**

1. One of the first stages in the production of cheese is the coagulation (clotting) of the milk protein, casein, which is brought about by the enzyme, chymosin.

The diagram below shows some of the main stages in the production of chymosin using yeast cells.



- (a) Cheese produced using chymosin cultured from yeast cells is acceptable to most vegetarians. Suggest why some consumers may still have concerns about eating cheese prepared in this way.

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(b) With reference to the diagram opposite, explain how enzymes are used in the production of chymosin using yeast cells.

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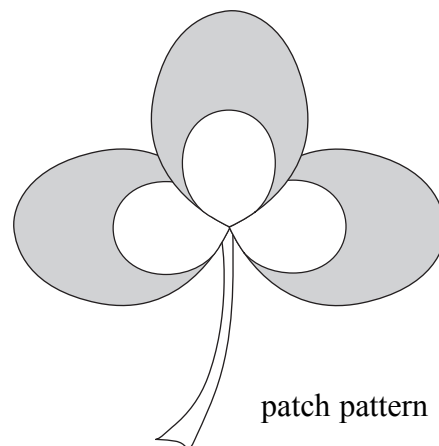
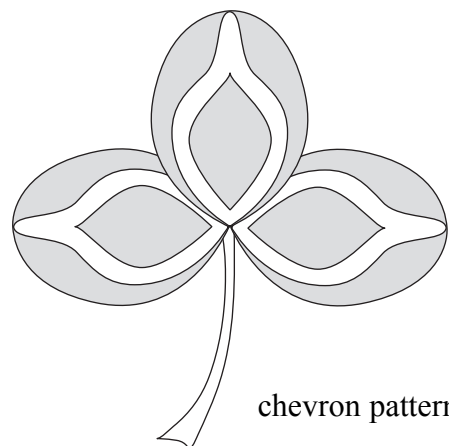
Q1

(Total 5 marks)



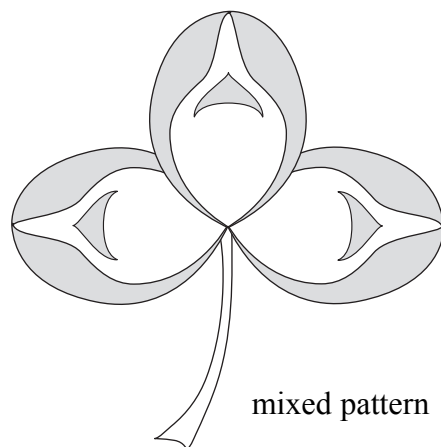
2. (a) The white clover, *Trifolium repens*, is one of the plants found growing as a weed in many lawns.

Leaves of the white clover are divided into three leaflets which often have characteristic white patterns visible on their surface. The two basic forms of the pattern are a chevron and a large patch. The diagram below shows these two patterns.



The basic form of the white pattern is governed by a single gene, **V**. Plants homozygous for the allele  $V^C$  will have the chevron pattern. Plants homozygous for the allele  $V^P$  will have the patch pattern.

If a clover plant with the chevron pattern is crossed with a plant with the patch pattern, the offspring have leaflets with a mixed chevron and patch pattern, as shown in the diagram below.



- (i) State the term used to describe the form of inheritance, shown in white clover, where the heterozygote offspring show the mixed pattern on their leaflets.

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A cross between two white clover plants, each with the mixed pattern, was carried out.

(ii) State the expected ratio of the phenotypes in the offspring of this cross.

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(iii) In the space below, draw a genetic diagram to show how this expected ratio was achieved.

(3)

(b) The ABO blood grouping in humans is governed by three alleles  $I^A$ ,  $I^B$  and  $I^O$ . The four phenotypic blood groups for this system are A, B, AB and O.

With reference to both similarities and differences, compare the inheritance of ABO blood groups in humans with the inheritance of leaflet patterns in white clover.

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(Total 9 marks)

Q2



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3. (a) In the space below, draw a diagram of a chloroplast showing the main features of this organelle.

On your diagram indicate the location of the light-dependent reactions and the light-independent reactions.

(4)



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(b) Describe the process of **non-cyclic photophosphorylation**.

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(c) Describe what happens to the products of **non-cyclic photophosphorylation**.

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Q3

(Total 10 marks)

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### 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. (a) Adipose tissue contains stored triglycerides. Describe the structure of a **triglyceride**.

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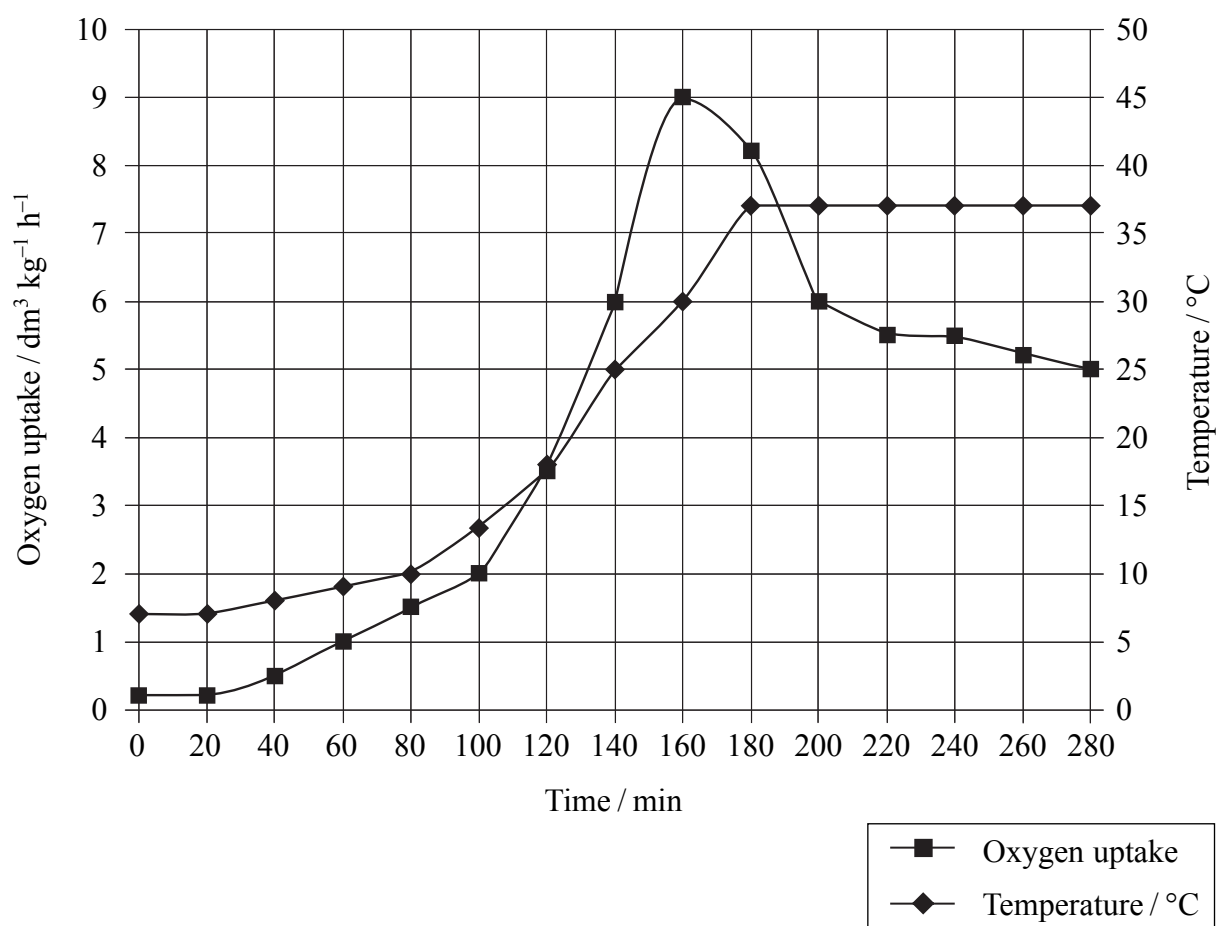




(b) When a hamster hibernates, its body temperature falls below 10 °C and its breathing and heart rate slow down. The animal goes into a ‘deep sleep’ over winter. At the end of hibernation, its body temperature must increase rapidly to wake the animal up.

Hibernating mammals have special adipose tissue known as ‘brown fat’. This tissue is usually found between the shoulder blades. Brown fat behaves differently from normal adipose tissue. When brown fat tissue is actively metabolising, it generates a lot of heat and this is used to warm the body.

The graph below shows the changes in temperature and oxygen uptake of a hamster coming out of hibernation.



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Using the information in the graph, explain how the metabolism of brown fat could have caused the changes in body temperature and oxygen uptake of the hamster.

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(c) Describe **three** other uses of triglycerides in the body of a mammal.

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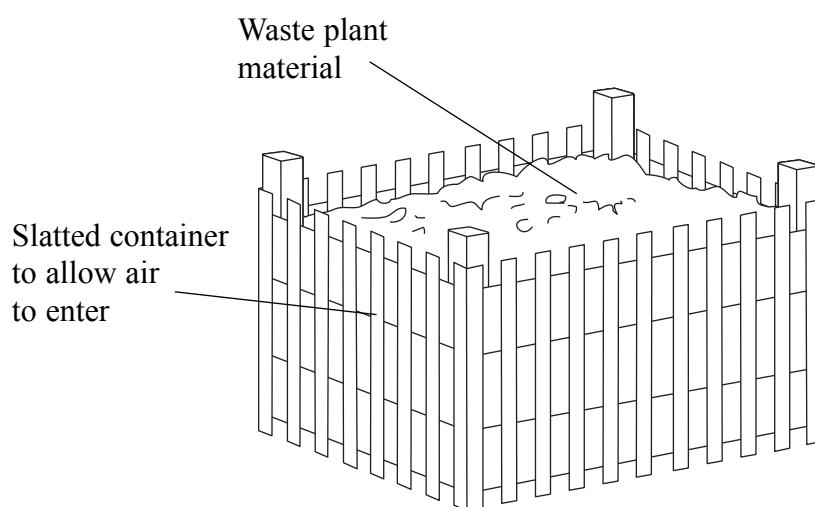
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| Q4 |  |
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5. Compost is usually produced from waste plant material by the action of aerobic microorganisms. It consists mainly of partly decomposed organic material that is rich in minerals such as nitrates. A variety of plant material, such as grass cuttings, fallen leaves and vegetable waste, can be used to produce compost.

The rate of production of compost depends on several factors such as temperature, moisture content and aeration.

The diagram below shows a container used for producing compost.



- (a) Explain how nitrates are produced from the waste plant material.

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(b) The compost can be added to soil to provide more nitrates. Explain how nitrates would be absorbed and used by plants during the growing season.

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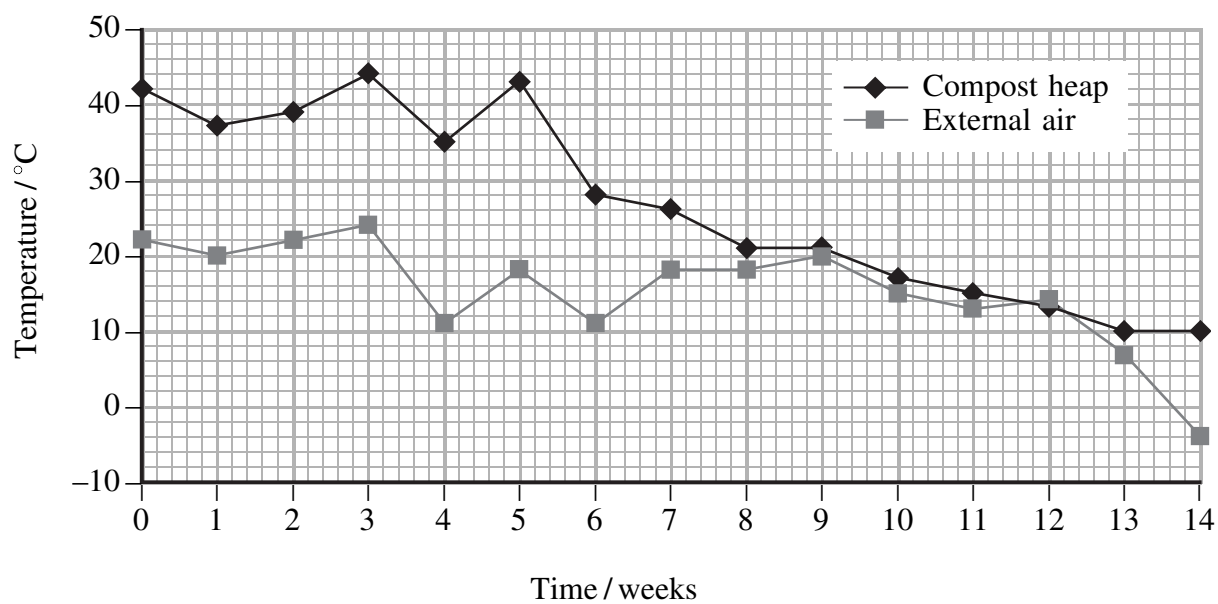
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(c) An investigation into the relationship between the temperature in a compost heap and the external air temperature was carried out. A container was filled with waste plant material. After 8 weeks, measurements of the temperature in the centre of the compost and the external air temperature were taken each week. The results of this investigation are shown on the graph below.



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(i) Compare the temperature in the compost with the temperature of the external air in the first six weeks.

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(ii) Suggest reasons for the differences in the two temperatures in the first six weeks.

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(iii) The temperature of the compost falls between week 9 and week 14. Suggest how changes in factors, other than external air temperature, may have contributed to this fall in temperature.

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Q5



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6. The distribution of organisms within a habitat or on a world-wide scale is influenced by both biotic and abiotic factors.

(a) Explain what is meant by the terms **biotic** and **abiotic** factors.

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(b) For a particular habitat that you have studied, describe **one** technique which you used to investigate how a specific abiotic factor affected the distribution of a **named** organism. (*The results of your investigation are not required.*)

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(c) Cotton is a crop plant that grows in areas where daytime temperatures can be very high and the relative humidity of the air can be extremely low.

Figure 1 below shows the relationship between stomatal opening and the temperature of the air surrounding the leaves in cotton plants.

**Figure 1**

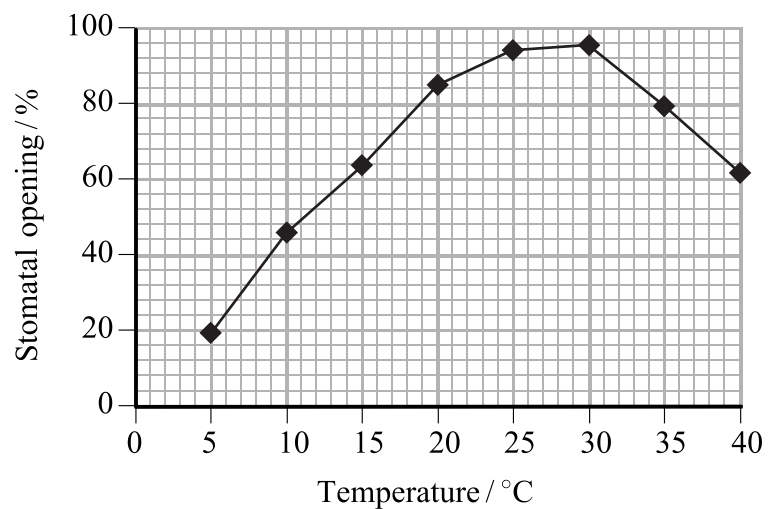
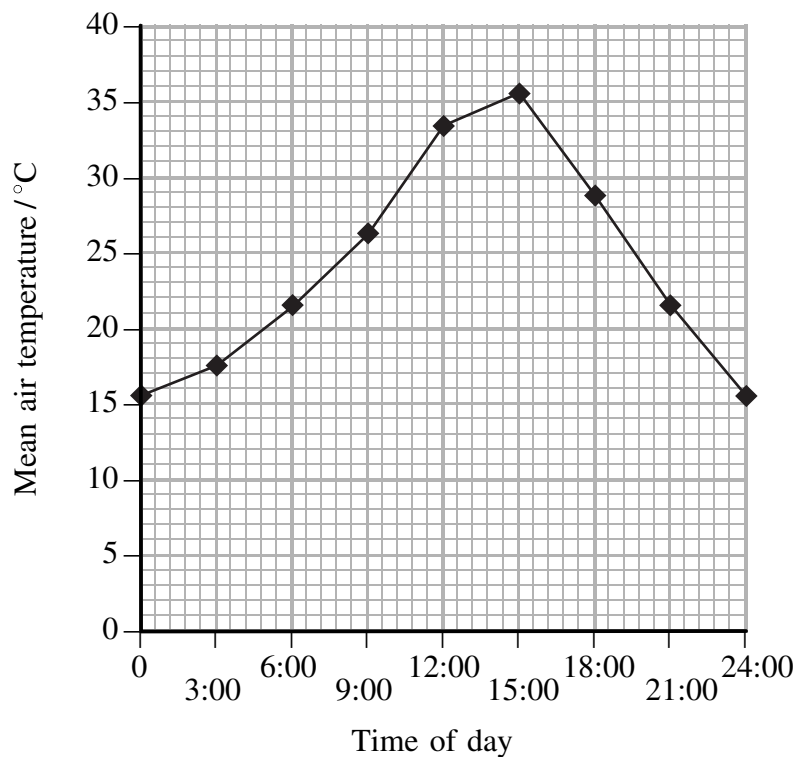


Figure 2 below shows the changes in average air temperature during a 24-hour period in a cotton-growing region during the growing season.

**Figure 2**



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(i) Describe the changes in stomatal opening as the temperature increases.

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(ii) Using information from both Figures 1 and 2, suggest why the changes you have described in part (c)(i) enable cotton to be grown in hot and dry conditions.

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(d) State the term used to describe the adaptations shown by plants that can survive in hot and dry conditions.

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**(Total 11 marks)**

**Q6**

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7. (a) Explain what is meant by the term **global warming**.

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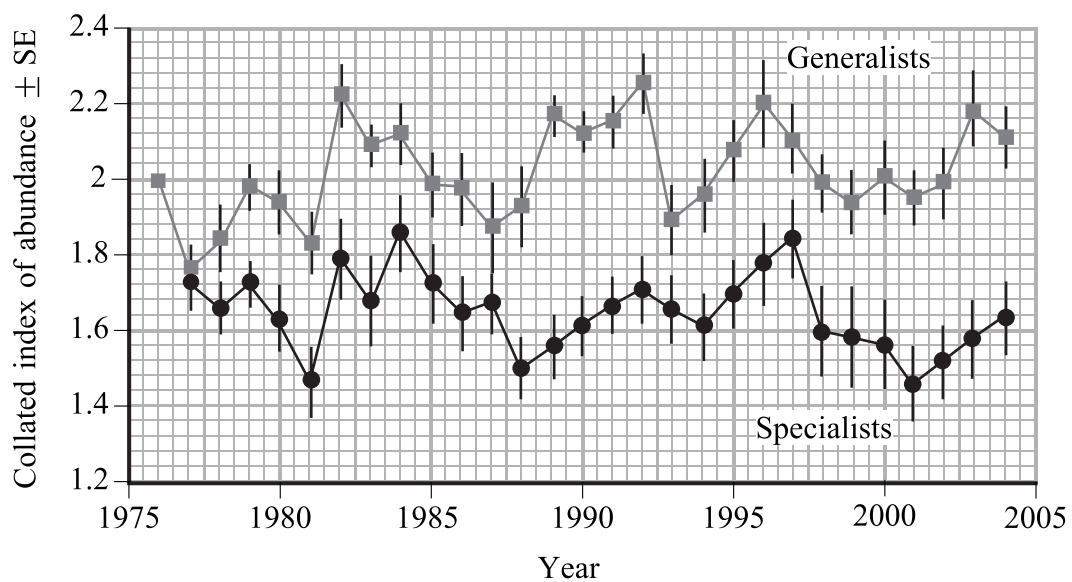
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(b) In 1976, a scheme was set up to record the distribution and abundance of butterflies in the United Kingdom. The records show that the abundance and distribution of many species of butterfly have changed. The graph below shows the changes in the abundance of two groups of butterflies. The generalists are butterflies found in a wide range of habitats, while the specialists are butterflies found only in certain types of habitat.



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(i) Compare the trends and patterns of the abundance of the two groups of butterflies shown in the graph.

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(ii) Suggest reasons for the changes that you have described in (b)(i).

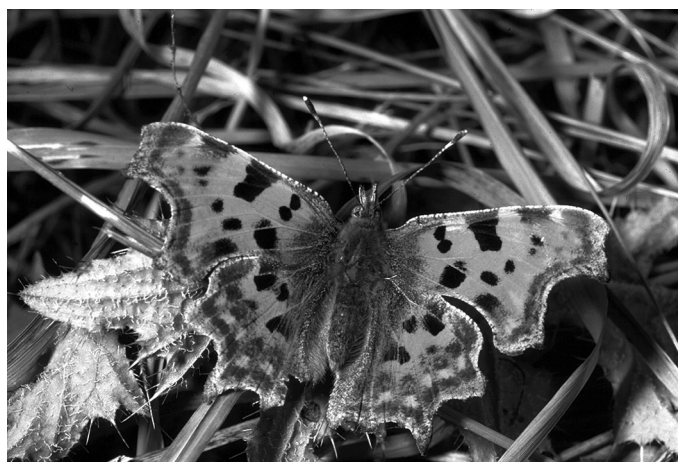
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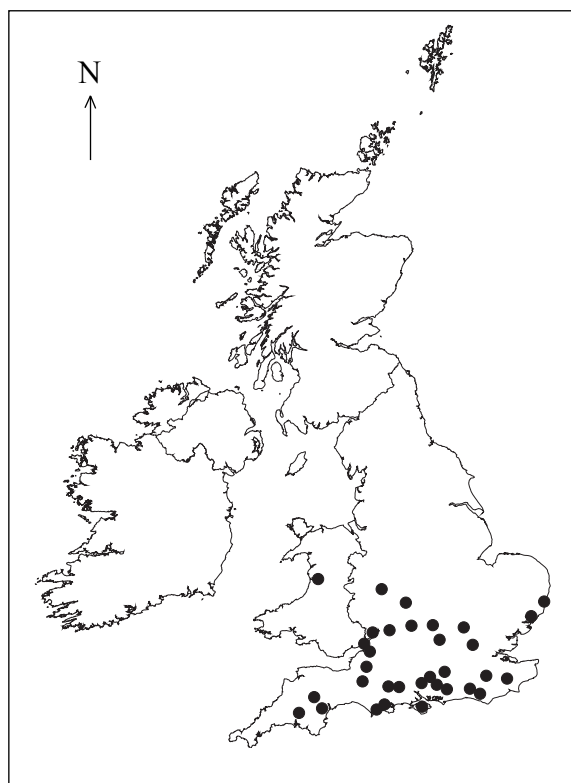


- (c) The distribution of the Comma butterfly (shown below) has altered considerably since 1982. This butterfly has expanded its range northwards more than any other British species of butterfly.

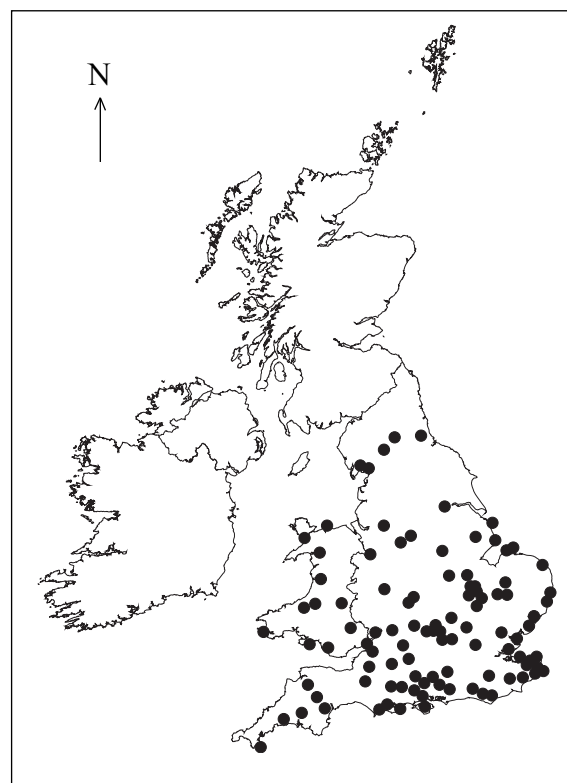
The dots on the maps indicate places where the Comma butterfly was recorded.



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1982



2000



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Suggest how global warming could affect the distribution of the Comma butterfly.

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Q7

(Total 11 marks)

**TOTAL FOR PAPER: 70 MARKS**

**END**

