

Candidate Name	Centre Number				Candidate Number				



GCSE BIOLOGY

COMPONENT 1

Concepts in Biology

FOUNDATION TIER

SAMPLE PAPER

(2 hours 15 minutes)



For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	10	
3.	5	
4.	6	
5.	10	
6.	12	
7.	14	
8.	13	
9.	14	
10.	8	
11.	8	
12.	14	
Total	120	

ADDITIONAL MATERIALS

In addition to this examination paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

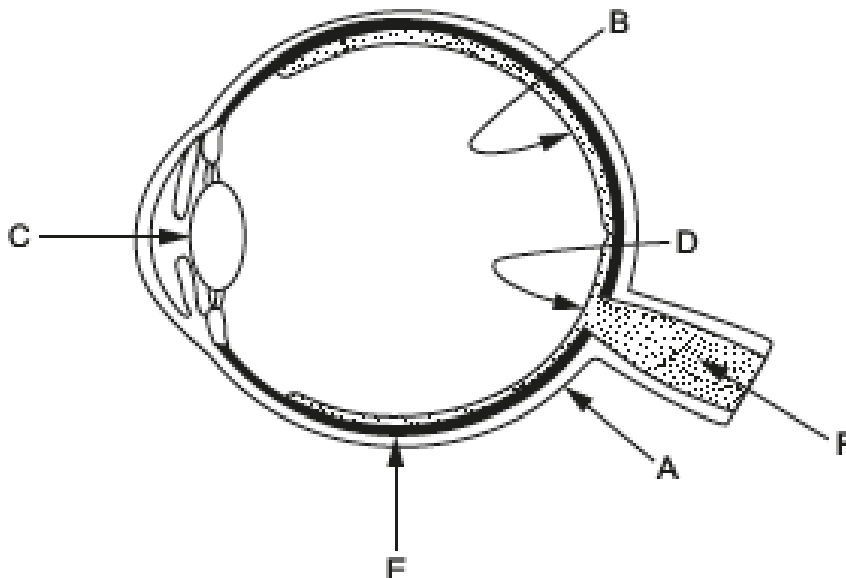
INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

The assessment of the quality of extended response (QER) will take place in question **9(b)**.

Answer **all** questions

1. The diagram shows a section through a human eye.



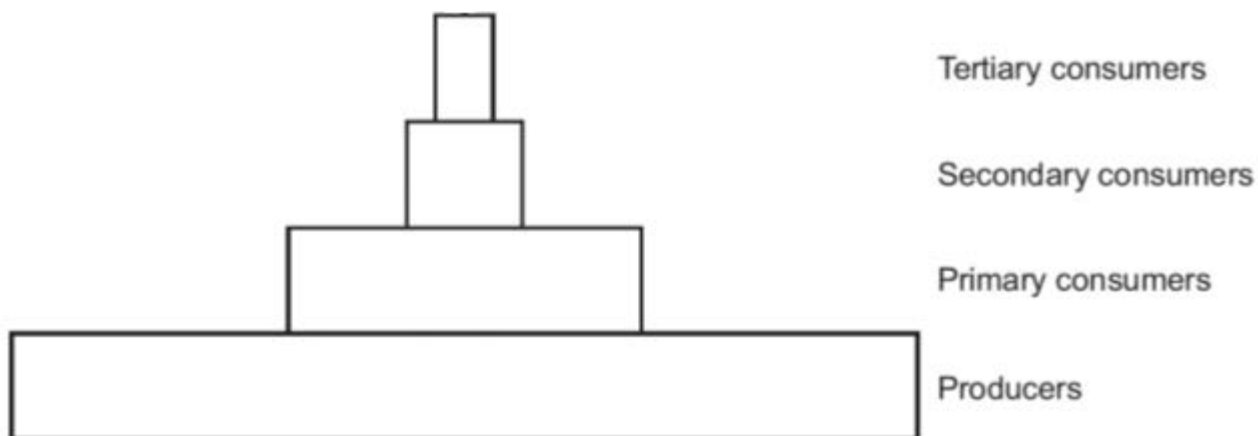
(a) Complete the table to match features on the diagram with the descriptions given. [4]

Label	Name of part of the eye	Description
B
.....	Optic nerve	Structure which transfers information from sensory cells to the brain
C	Structure which assists in focussing rays of light to form an image

(b) Matt goes into a darkened room and cannot see any of the items there. Describe how the pupil of his eye changes over the next few minutes and state how this affects his vision. [2]

.....

2. (a) The diagram below shows a pyramid of biomass for the trophic levels of organisms in a habitat.



- (i) Which trophic level consists of photosynthetic organisms? [1]

.....

- (ii) From the list below, add the biomass values ($\text{kg/m}^2/\text{yr}$) to each of the trophic levels. [2]

10 000 60 6 700 650

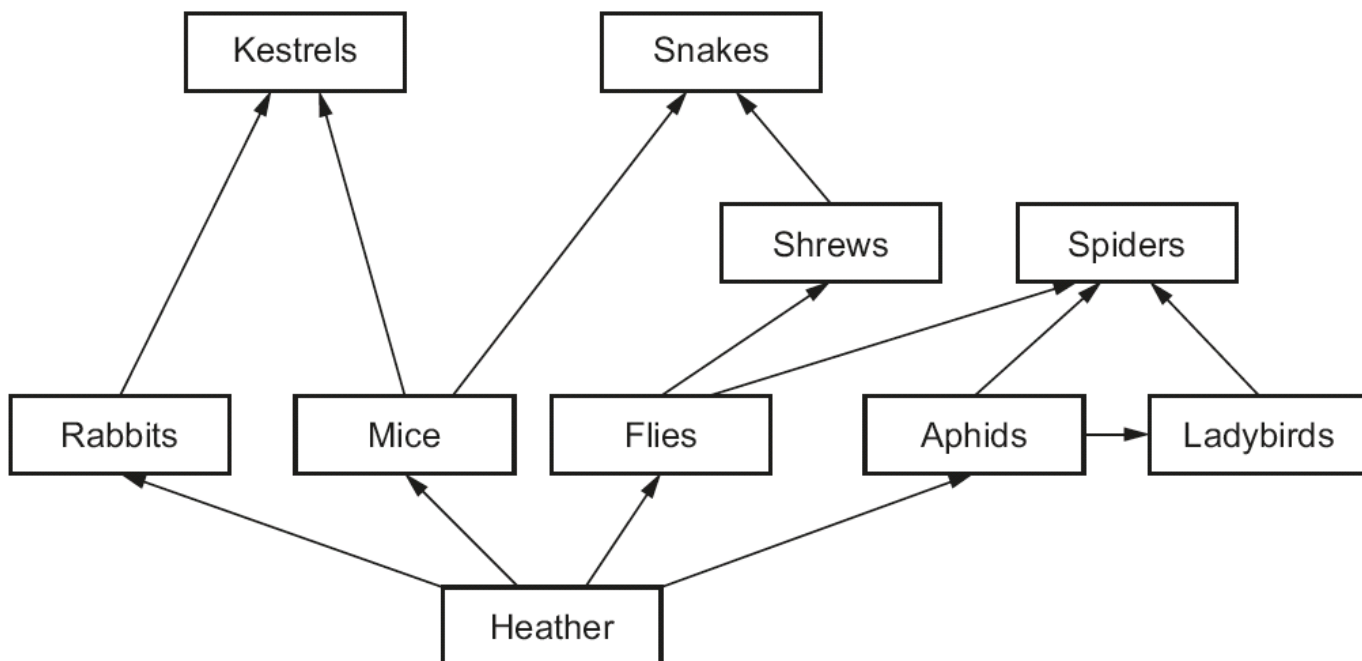
- (iii) From your pyramid, calculate the percentage of biomass which passes from the primary consumers to the secondary consumers. [2]

percentage of biomass = %

- (iv) Give **two** reasons why it is not possible for all the biomass from the primary consumers to pass to the secondary consumers. [2]

.....
.....

(b) The food web below shows the organisms in a heathland habitat.



(i) State **two** secondary consumers which compete for the same species of herbivore as food. [1]

.....

(ii) Give **one** animal which feeds on both herbivores and carnivores. [1]

.....

(iii) Explain how the numbers of the animals in the food web would change if large quantities of heather plants were destroyed. [1]

.....

.....

3. *Aspidistra elatior* is a plant which grows in forests in Asia.



Aspidistra plants growing in Asia

- The *Aspidistra* plants survive best at low levels of light, temperatures between 18 – 20 °C and in acidic soil with a moisture content below 20%.
- It reproduces asexually in these conditions.
- It reproduces sexually when conditions become unfavourable by producing flowers which need soil invertebrates for pollination.

- (a) (i) Give a reason why *Aspidistra* flowers are produced at soil level. [1]

.....

- (ii) In the following table, **place a tick** (✓) by the environments (A to E) which would allow *Aspidistra* plants to reproduce asexually. A pH scale is provided to help you. [2]

1 2 3 4 5 6 7 8 9 10 11 12 13 14
acid ←————— neutral —————→ alkali

Environment	Light intensity (a.u)	Soil moisture content (%)	soil pH value	Temperature (°C)	Asexual reproduction ✓
A	18	13	9	15	
B	66	83	3	21	
C	13	15	4	20	
D	75	42	11	23	
E	9	17	4	19	

(b) Explain why it is an advantage for Aspidistra plants to reproduce asexually. [2]

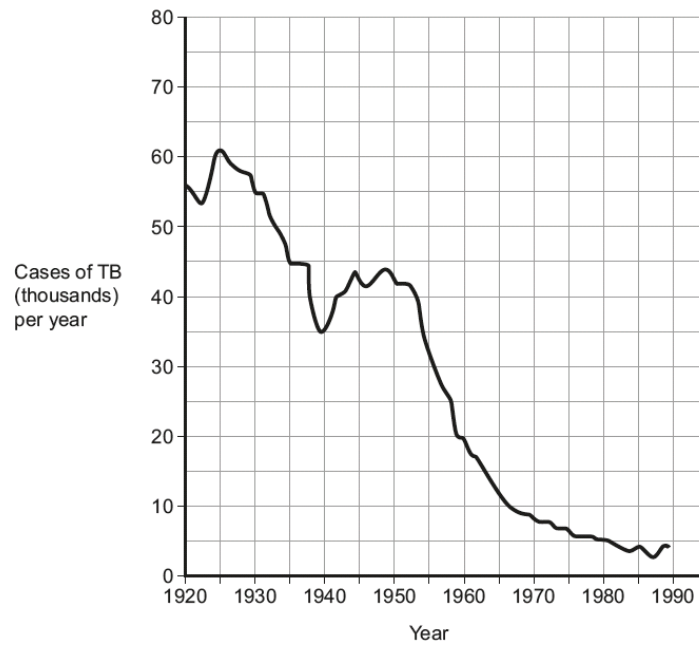
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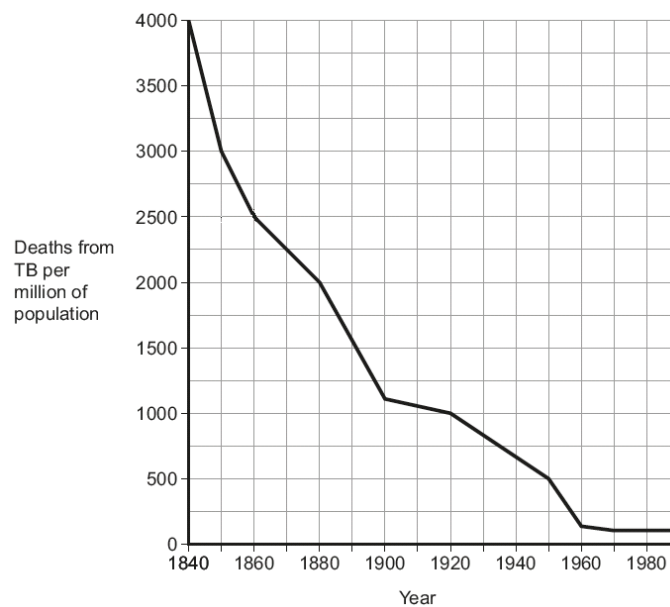
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4. Tuberculosis (TB) is a disease caused by the bacterium *Mycobacterium tuberculosis*. The graphs below show information about TB in the UK. Antibiotics were first used to treat TB in the 1940s. Vaccination became available in the 1960s.

Graph 1



Graph 2



From this information

- (a) (i) I Calculate the reduction in the death rate from tuberculosis between 1860 and 1900. [2]

deaths per million population =

- II Suggest why the death rate fell during this time. [1]

.....

- (ii) From the graphs, what evidence is there that antibiotics were effective in reducing the death rate from TB between 1940 and 1950? [1]

.....

.....

- (iii) From graph 1, what evidence is there to support the idea that the vaccination against TB has been effective? [1]

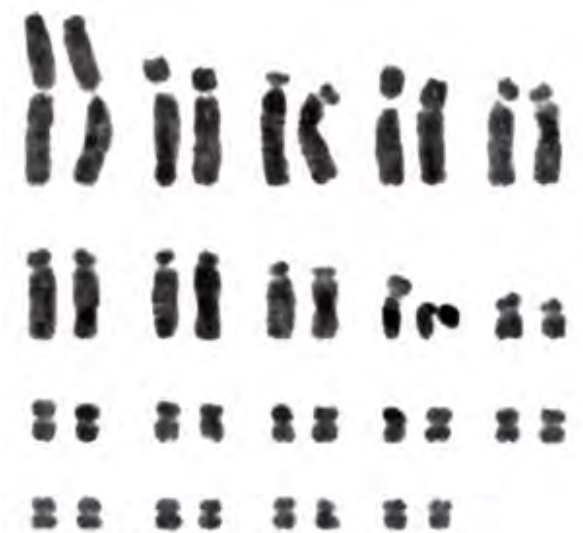
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- (b) In 2012 an investigation by the World Health Organisation (WHO) revealed a problem. 20% of cases of TB occurring in the world were caused by a strain *Mycobacterium tuberculosis* called DRTB which had become resistant to antibiotics. Suggest how doctors and hospitals may have contributed to the problem. [1]

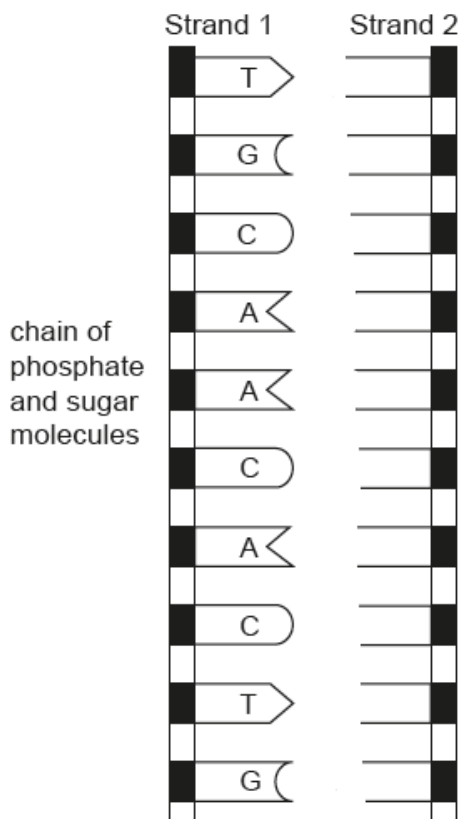
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5. The photograph shows the 38 chromosomes in a body cell of a domestic cat, (*Felis catus*).



- (a) State the number of these chromosomes which would be found in a: [2]
- (i) sperm cell;
- (ii) fertilised egg cell.
- (b) Chromosomes are composed of DNA.
The diagram below shows a very short section of DNA from a gene on a chromosome of *Felis catus*.



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- (i) Complete the diagram by adding the letters for the missing bases on strand 2 and completing the shapes. [3]
- (ii) Draw a circle around **one** nucleotide. [1]
- (iii) The bases from strand 1 of the same gene from three other species of cat are shown below.

Species 1	T G G T C C A C T G
Species 2	T G C A C C A C T G
Species 3	T G C G A G T G A G

- I Giving a reason, identify the species (1, 2 or 3) which **is most closely** related to *Catus felis* [2]

Species

Reason

.....

- II Explain how genetic profiling could be used to show the similarities between these species. [2]

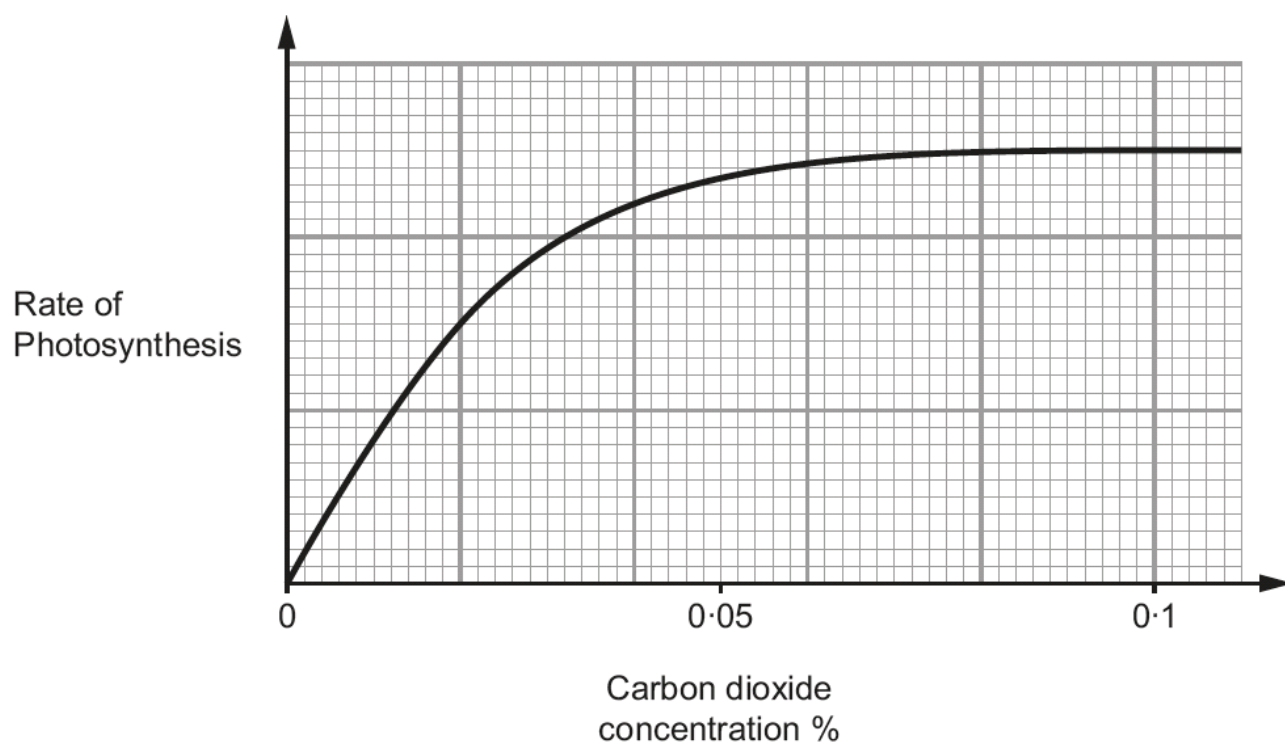
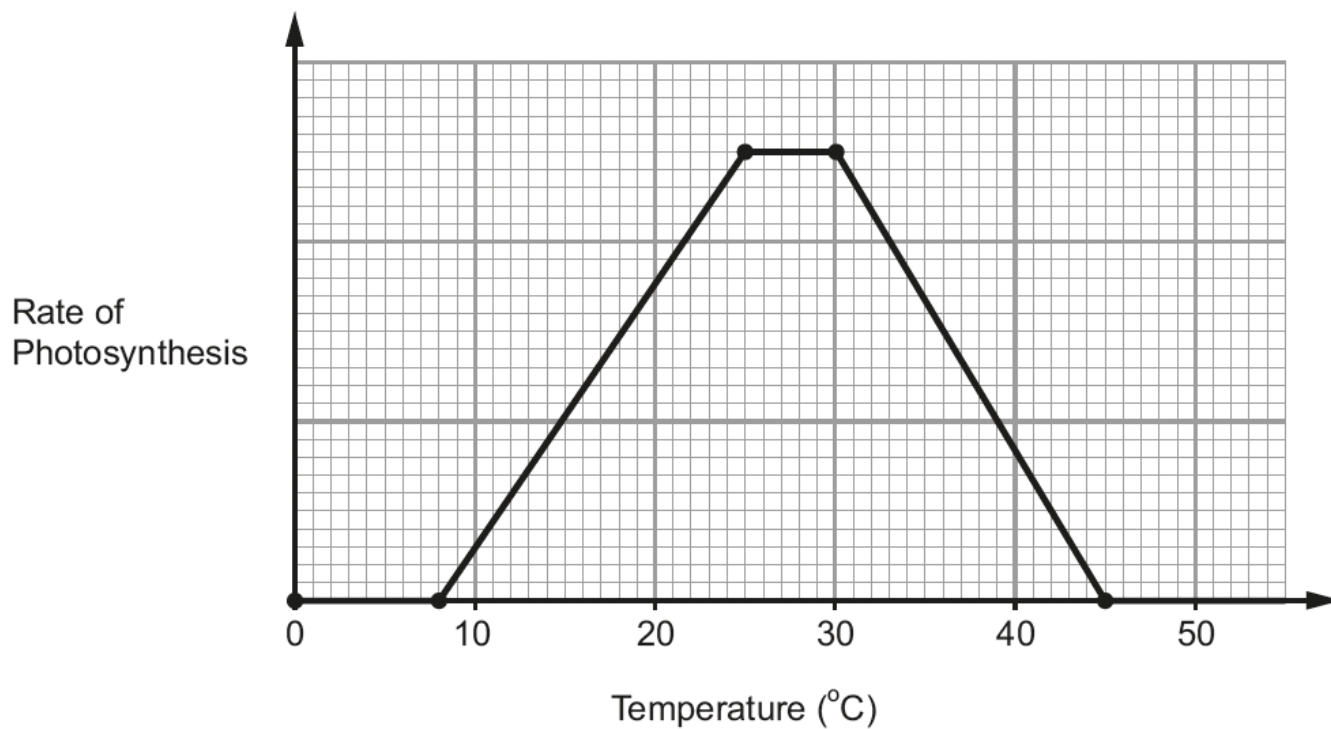
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6. (a) (i) Complete the word equation which summarises photosynthesis. [2]
carbon dioxide + water \longrightarrow +
- (ii) I Name the structure in plant cells which contains chlorophyll. [1]
.....
- II Explain why it is necessary in photosynthesis. [2]
.....
.....
- (b) Scientists investigated photosynthesis in tomato plants in greenhouses during the winter. They varied carbon dioxide levels and temperatures in order to identify the conditions which would give maximum photosynthesis and therefore maximum growth. There was no shortage of light at any time.



The graphs show the results of the investigation.



From these graphs:

- (i) Describe how the rate of photosynthesis in tomatoes is affected by changes of:

I temperature [2]

.....
.....

II carbon dioxide concentration [2]

.....
.....

- (ii) State the conditions which would be the best choice for commercial tomato growers wanting the highest yields and maximum profit. Explain your answer. [3]

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7. Many species of butterflies and other insects have declined considerably in the UK since 1950. The main reason for this decline has been the destruction of habitat caused by human activities such as use of land for food production, with hedges and trees being removed.

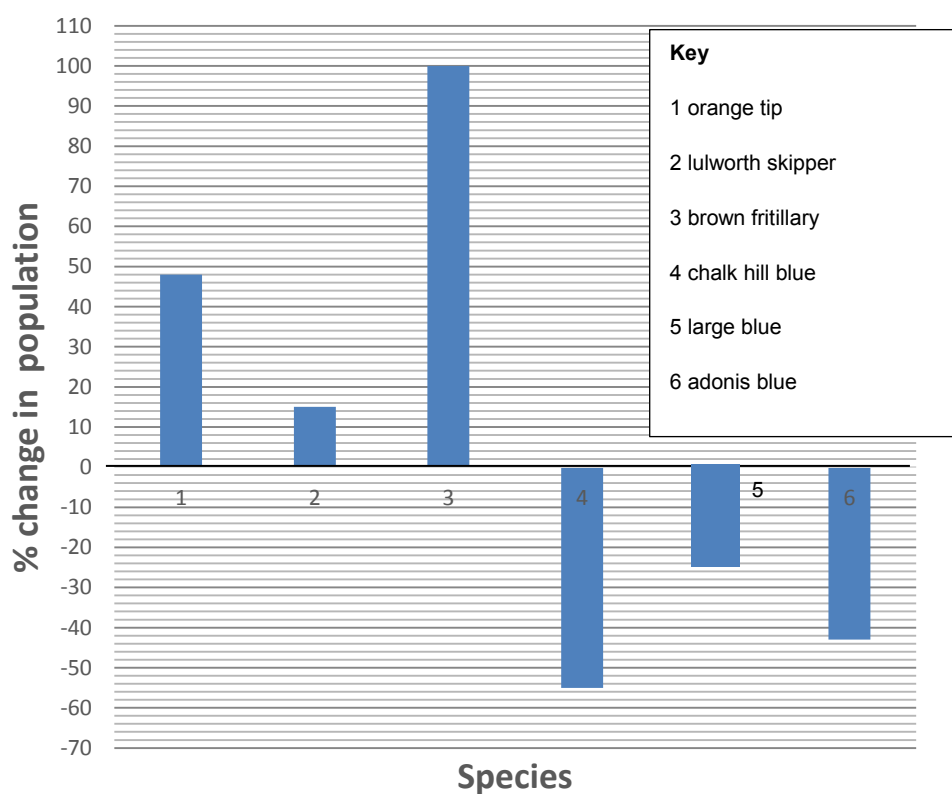


Orange tip



Chalk hill blue

The bar chart below shows data for six of these butterfly species from an investigation carried out between 2012 and 2014.



- (a) From the bar chart:
- (i) Which species shows the greatest percentage decrease between 2012 and 2014? [1]
 species by%
- (ii) Calculate
- I The number of brown fritillary in 2014, based on a count of 256 in 2012. [1]
 Number of butterflies =
- II The number of the large blue in 2012, based on a count of 150 in 2014. [2]
 Number of butterflies =
- (iii) The chalk hill blue and large blue are officially listed as “Critically Endangered” in the UK. What will happen to these species if numbers do not recover in future years? Explain how this will affect biodiversity. [3]

- (b) For some butterfly species, numbers are increasing because habitat is being restored or conserved.
- (i) Suggest **one** way in which farmers could help to restore butterfly habitat. [1]

- (ii) How do groups such as the UK Environment agency help in conserving natural habitat? [1]

(c) The charity 'Butterfly Conservation' collects data on 50 of the 260 species of UK butterflies. Observers make repeated counts every year in every part of the country.

(i) State **two** features of this monitoring process which would allow scientists to have confidence in the data obtained. [2]

.....
.....

(ii) Describe **one** way in which the monitoring process could be improved to give increased confidence in the results. [1]

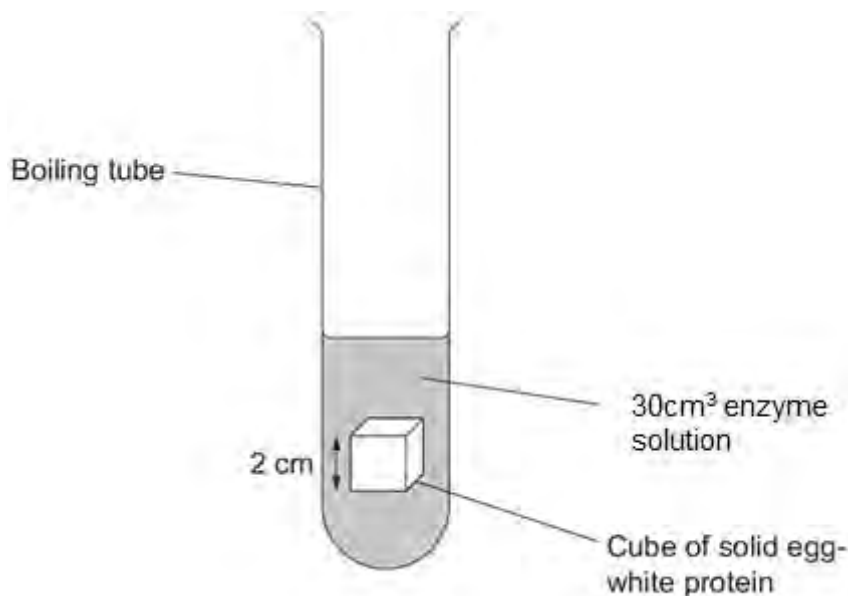
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(d) Farmers often use chemical sprays to kill insect pests and weeds which can reduce the growth of their crops.
Give **two** reasons why many conservationists do not want chemical sprays to be used in the UK. [2]

.....
.....

8. Some students investigated the action of a protease enzyme which digests the protein in egg white. They set up six boiling tubes, as shown in the diagram below, each with a different pH value. The mass of the cube of egg white decreased as the protein was digested.

They carried out the investigation at 25 °C and also at 37 °C and recorded the percentage decrease in the mass of egg white protein after 24 hours.



- (a) Calculate the volume of the cube of egg white at the start of the investigation. [2]

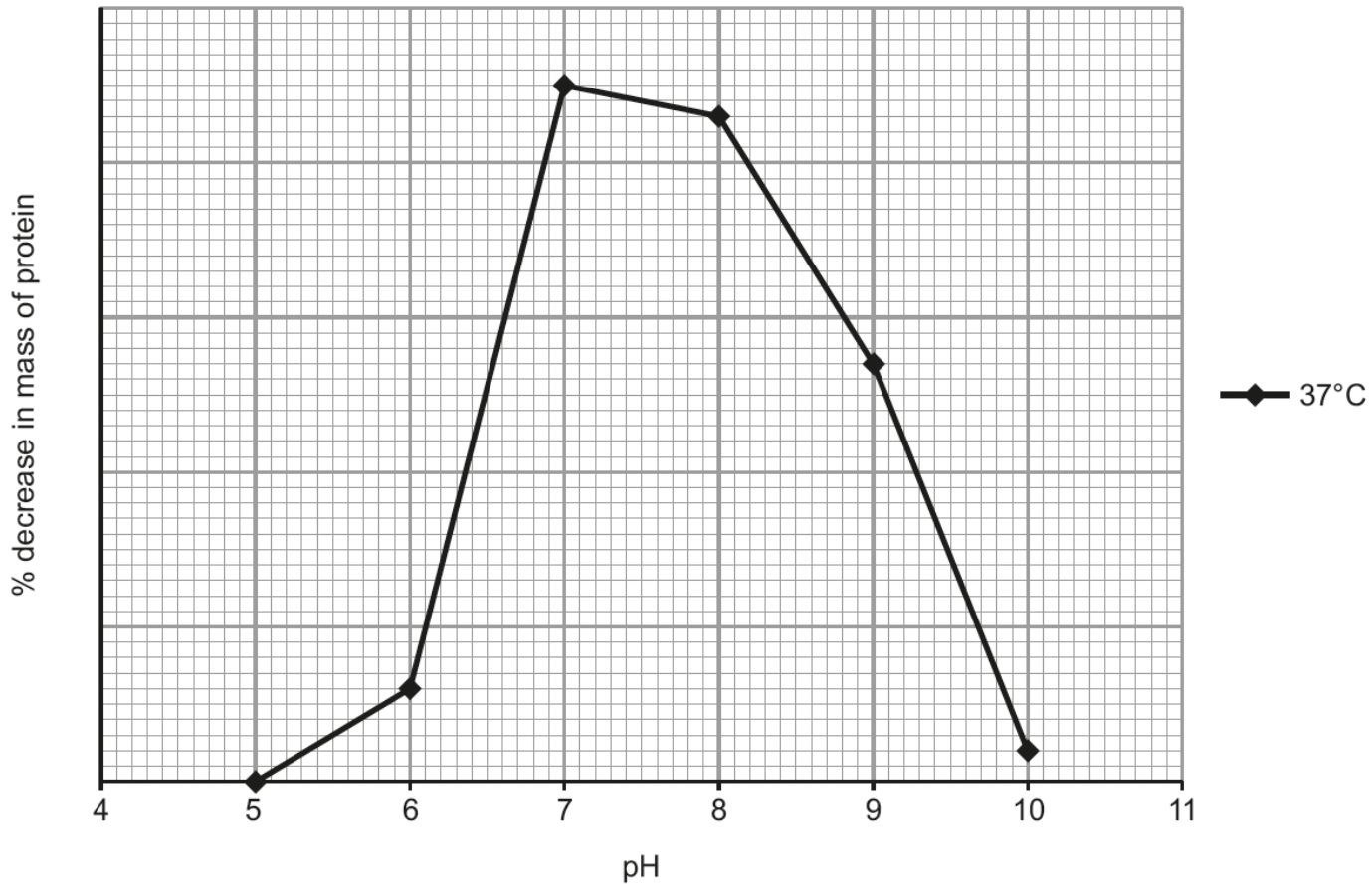
volume =cm³

The results of the investigation are shown below

	pH Value					
	5	6	7	8	9	10
% decrease in mass of protein at 25 °C	0	1	24	28	7	2
% decrease in mass of protein at 37 °C	0	6	45	43	27	2

Graph of results

The data for 37 °C have been plotted for you.



(b) Plot the results for 25 °C onto the graph above: [4]

- add a scale for the % decrease in mass of protein
- plot the points
- join your points with a ruler and label your line.

(c) From these results:

(i) Describe the effect of pH on the activity of the enzyme. [1]

.....

.....

(ii) Suggest an optimum pH value for the enzyme, giving a reason for your choice. [1]

pH

Reason

.....

- (iii) State why it is not possible to identify the optimum pH value accurately from these results. [1]

.....

- (iv) From the graphs, calculate the difference in the percentage decrease in mass at pH6.5 between 25 °C and 37 °C. [1]

percentage decrease =%

- (v) Explain the reason for the difference in the activity of the protease enzyme at 25 °C and 37 °C at pH6. [2]

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- (d) The students set up a control tube with boiled enzyme to compare with the tubes they used in their investigation. What was the purpose of this control tube? [1]

.....

9. (a) The images below show three ways in which bacterial diseases can be transmitted. Explain how bacteria could be transmitted in each image and suggest how each means of transmission could be avoided. [6]

A



B



C



A

.....

.....

B

.....

.....

C

.....

.....

- (c) Explain how the scientists could have confirmed the results of their investigation.

[2]

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10. (a) A breeder of prize-winning roses has two different rose bushes. One bush produces large red roses but has many thorns on its stems. The other bush produces small red roses and has stems with very few thorns. Explain how, by selective breeding, the rose breeder could produce a rose bush with large red flowers and very few thorns on its stems. [3]

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- (b) If the rose breeder was successful, he could produce many more rose bushes by taking cuttings from the new parent bush.

(i) Why would the cuttings produce bushes identical to the parent bush? [1]

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(ii) Suggest **two** reasons why it would be unwise to produce all rose bushes in the country only from cuttings. [2]

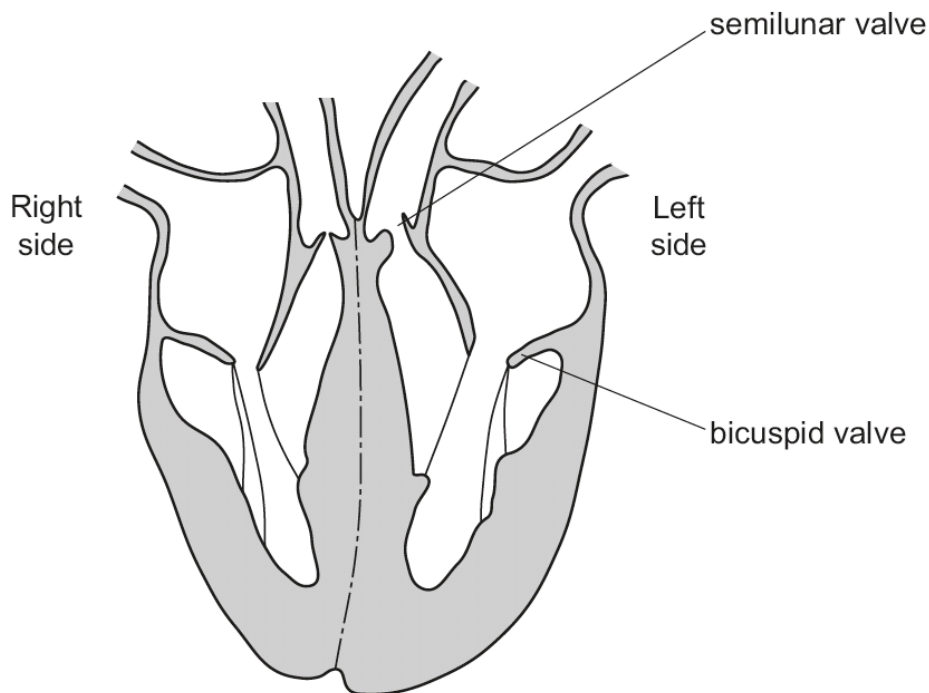
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- (c) In roses, the allele for white flowers (r) is recessive to the allele for red flowers (R).

A rose bush with red flowers was self-fertilised. The seeds were collected and grown. 25% of these rose bushes produced white flowers. Using the symbols for the alleles given above, explain these results using a Punnett square in the space below. Give a key to the symbols used. [2]

11. The diagram shows a section through a heart.



(a) Complete the table below to show what is happening to the following parts of the **left** side of the heart during the passage of blood through the heart. [6]

Left atrium	Left ventricle	Bicuspid valve	Semi-lunar valve
contracts to force blood into left ventricle			
relaxes and fills with blood			

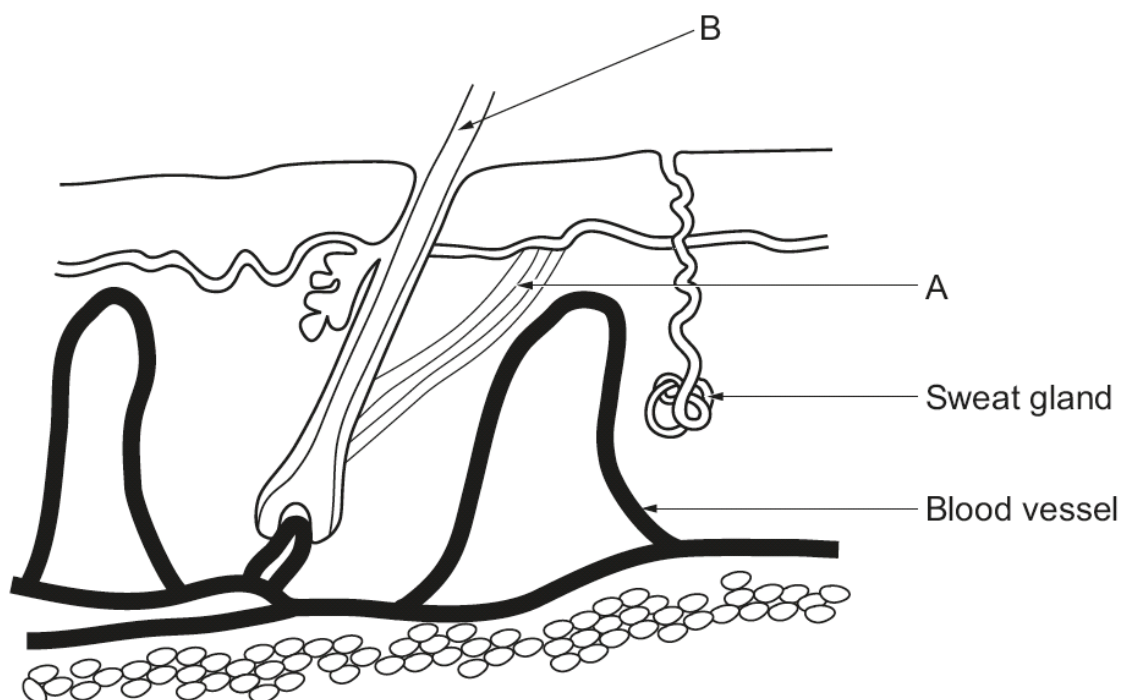
(b) Explain why the walls of the ventricles are thicker than those of the atria. [2]

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12. (a) The diagram shows the structure of human skin.



- (i) Explain how the structures labelled **A** and **B** function to help reduce heat loss in cold conditions. [3]

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.....

- (ii) Blood vessels and sweat glands are important in lowering the body temperature if it becomes too high. If the body temperature reaches 40 °C 'Heat Stroke' can occur, which can be fatal.

- I State how the blood vessels help in cooling the body in hot conditions, such as on a sunny beach. [2]

.....

.....

- II In hot, humid conditions the air may contain a very high level of water vapour. Explain why it is possible for heat stroke to occur in these conditions, even if sweat glands are functioning normally. [2]

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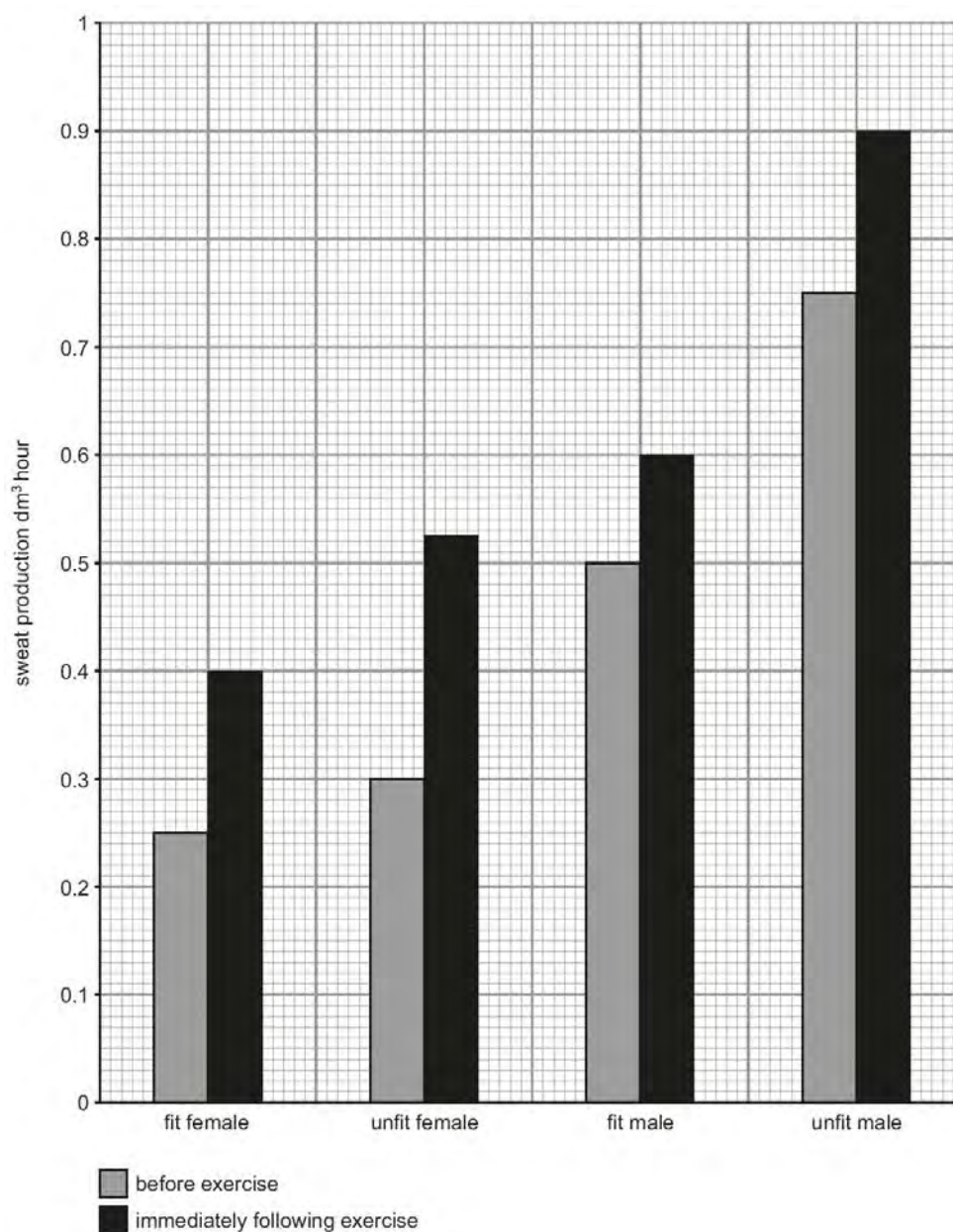
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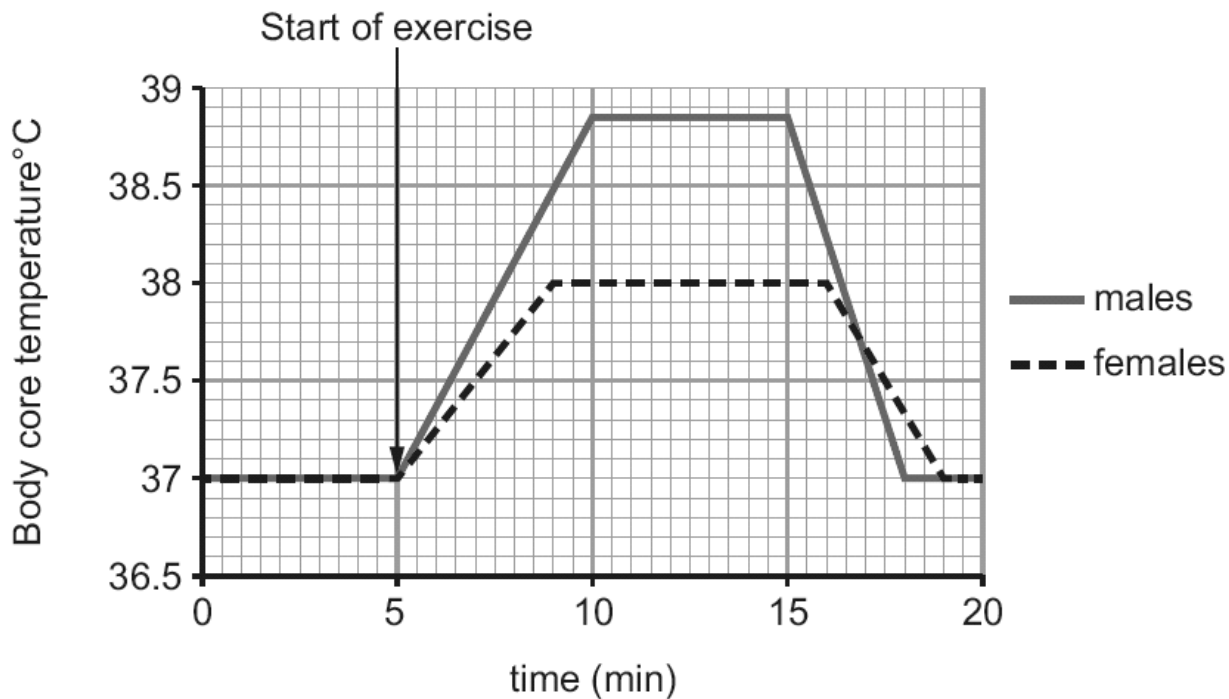
- (b) A student investigated how sweating changed during exercise in four people, two males and two females aged between 22 and 49.

He measured their rates of sweat production at rest and while they used an exercise cycle at a constant level of effort for 10 minutes, in a controlled environment.

Two of the people were fit athletes and two were not athletically fit. Sweat rates were measured on the arms or the forehead. Body temperature was also recorded.

The results are shown in the following graphs.





Use the graphs to answer the questions below.

- (i) Compare the effect of exercise on the rates of sweating in fit and unfit people. [2]

.....

- (ii) Calculate the percentage increase in the fit male's sweating rate after exercise. Show your working. [2]

Sweating rate =%

- (iii) Describe **one** difference in the way the body temperature of males and females changes during exercise. [1]

.....

- (iv) What is the evidence that sweating is more efficient at lowering body temperature in males? [1]

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- (v) State **one** way in which the student could improve his investigation in order to make it a fairer test. [1]

.....

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