Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

General Certificate of Education
Advanced Level Examination
June 2012

Human Biology HBIO5

Unit 5 The air we breathe, the water we drink, the food we eat

Friday 22 June 2012 9.00 am to 11.00 am

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Time allowed
- 2 hours

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

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

1 (a) During photosynthesis, where in a chloroplast does each of the following occur?

1 (a) (i) The light-dependent stage.

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(1 mark)

1 (a) (ii) The light-independent stage.

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(1 mark)

1 (b) (i) Name the **two** products of the light-dependent stage that are used in the light-independent stage.

Product 1 .....

Product 2 .....

(1 mark)

1 (b) (ii) What are these products used for in the light-independent stage?

Product 1 .....

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Product 2 .....

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(2 marks)

5

2 (a) What is meant by a species?

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(2 marks)

2 (b) Describe how allopatric speciation differs from sympatric speciation.

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(2 marks)

4

Turn over for the next question

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

3 (a) Human activities have increased the amount of greenhouse gases in the atmosphere.

Give **two** ways in which the use of biofuels can help to reduce further increases.

1 .....

2 .....

(2 marks)

3 (b) Scientists investigated the changes in the natural ranges of comma butterflies and a bird called the black grouse.
They recorded where these species were found between 1970 and 1989 and then between 1990 and 2009.

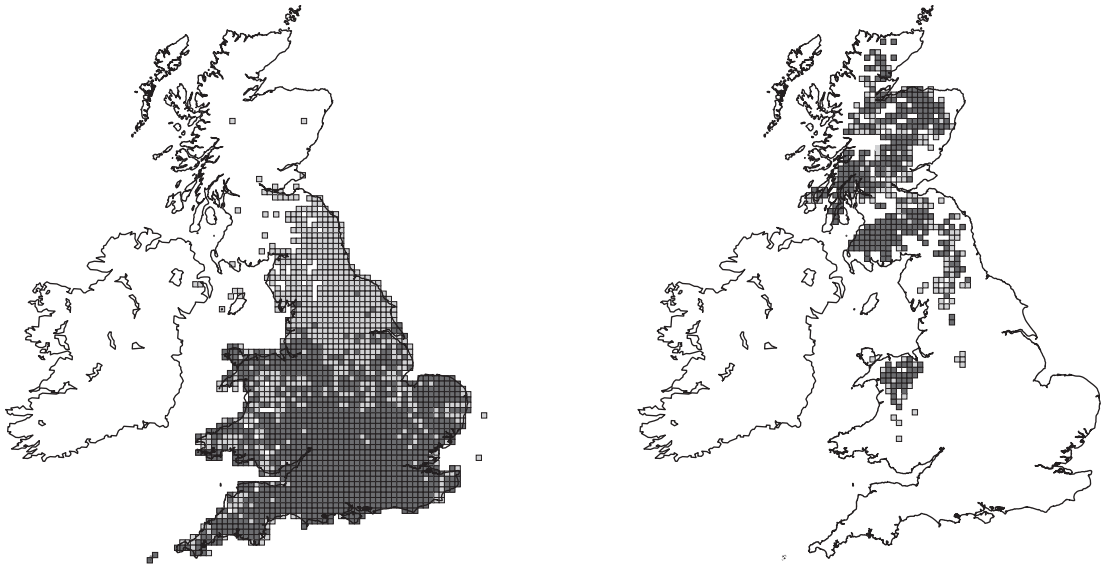
Their results are shown below.

Comma butterfly

- Where found between 1970 and 2009
- New areas where found between 1990 and 2009

Black grouse

- Where found between 1970 and 2009
- Where found between 1970 and 1989 but no longer present between 1990 and 2009



What are the differences in the changes in the natural ranges of comma butterflies and the black grouse?

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(2 marks)

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4 (a) What is the function of oxygen in aerobic respiration?

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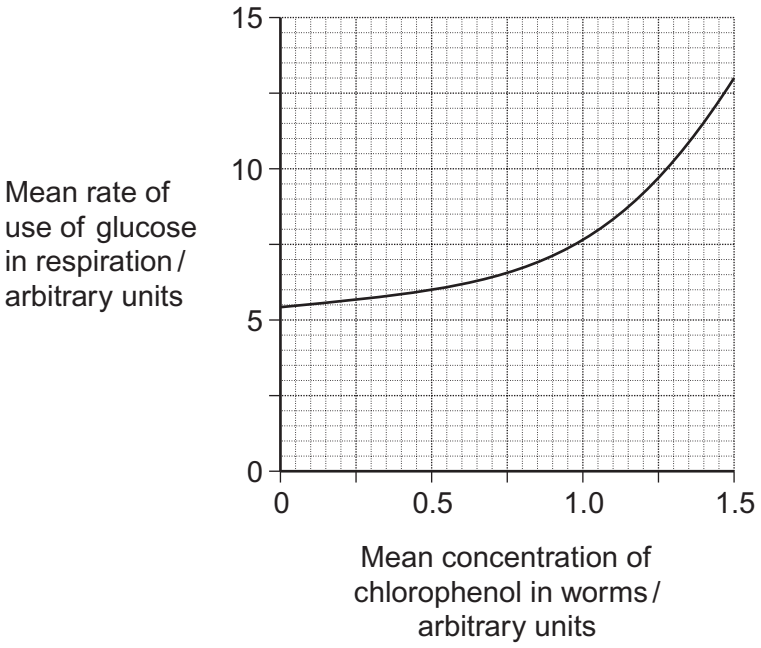
(2 marks)

Chlorophenols are substances that can pollute water or soil.

Scientists investigated the effect of different concentrations of a chlorophenol on the metabolic rate of worms. The scientists measured the rate at which the worms used glucose in respiration.

The chlorophenol they used affects the inner membranes of mitochondria and allows some electron transport to take place without the production of ATP.

The graph shows their results.



4 (b) Use the information provided and your knowledge of respiration to explain these results.

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(3 marks)

(Extra space) .....

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5

Turn over for the next question

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

5 *Clostridium difficile* is a bacterium which can cause severe diarrhoea. This can happen when populations of the normal community of bacteria in the gut are reduced by antibiotics commonly taken to treat infections.

5 (a) What is meant by a population of a bacterium?

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(1 mark)

5 (b) Patients in hospitals often develop diarrhoea caused by *C. difficile.*

Suggest why.

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(2 marks)

Question 5 continues on the next page

Doctors investigated the use of faecal transplants to treat hospital patients with severe cases of diarrhoea caused by *C. difficile*.

The patients were first treated with vancomycin. This is one of the few antibiotics that can kill *C. difficile* and it is only used in hospitals. A solution containing faeces from a healthy person was then introduced into the patients' guts.

The doctors found that 85% of the patients remained free of diarrhoea for at least one month after the transplant.

5 (c) Use the information provided to explain how this treatment caused patients to be free from diarrhoea.

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(4 marks)

(Extra space) .....

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5 (d) Some of the patients who continued to have diarrhoea were infected with *C. difficile* which had become resistant to vancomycin.

Use the information provided to suggest how this resistance evolved.

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(3 marks)

(Extra space) .....

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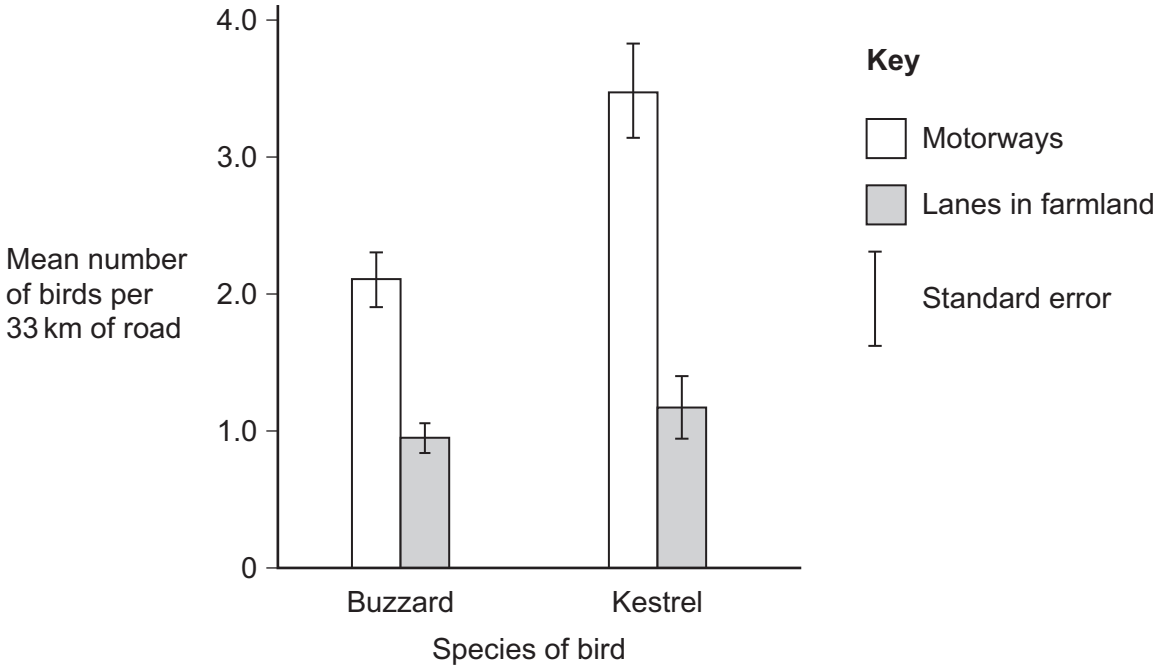
Turn over for the next question

6 Kestrels and buzzards are birds of prey that hunt for small animals.

Ecologists investigated the use of motorway roadsides as hunting areas by kestrels and buzzards. At regular intervals throughout the year, they drove 33 km along each motorway and recorded the number of birds of each species they saw over the motorway. They used the same method to record the numbers of birds over lanes in surrounding farmland. The farmland was almost all fields used to grow crop plants.

The graph shows their results.



6 (a) Give **two** factors that the ecologists should have kept constant in this investigation.

1 .....

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(2 marks)

6 (b) The ecologists concluded that kestrels and buzzards preferred motorways to lanes in farmland as hunting areas and that this was especially true for kestrels.

Evaluate this conclusion.

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(4 marks)

(Extra space) .....

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6 (c) In the winter, when there were no crops in the fields, the ecologists found that the number of kestrels over the motorways was significantly higher than in summer.

Suggest **one** reason why the number of kestrels over the motorways was higher in winter.

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(2 marks)

8

7 (a) In Britain, competition from large populations of Japanese knotweed has resulted in reduced populations of native species of plants.

Suggest and explain **one** way that competition from Japanese knotweed can reduce populations of native species.

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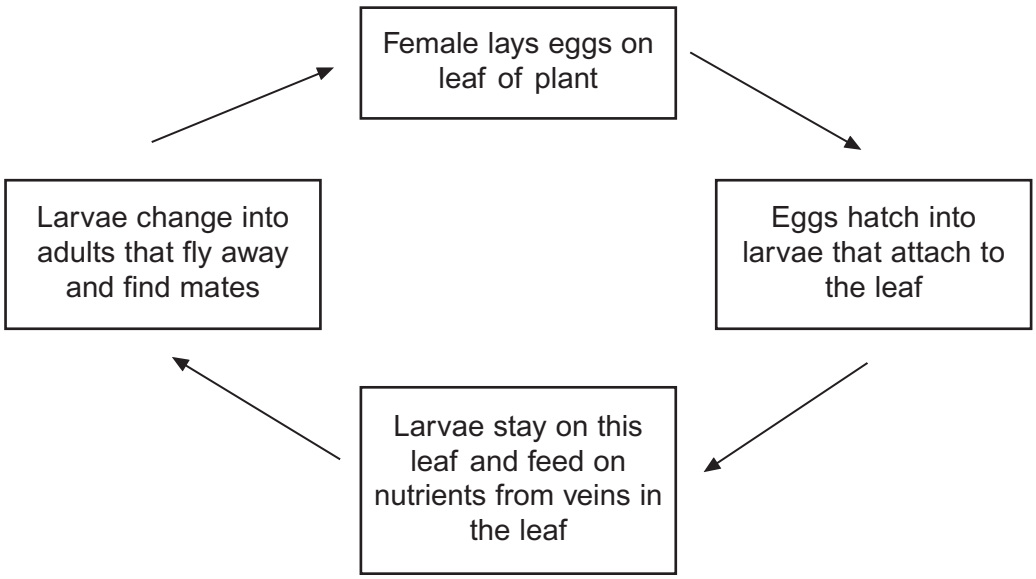
(2 marks)

Ecologists in Britain investigated the use of a species of insect, *Aphalara itadori*, from Japan, to control Japanese knotweed.
The life cycle of this insect is shown below.



The ecologists investigated whether this insect would affect plant species other than Japanese knotweed. They tested its effect on 90 species of plants from Britain. This included species belonging to the same family as Japanese knotweed.
Their results were as follows.

- When females were given a free choice of plants, 98.8% of eggs were laid on Japanese knotweed.
- Larvae on leaves of plants other than Japanese knotweed did not develop into adults.
- Larvae caused very poor growth of leaves and plants.

7 (b) Suggest **one** reason why the ecologists included species of plant belonging to the same family as Japanese knotweed in this investigation.

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(2 marks)

7 (c) The ecologists concluded that *A. itadori* could safely be used to control Japanese knotweed in Britain.

Use the information provided to explain why they reached this conclusion.

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(4 marks)

(Extra space) .....

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Question 7 continues on the next page

7 (d) *A. itadori* does not kill Japanese knotweed.

Where *A. itadori* is used, native plants are usually able to outcompete the Japanese knotweed. Suggest **one** reason why.

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(2 marks)

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8 (a) Anaphylaxis can affect people with hypersensitivity to a specific food substance.

Describe what happens in a person suffering anaphylaxis.

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(3 marks)

(Extra space) .....

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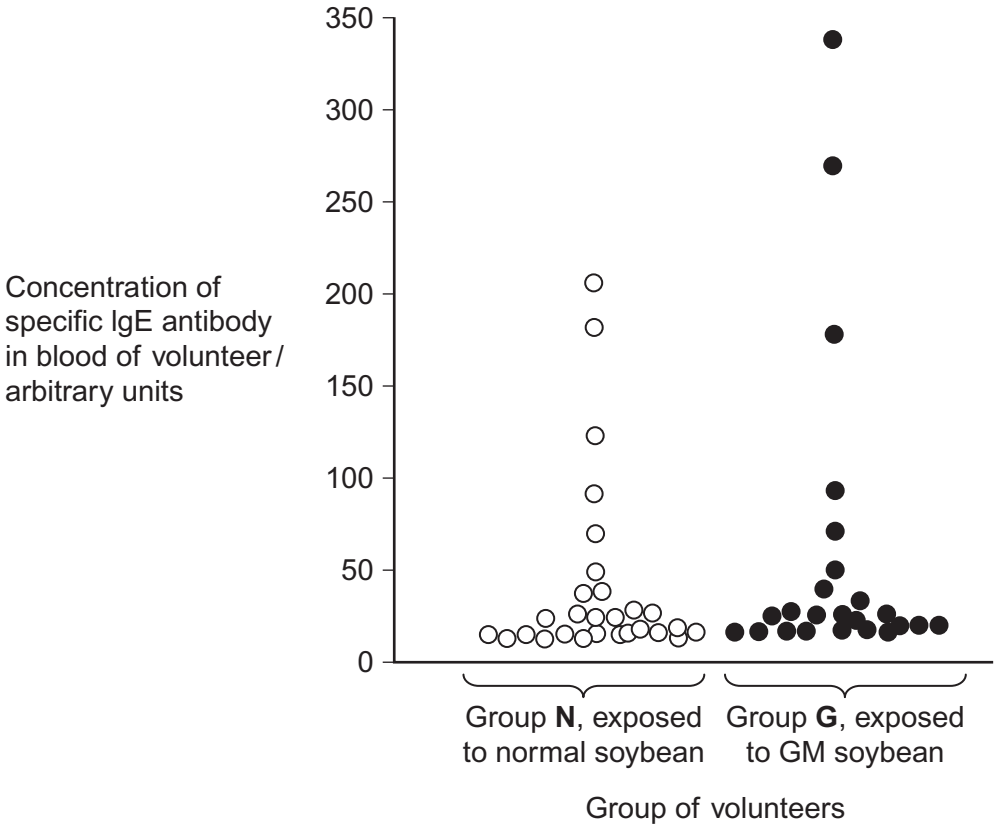
Question 8 continues on the next page

Scientists investigated whether genetically modified (GM) soybean produced a greater allergic response than normal soybean. They recruited a large number of volunteers who had food allergies. The volunteers were divided into two groups, **N** and **G**, at random.

- Group **N** was exposed to a small amount of an extract from normal soybean.
- Group **G** was exposed to a small amount of an extract from GM soybean.

After a suitable time, the scientists measured the concentration of IgE antibody specific to soybean extract in the blood of each volunteer.

The graph shows their results, in the form they were presented by the scientists. Each circle represents the result from one volunteer.



8 (b) What do these results show about the responses of these volunteers to extracts from normal and GM soybean?

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(2 marks)

8 (c) The GM soybean used in this investigation contains a gene from a bacterium that codes for an enzyme not present in normal soybean.

Suggest why the researchers thought that GM soybean might produce a different allergic response to normal soybean.

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(1 mark)

8 (d) The scientists used the concentration of specific IgE antibody in the blood to measure the allergic response to the soybean extract.

Explain why.

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(2 marks)

8 (e) The scientists used a statistical test to compare the mean concentrations of IgE in each group. They obtained a probability value, P, greater than 0.05.

What does this value show?

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(1 mark)

9

9 Doctors compared the effects of benzoyl peroxide and light therapy on acne. Benzoyl peroxide is the active ingredient in many acne-treatment creams.

They recruited 75 volunteers with acne and divided them at random into three groups.

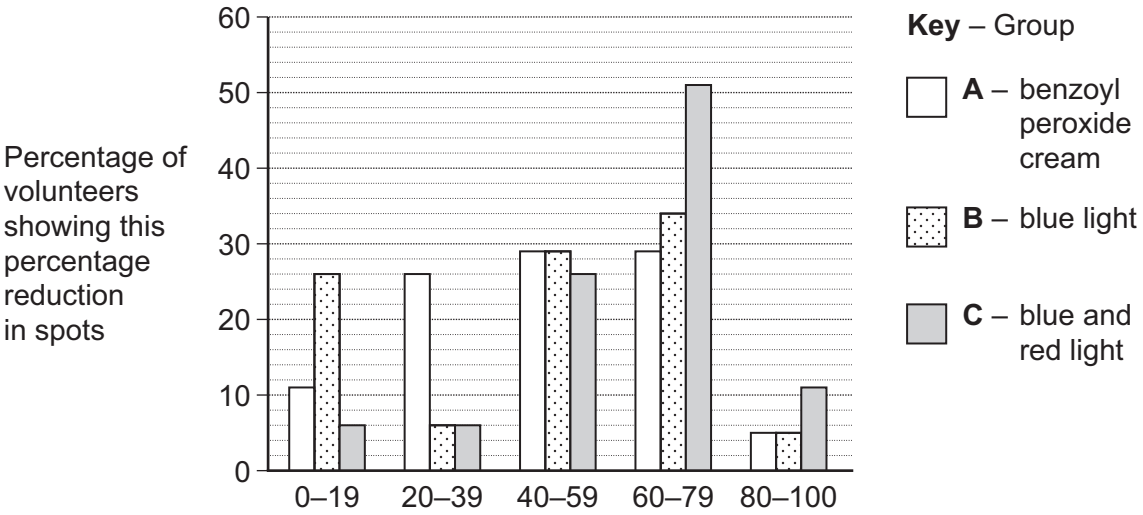
Group A used benzoyl peroxide cream
Group B used a bright blue light, wavelength 415 nm
Group C used the bright blue light and a bright red light, wavelength 660 nm

The volunteers in each group were given daily treatments.

The doctors counted the number of spots on each volunteer at the start of the investigation. They counted the number of spots again after 12 weeks' treatment.

Figure 1 shows their results.

Figure 1



9 (a) Describe the differences between the results for these acne treatments.

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(3 marks)

(Extra space) .....

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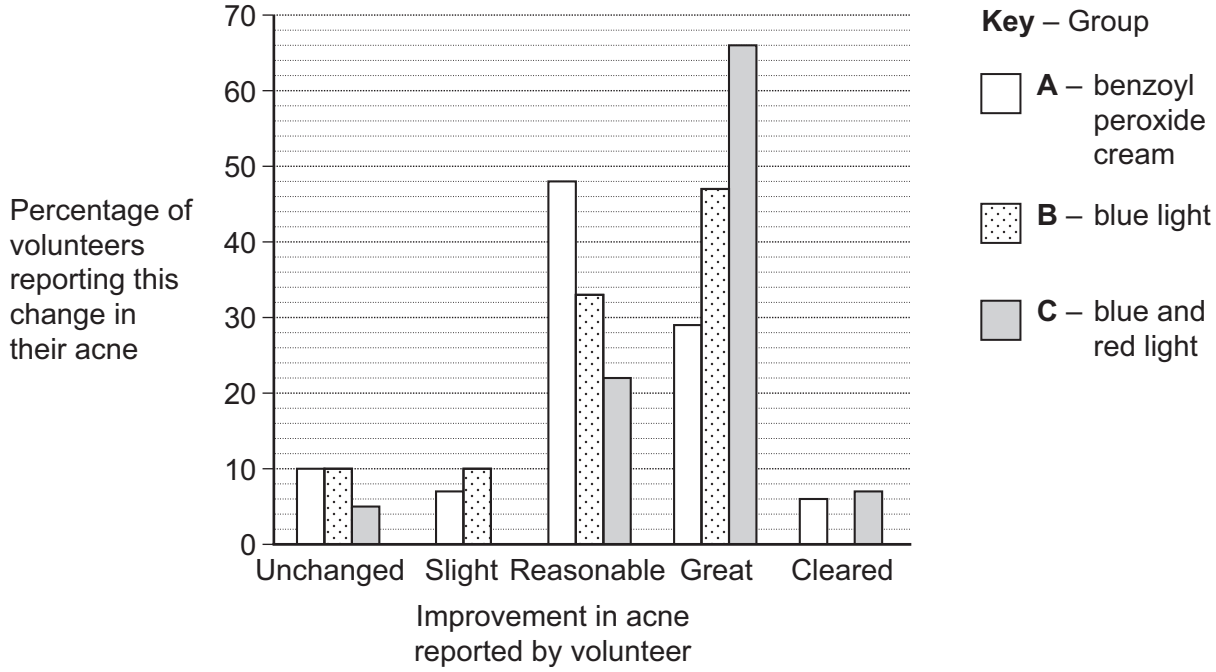
The doctors also asked each volunteer to assess the effect of their acne treatment as *unchanged*, *slight improvement, reasonable improvement, great improvement* or *cleared.*

Figure 2 shows the results of these assessments.

Figure 2



9 (b) How do the results of the volunteers' assessments in **Figure 2** compare with the doctors' spot counts in **Figure 1**?

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(3 marks)

(Extra space) .....

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Question 9 continues on the next page

9 (c) The doctors concluded that their spot counts were more reliable than the volunteers' assessments when comparing acne treatments.

Do you agree with this conclusion? Give a reason for your answer.

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(2 marks)

9 (d) The doctors decided further investigations were required before they could make a recommendation about which of these treatments should be used to treat acne.

Suggest **one** reason why they reached this decision.

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(2 marks)

10

ESSAY

You should write your essay in continuous prose.

Your essay will be marked for its scientific accuracy. It will also be marked for your selection of relevant material from different parts of the specification and for the quality of your written communication.

The maximum number of marks that can be awarded is:

Scientific content	16
Breadth of knowledge	3
Relevance	3
Quality of Written Communication	3

10 Write an essay on **one** of the topics below.

EITHER

10 (a) How humans affect populations of other organisms. *(25 marks)*

OR

10 (b) The importance of shapes fitting together in cells and organisms. *(25 marks)*

END OF QUESTIONS

If you want to make a plan write it here.

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