Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **5090/61**

Paper 6 Alternative to Practical **May/June 2021**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Any blank pages are indicated.

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

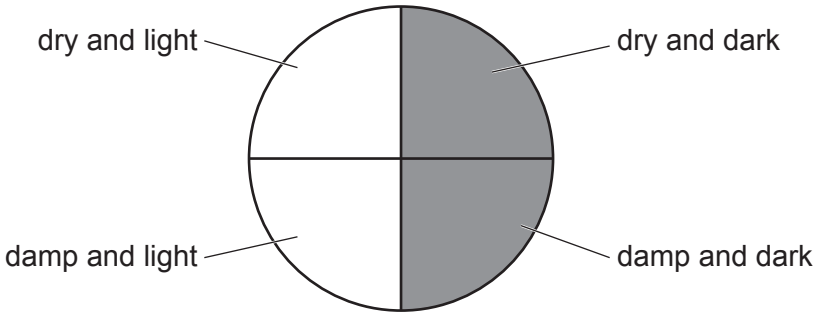
1 A student investigated the response of some small animals called woodlice to various stimuli.

A circular container with a lid called a 'choice chamber' was used.

This had four distinct areas:

- dry and light
- damp and light
- dry and dark
- damp and dark.

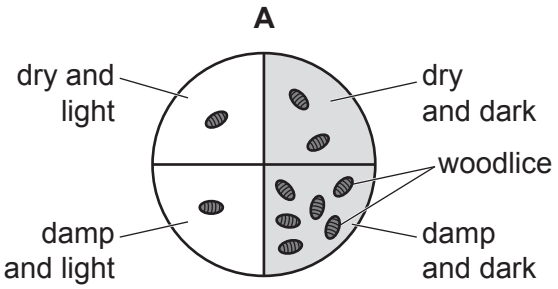
The diagram shows the choice chamber viewed from above.

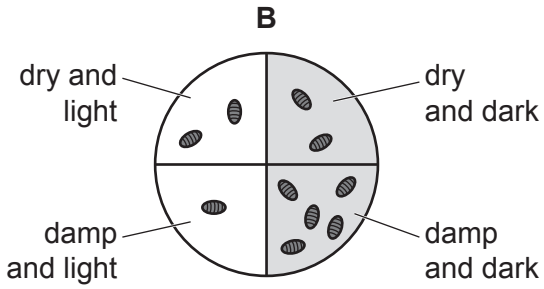


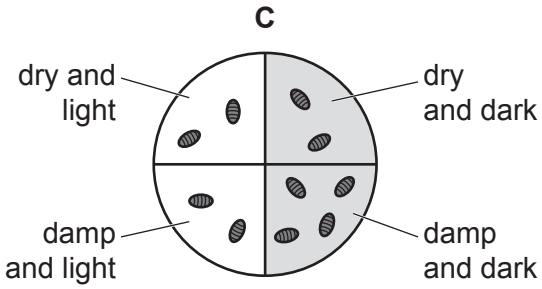
The student put 10 woodlice in the choice chamber and left them for 20 minutes. The woodlice were free to move anywhere they wanted in the choice chamber during that time.

After 20 minutes she drew a diagram to show the position of the woodlice in the choice chamber. This is shown in diagram **A**.

She repeated this procedure twice, with the results shown in diagrams **B** and **C**.







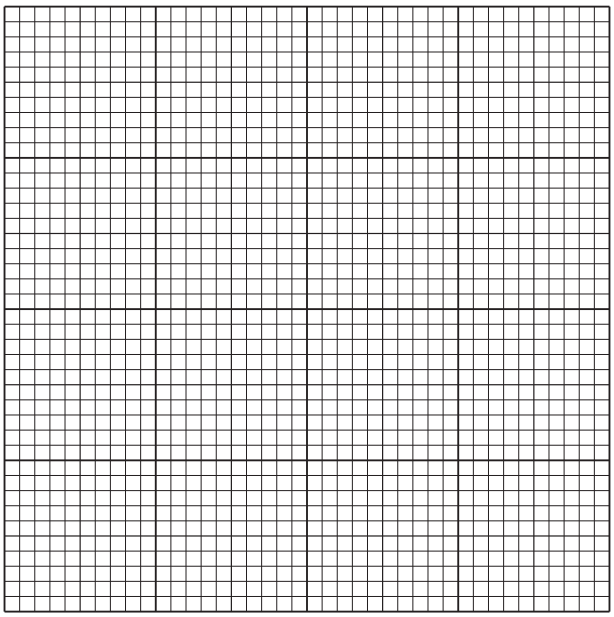
She recorded her observations in the table.

(a) **(i)** Count the numbers of woodlice in each area of choice chamber **C** and record them in the table. [1]

conditions	number of woodlice			mean number of woodlice
	A	**B**	**C**	
dry and dark	2	2		
damp and dark	6	5		
damp and light	1	1		
dry and light	1	2		

(ii) Calculate the mean number of woodlice in each of the four areas of the choice chamber **to the nearest whole number**. Record these results in the table. [2]

(b) Construct a bar chart on the grid provided to show the mean number of woodlice (to the nearest whole number) found in each area of the choice chamber. [4]



(c) **(i)** Using the data in the table and your bar chart, state which area of the choice chamber the woodlice preferred.

..... [1]

(ii) Suggest where the student should have placed the 10 woodlice when she first put them into the choice chamber. Explain your answer.

.....

.....

.....

..... [2]

(iii) Suggest **two** ways in which the results of this investigation could be made more reliable.

1 .....

.....

2 .....

..... [2]

(iv) Another student says that it would be a good idea to make some holes in the lid of the choice chamber. Suggest **one** advantage and **one** disadvantage of doing this.

advantage .....

.....

disadvantage .....

.....
[2]

[Total: 14]

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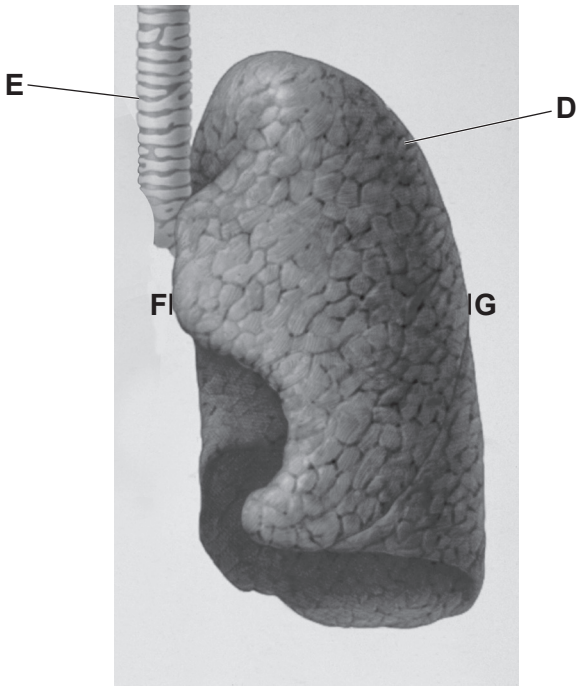
2 The photograph shows a mammalian organ.



(a) **(i)** Identify the organ labelled **D**. ..... [1]

(ii) Identify the structure labelled **E**. ..... [1]

(b) In the space below, make a large drawing of structures **D** and **E** as they appear in the photograph. Do not include the surface detail of structure **D** in your drawing.

[5]

(c) **(i)** **On the photograph**, draw a line between **F** and **G**.

Measure and record this length.

..... mm [2]

(ii) **On your drawing**, draw a line at the same location as the line **F**–**G**.

Measure and record the length of this line.

..... mm [2]

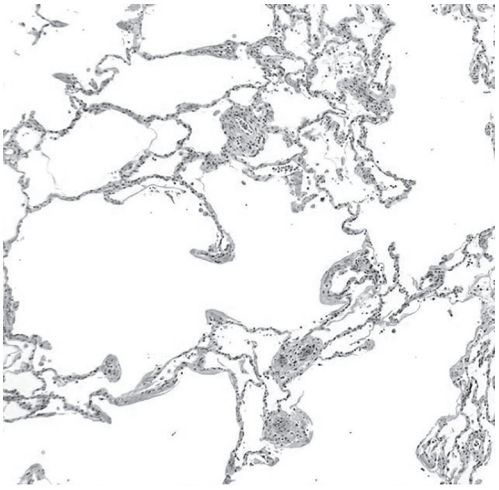
(iii) Use your measurements in **(c)(i)** and **(c)(ii)** to calculate the magnification of your drawing compared to the photograph. Give your answer to one decimal place.

Space for working.

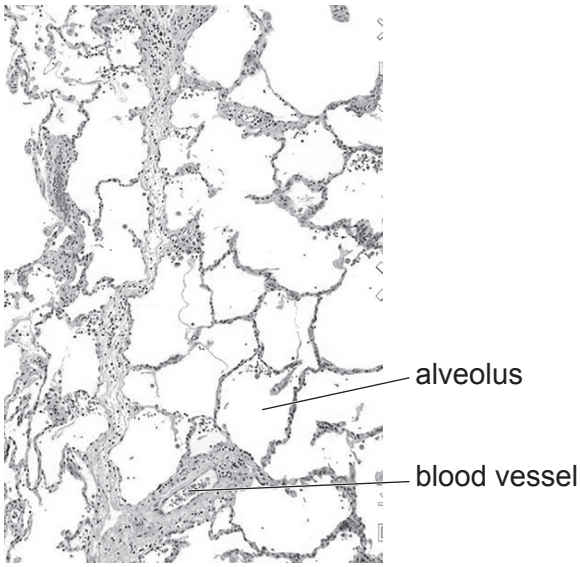
magnification × ..... [2]

(d) The photomicrographs show the detail of the same organ from a smoker and a non-smoker.

Both photomicrographs are to the same scale.



smoker



non-smoker

Complete the table to identify **two** differences between the two photomicrographs. [2]

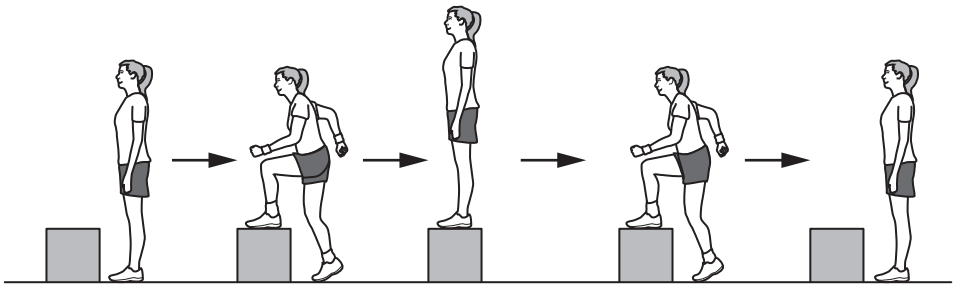
smoker	non-smoker
1	
2	

[Total: 15]

3 A student investigated the effect of exercise on her pulse rate using the Step Test.

The details of the Step Test are shown below:

The Step Test



1. Repeat the 'step exercise' as shown in the diagram continuously for 4 minutes.
2. Rest for 1 minute then count the number of heart beats for 15 seconds.
3. Rest for a further 45 seconds then count the number of heart beats for 15 seconds.
4. Rest for a final 45 seconds then count the number of heart beats for 15 seconds.
5. Use your results to calculate heart beats per minute (pulse rate).

The table shows her results.

time after step exercise / minutes	heart beats / 15 seconds	heart beats / minute
1	31	124
2	28	112
3	21	84
	total number of heart beats	

(a) **(i)** Complete the table by calculating the total number of heart beats for the 3 minutes after the step exercise. [1]

(ii) The resting pulse rate of the student before exercising was 16 heart beats in 15 seconds.

Calculate the number of heart beats in a minute for this resting pulse rate.

..... [1]

(iii) Use your answer to **(a)(ii)** and the data in the table to state the effect of exercise on the pulse rate of this student.

..... [1]

(iv) The fitness rating of an individual can be calculated using the formula shown.

$$\text{fitness} = \frac{24\,000}{\text{total number of heart beats for the 3 minutes after the step exercise}}$$

fitness	**fitness rating**
60 or less	poor
61 to 70	average
71 to 80	very good
greater than 81	excellent

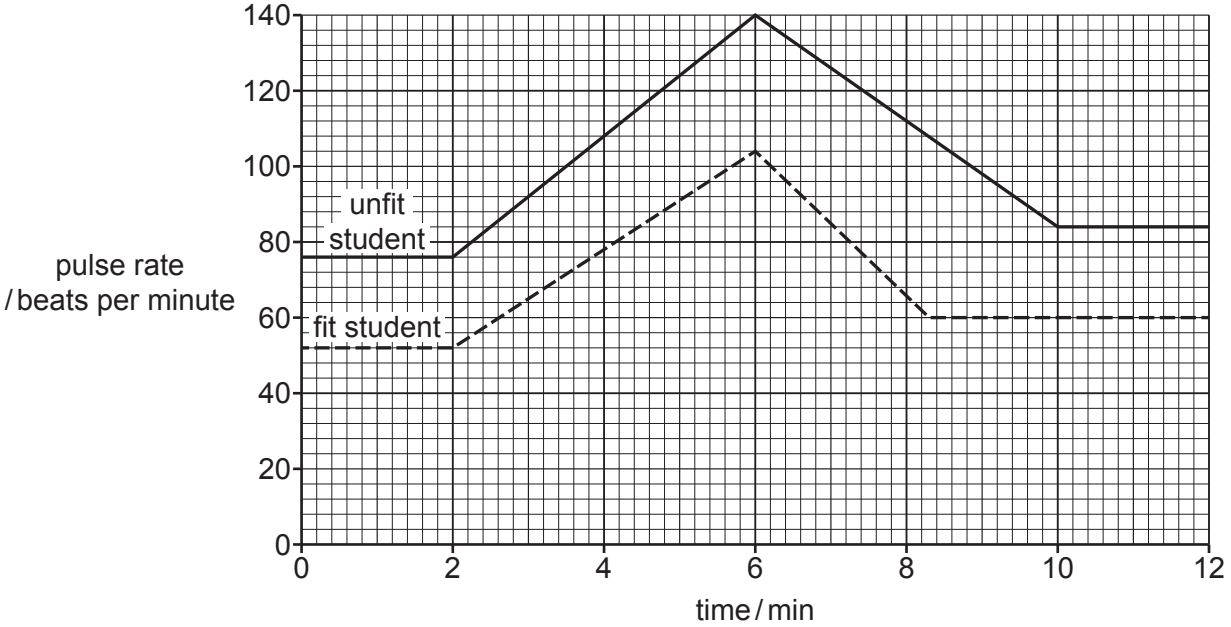
Use the information given above to calculate the student's fitness and to determine her fitness rating.

Space for working.

fitness .....

fitness rating .....
[3]

(b) The graph shows the pulse rate of an unfit student and a fit student before, during and after doing the Step Test.



(i) Describe the differences in pulse rate between the unfit student and the fit student as shown in the graph.

.....

.....

.....

.....

.....

..... [3]

(ii) Use the graph to calculate the difference in pulse rate between the unfit student and the fit student 6 minutes **after starting to exercise**.

Space for working.

..... [2]

[Total: 11]

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