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CANDIDATE NAME

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8464978600

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **February/March 2022**

1 hour 15 minutes

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 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

1 **(a)** **(i)** State the name of the gas exchange surface in humans.

..... [1]

(ii) State **two** features of the gas exchange surface in humans.

1 .....

2 .....

[2]

(b) Fig. 1.1 is a diagram of the gas exchange system in humans.

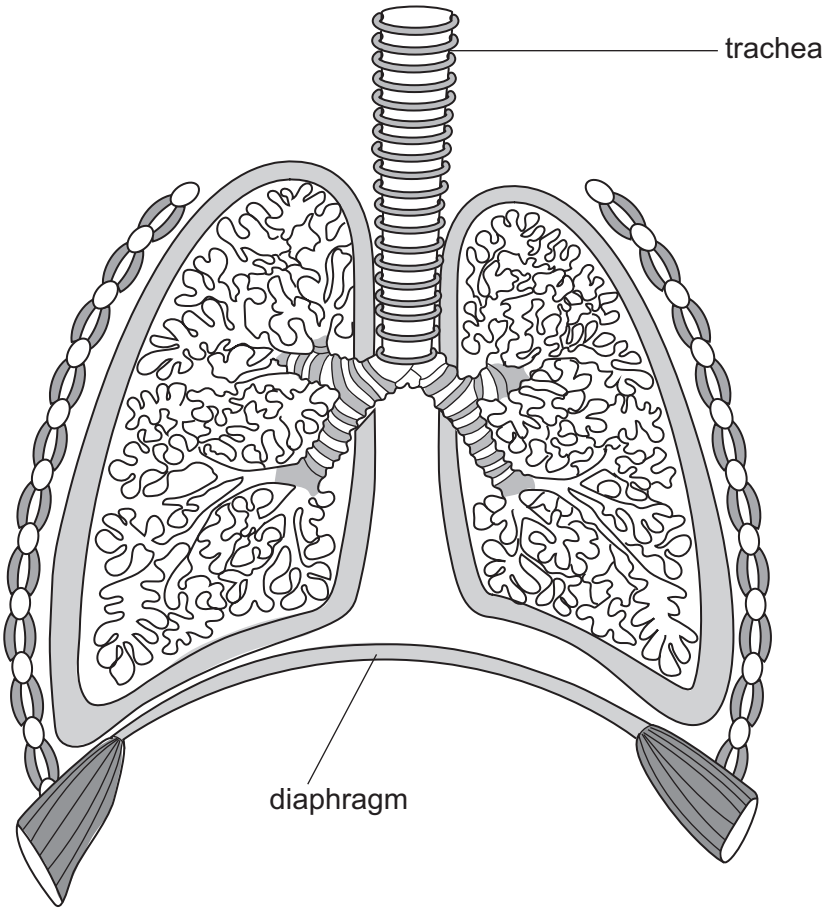

Fig. 1.1

(i) Draw a label line and the letter **X** on Fig. 1.1 to identify an external intercostal muscle. [1]

(ii) State the name of the tissue that forms C-shaped structures in the wall of the trachea and state its function.

name .....

function .....

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[2]

(iii) Describe the effects on the thorax of contraction of the diaphragm.

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..... [2]

(c) Table 1.1 compares the composition of inspired and expired air.

Table 1.1

gas	name of the gas	percentage in inspired air	percentage in expired air
A	nitrogen	78	78
B		21	16
C		0.04	4
D		variable	saturated

(i) Complete Table 1.1 by writing the names of gases **B**, **C** and **D**. [3]

(ii) For gas **B** and gas **C**, explain the differences in the percentages shown in Table 1.1 between inspired and expired air.

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..... [3]

[Total: 14]

[Turn over

2 **(a)** Fig. 2.1 is a photomicrograph showing the fertilisation of one human egg cell.

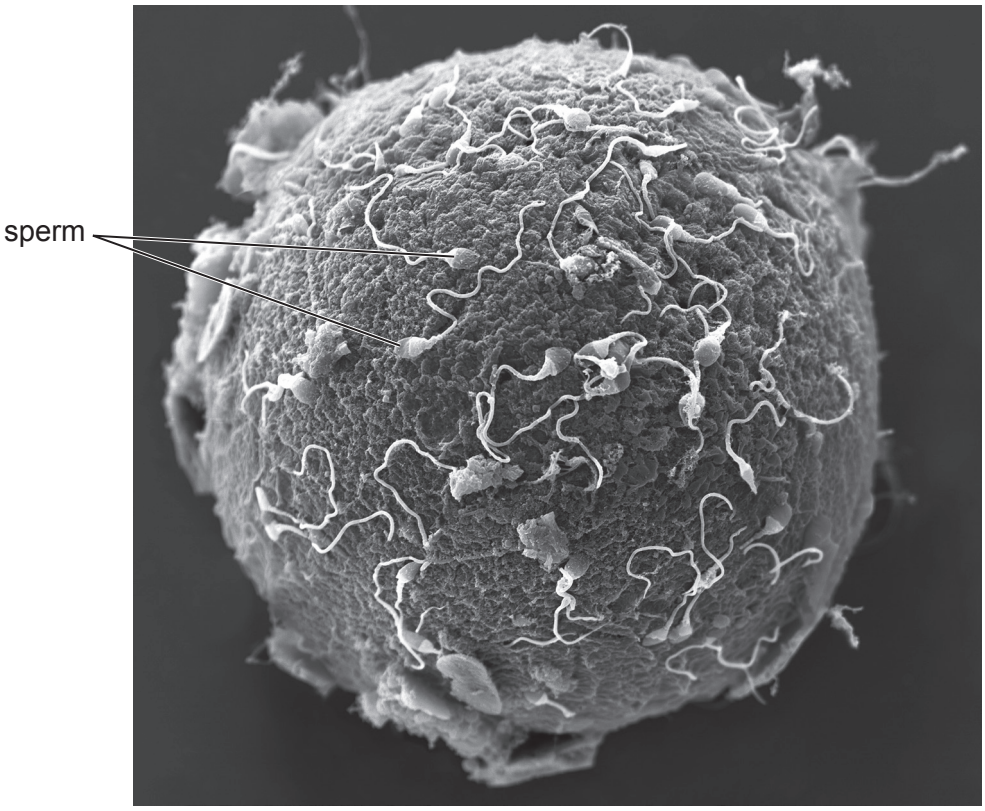

Fig. 2.1

Describe **and** explain the adaptations of the cells shown in Fig. 2.1 that enable fertilisation and early development of the embryo to occur.

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..... [6]

(b) People can use artificial insemination (AI) or *in vitro* fertilisation (IVF) to increase their chance of becoming pregnant.

(i) Outline the process of artificial insemination.

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..... [3]

(ii) Outline how the process of *in vitro* fertilisation (IVF) differs from artificial insemination (AI).

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..... [2]

(iii) Describe the social implications of fertility treatments.

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..... [4]

[Total: 15]

3 **(a)** A scientist investigated the effect of temperature on the mass of leaves picked from a tea plant, *Camellia sinensis*.

- Three samples of leaves were picked and the mass of each sample of leaves was recorded.
- Each sample of leaves was kept at a different temperature for four hours.
- After four hours, the mass of each sample of leaves was measured and recorded again.
- The scientist then calculated the final mass as a percentage of the initial mass for each sample.

Fig. 3.1 shows the results.

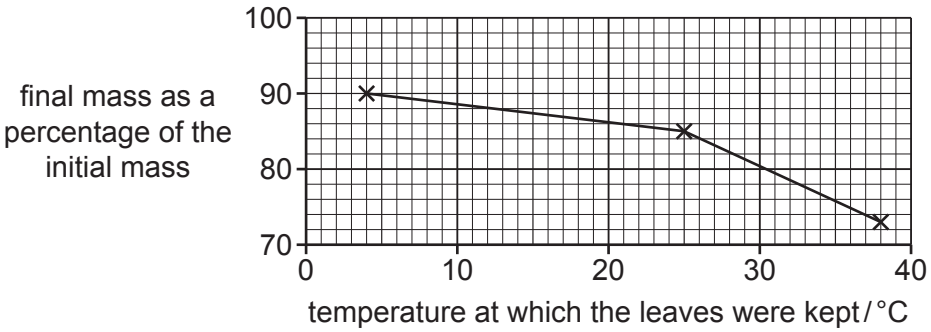

Fig. 3.1

(i) Explain the results shown in Fig. 3.1.

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..... [5]

(ii) State **one** factor, other than temperature, that would affect the loss of mass from the leaves of a plant.

..... [1]

(b) Fig. 3.2 is a photomicrograph of the tissue that transports water and mineral ions in a plant.

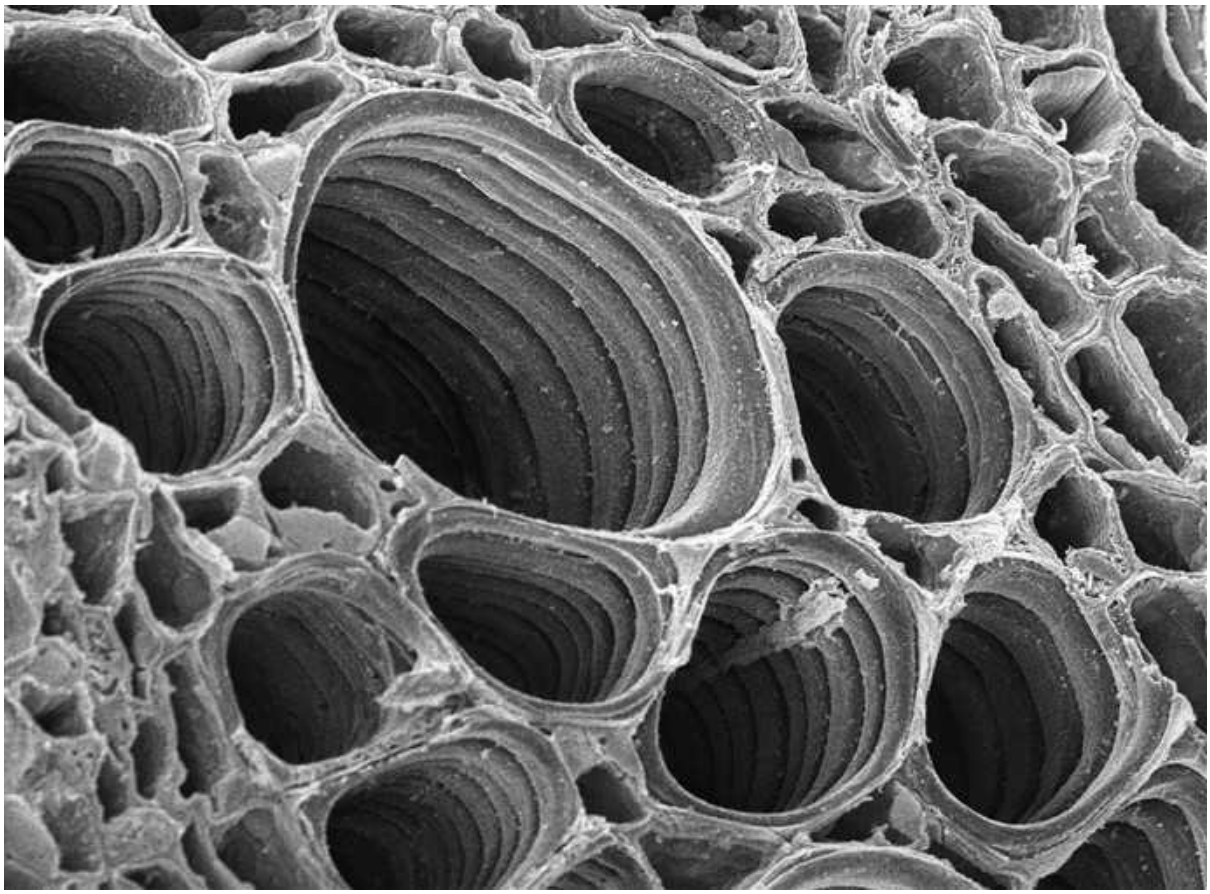

Fig. 3.2

(i) State the name of the tissue shown in Fig. 3.2.

..... [1]

(ii) Describe how the tissue shown in Fig. 3.2 is adapted for its functions in the plant.

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..... [3]

[Turn over

(c) Explain how mineral ions enter a plant.

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..... [3]

[Total: 13]

4 **(a)** Fig. 4.1 is a diagram of *Vibrio cholerae*, the bacterium that causes cholera.

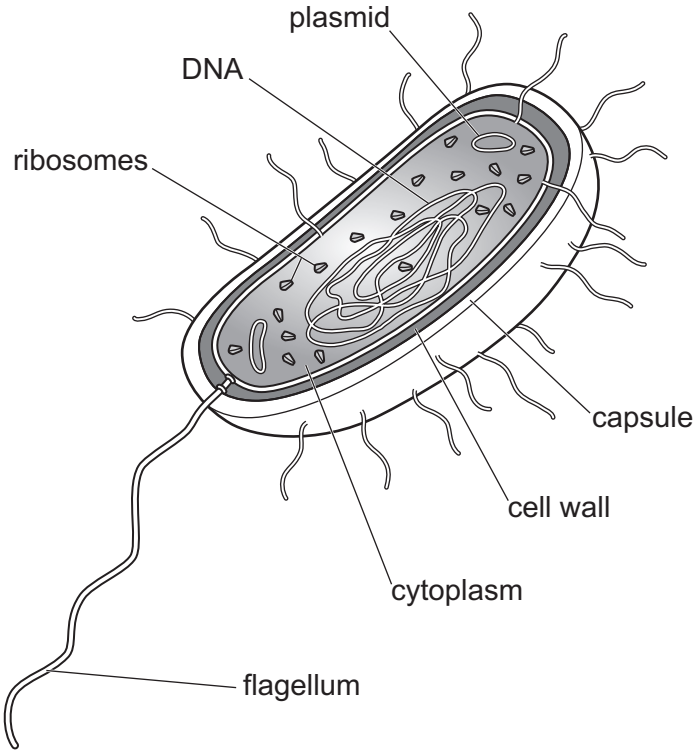

Fig. 4.1

(i) Describe **two** similarities and **two** differences between a palisade mesophyll cell and the bacterial cell shown in Fig. 4.1.

similarity 1 .....

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similarity 2 .....

.....

difference 1 .....

.....

difference 2 .....

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[4]

(ii) Explain how the cholera bacterium causes diarrhoea.

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..... [3]

(b) A scientist tested the resistance of one strain of bacteria to different antibiotics.

The scientist tested solutions of five different antibiotics, **A** to **E**.

She soaked a paper disc in each antibiotic solution.

The paper discs with antibiotics were placed in a Petri dish containing bacteria on agar jelly.

Fig. 4.2 is a diagram of the appearance of the Petri dish after 48 hours. The shaded areas show where bacteria grew. The clear areas show where bacteria did **not** grow.

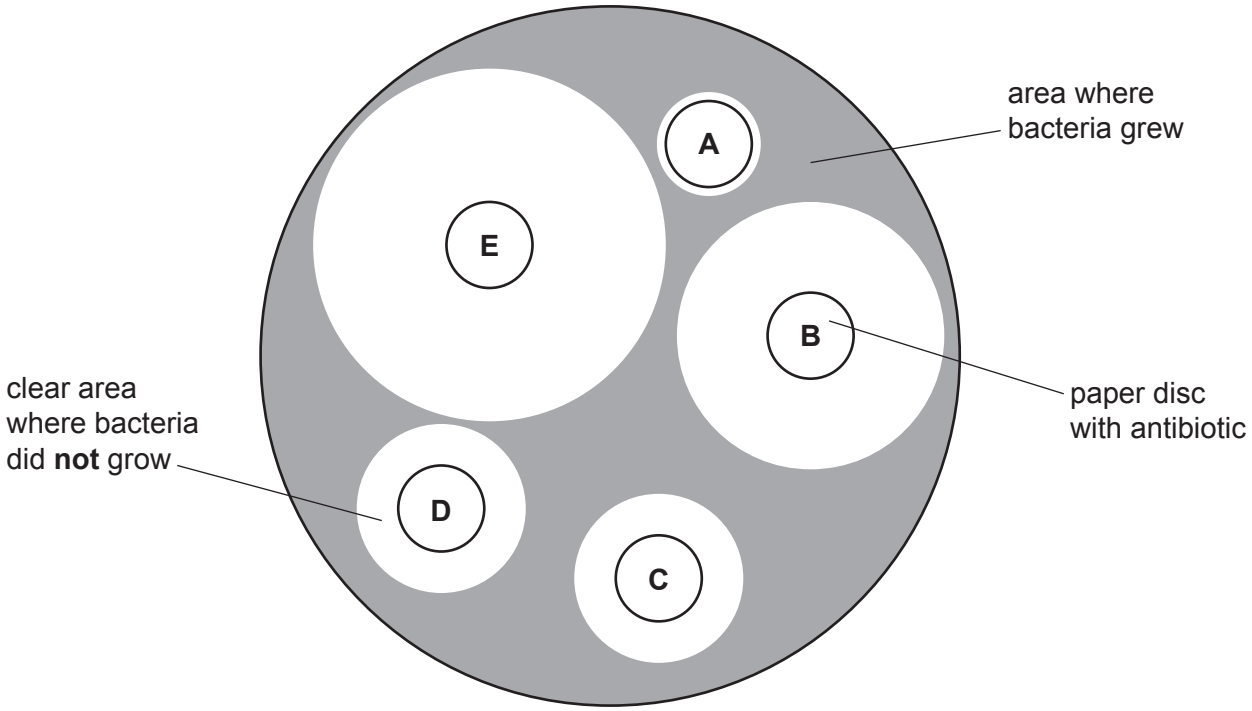

Fig. 4.2

(i) The strain of bacteria used in this investigation causes a disease.

Using the information in Fig. 4.2, explain why antibiotic **E** would be the most effective at treating this disease.

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..... [1]

(ii) The results in Fig. 4.2 show that this strain of bacteria is resistant to antibiotic **A**.

Five years ago, a similar investigation found that the clear area for antibiotic **A** was the same size as antibiotic **B** is in Fig. 4.2.

Explain how bacteria become resistant to antibiotics.

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..... [4]

(iii) Describe how to minimise the risk of antibiotic **B** developing the same results as antibiotic **A**.

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..... [1]

[Total: 13]

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5 The Arabian oryx and the northern white rhinoceros are both mammals.

Fig. 5.1 is a photograph of an Arabian oryx. Fig. 5.2 is a photograph of a northern white rhinoceros.

Fig. 5.1

Fig. 5.2

(a) Describe two pieces of evidence **visible** in Fig. 5.1 and Fig. 5.2 that show these animals are mammals.

1 .....

2 .....

[2]

(b) Different conservation methods are used to try to prevent species from becoming extinct.

A population of the Arabian oryx and a population of northern white rhinoceros were monitored.

Fig. 5.3 shows how the population size of each species has changed over time.

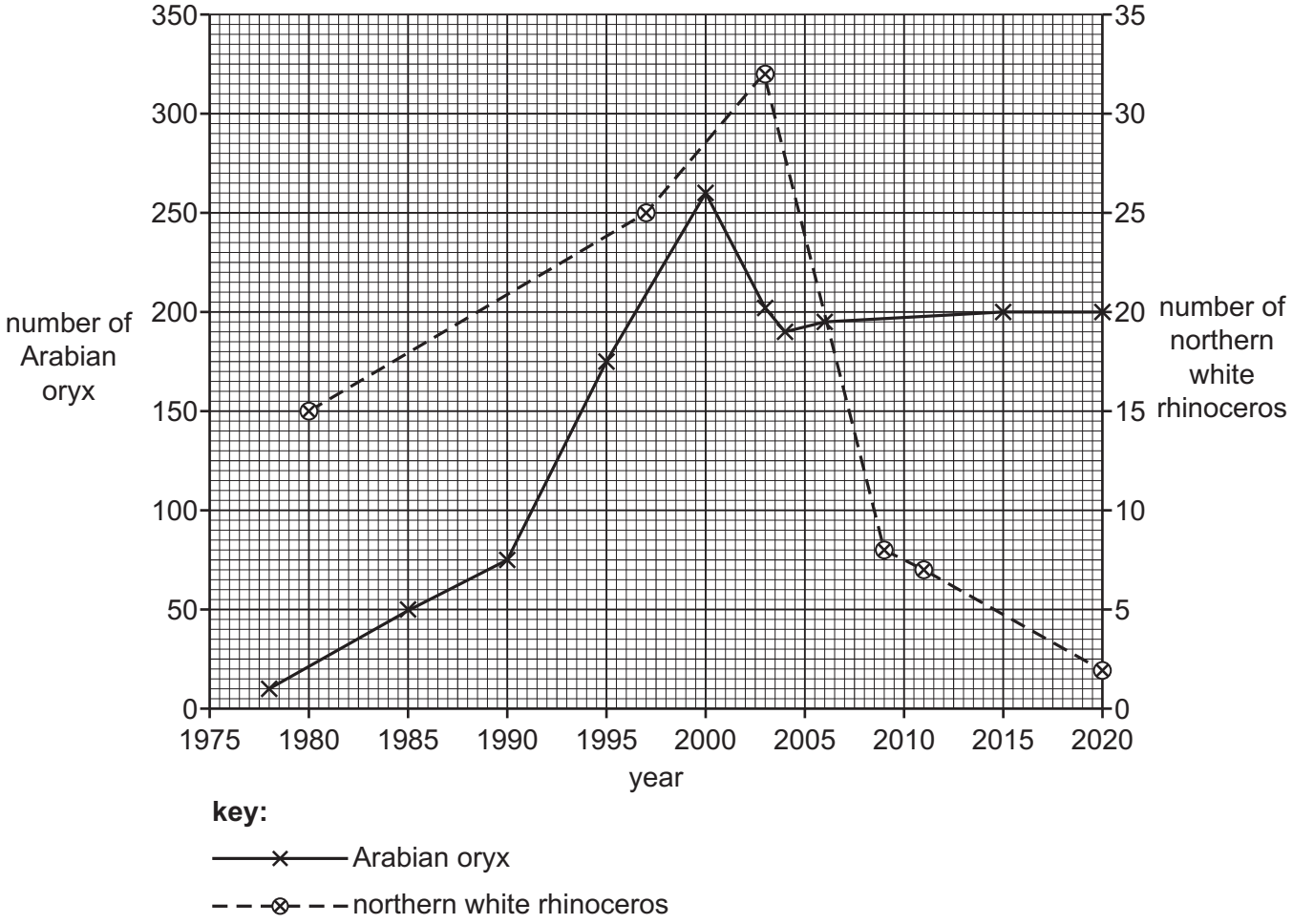

Fig. 5.3

(i) Calculate the percentage increase in the number of Arabian oryx between 1990 and 2000.

Give your answer to **three** significant figures.

Space for working.

..... %
[3]

(ii) Describe the data for the northern white rhinoceros shown in Fig. 5.3.

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..... [3]

(c) Suggest the conservation methods that were used to increase the number of Arabian oryx between 1978 and 2000.

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(d) Explain the risks to the northern white rhinoceros species as a result of its population size.

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..... [3]

[Total: 14]

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6 **(a)** Complete Table 6.1 to show the names, functions and sites of action of the three different digestive enzymes.

Table 6.1

name of enzyme	function	site of action
pepsin		
trypsin		
	breaks down maltose to glucose	

[3]

(b) Enzymes are proteins.

Fig. 6.1 shows the stages involved in protein synthesis.

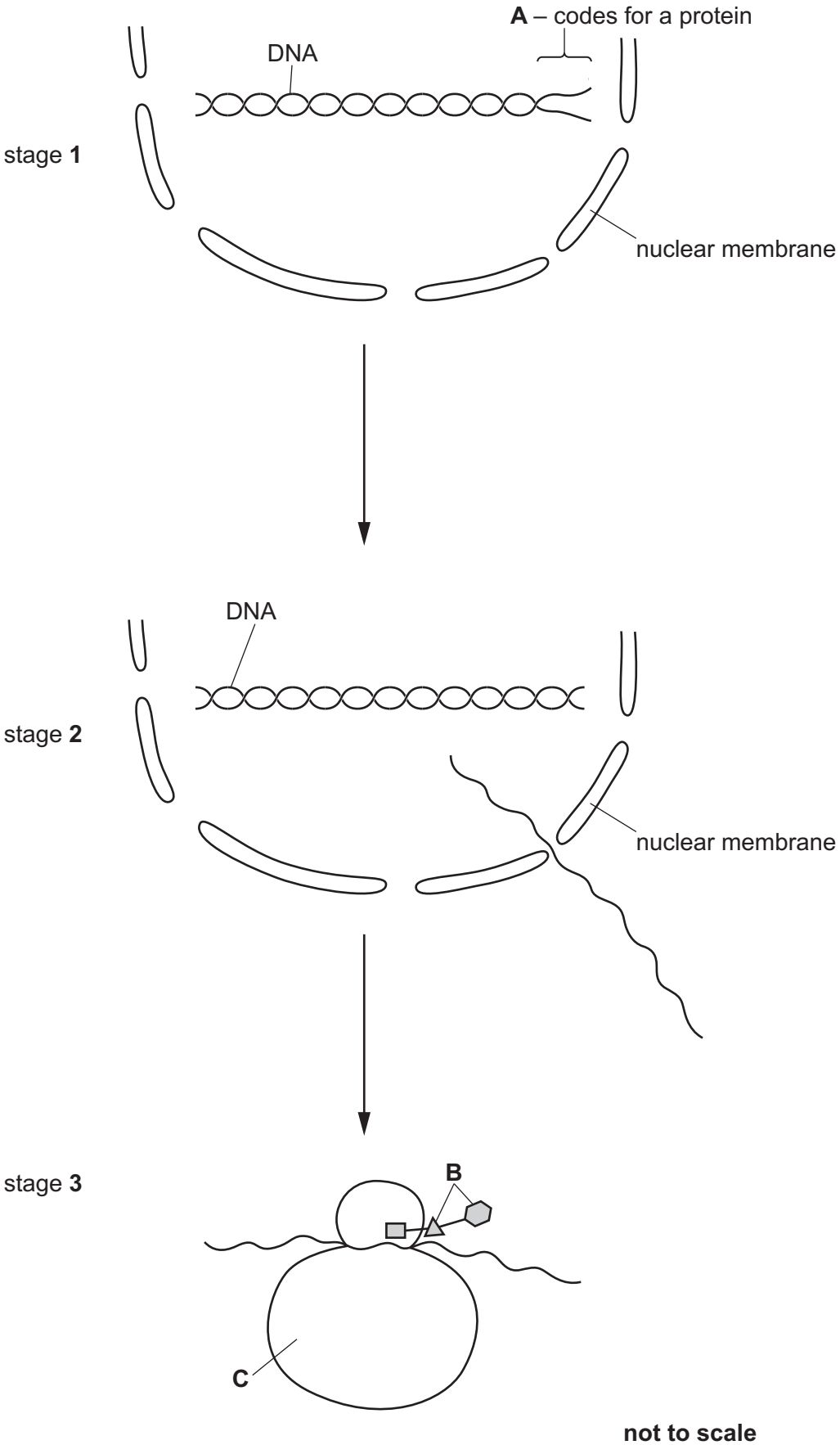

Fig. 6.1

(i) State the name of the parts represented by the letters **A** and **C** in Fig. 6.1.

A .....

C .....
[2]

(ii) Describe the events that occur during stage **2** in Fig. 6.1.

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..... [2]

(iii) State what determines the order in which the parts labelled **B** are assembled.

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..... [1]

(c) The shape of a protein is very important for its function.

Explain the importance of shape for the function of an enzyme.

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..... [3]

[Total: 11]

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