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	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
January 2011

Biology BIOL1

Unit 1 Biology and disease

Tuesday 11 January 2011 9.00 am to 10.15 am

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

Time allowed
- 1 hour 15 minutes

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.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- 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 60.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

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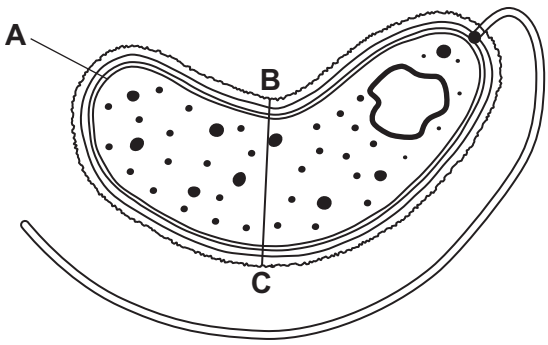
Answer **all** questions in the spaces provided.

1 The diagram shows a cholera bacterium. It has been magnified 50 000 times.



1 (a) Name **A**.

.....

(1 mark)

1 (b) Name **two** structures present in an epithelial cell from the small intestine that are **not** present in a cholera bacterium.

1 .....

2 .....

(2 marks)

1 (c) Cholera bacteria can be viewed using a transmission electron microscope (TEM) or a scanning electron microscope (SEM).

1 (c) (i) Give **one** advantage of using a TEM rather than a SEM.

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(1 mark)

1 (c) (ii) Give **one** advantage of using a SEM rather than a TEM.

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(1 mark)

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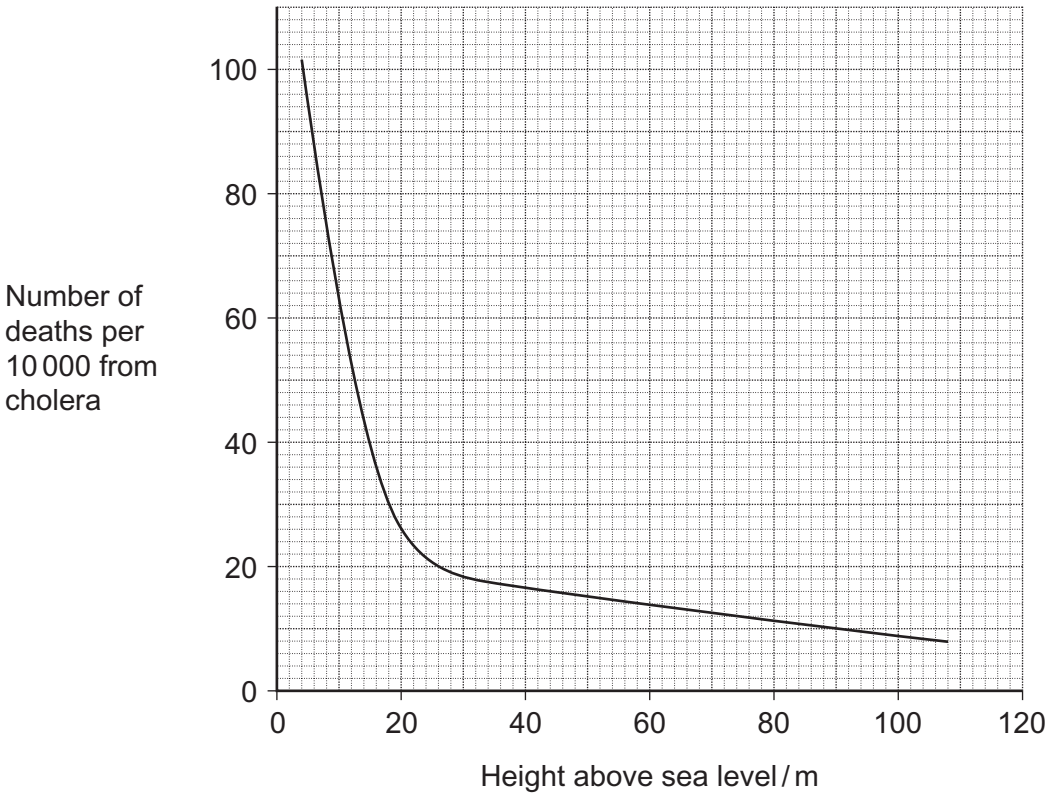
1 (d) Calculate the actual width of the cholera bacterium between points **B** and **C**.
Give your answer in micrometres and show your working.

.....µm
(2 marks)

1 (e) An outbreak of cholera occurred in London in 1849. The graph shows the relationship between the number of deaths from cholera and the height at which people lived above sea level.



Describe the relationship between the number of deaths from cholera and the height at which people lived above sea level.

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(2 marks)

9

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2 (a) *Induced fit* and *lock and key* are two models used to explain the action of enzymes.

2 (a) (i) Describe the *induced fit* model of enzyme action.

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(2 marks)

2 (a) (ii) Describe **one** way that the *lock and key* model is different from the *induced fit* model.

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(1 mark)

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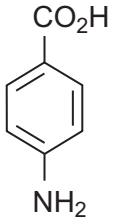
2 (b) Folic acid is a substance required by bacteria for cell growth. Bacteria produce folic acid by the following reaction.

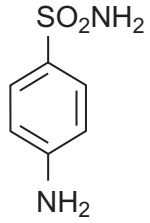
$$\text{para-aminobenzoic acid (PABA)} \xrightarrow{\text{enzyme}} \text{folic acid}$$

The diagram shows the structure of a molecule of PABA. It also shows the structure of a molecule of a drug called sulfanilamide, which can be used to treat bacterial infections. Sulfanilamide prevents bacteria producing folic acid.

PABA



sulfanilamide



Use the diagram and your knowledge of enzymes to explain how sulfanilamide prevents bacteria producing folic acid.

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(3 marks)

(Extra space) .....

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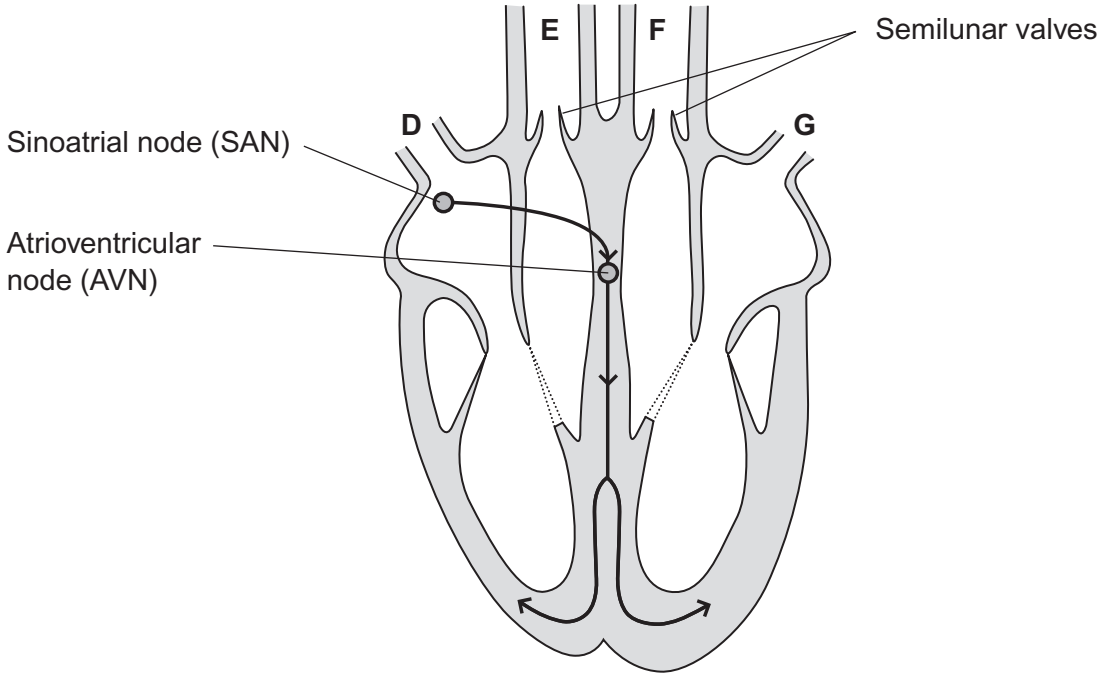
3 The diagram shows a human heart as seen from the front. The main blood vessels are labelled **D** to **G**. The arrows show the pathways taken by the electrical activity involved in coordinating the heartbeat in the cardiac cycle.



3 (a) Which of the blood vessels, **D** to **G**

3 (a) (i) carries oxygenated blood to the heart

(1 mark)

3 (a) (ii) carries deoxygenated blood to the lungs?

(1 mark)

3 (b) Explain, in terms of pressure, why the semilunar valves open.

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(1 mark)

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3 (c) When a wave of electrical activity reaches the AVN, there is a short delay before a new wave leaves the AVN. Explain the importance of this short delay.

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(2 marks)

3 (d) The table shows the cardiac output and resting heart rate of an athlete before and after completing a training programme.

	Before training	**After training**
Cardiac output / cm^3	5000	5000
Resting heart rate / beats per minute	70	55

3 (d) (i) Calculate the athlete's stroke volume after training. Show your working.

.....cm^3

(2 marks)

3 (d) (ii) Use information from the table to explain how training has caused the resting heart rate of this athlete to be lower.

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(2 marks)

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4 (a) Omega-3 fatty acids are unsaturated. What is an *unsaturated* fatty acid?

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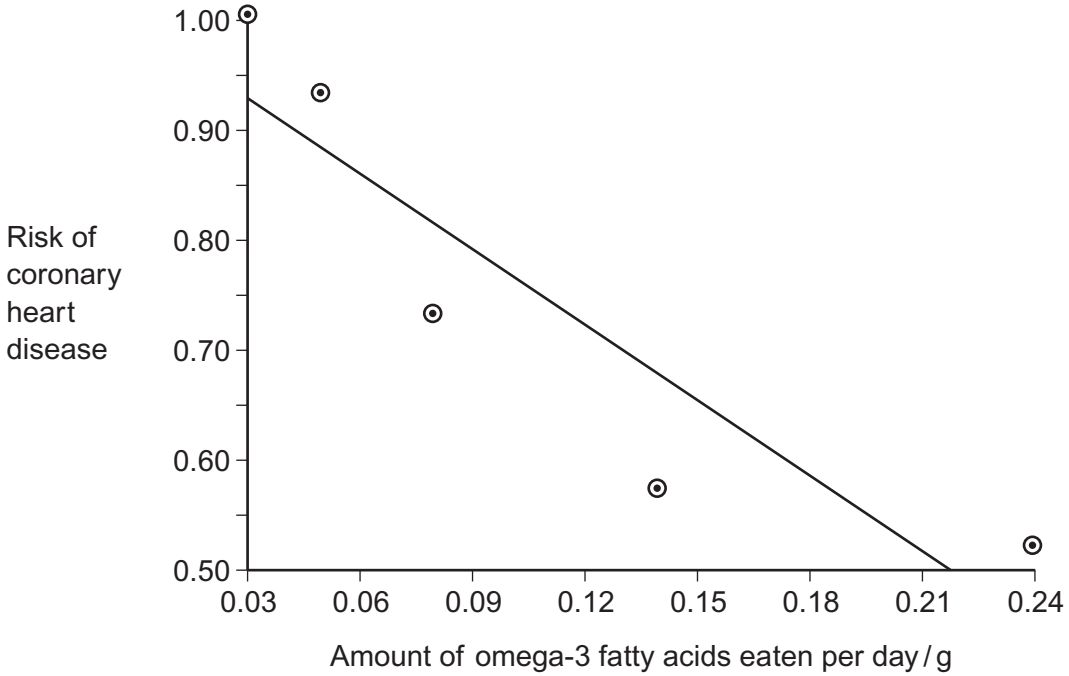
(2 marks)

4 (b) Scientists investigated the relationship between the amount of omega-3 fatty acids eaten per day and the risk of coronary heart disease. The graph shows their results.



Do the data show that eating omega-3 fatty acids prevents coronary heart disease? Explain your answer.

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(3 marks)

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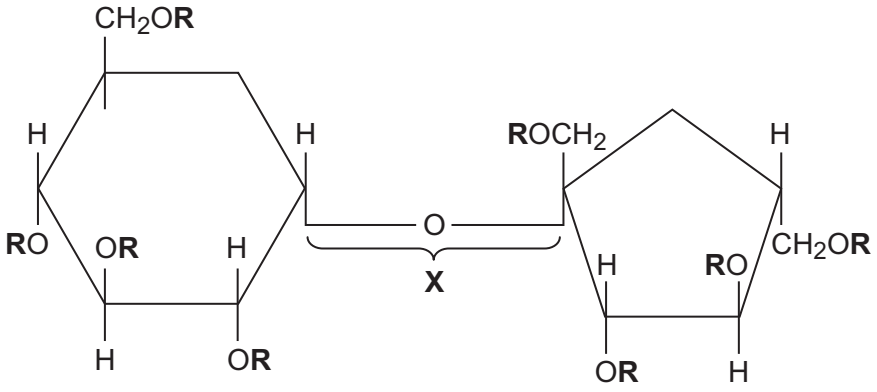
4 (c) Olestra is an artificial lipid. It is made by attaching fatty acids, by condensation, to a sucrose molecule. The diagram shows the structure of olestra. The letter **R** shows where a fatty acid molecule has attached.



4 (c) (i) Name bond **X**.

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(1 mark)

4 (c) (ii) A triglyceride does **not** contain sucrose or bond **X**.
Give **one** other way in which the structure of a triglyceride is different to olestra.

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(1 mark)

4 (c) (iii) Starting with separate molecules of glucose, fructose and fatty acids, how many molecules of water would be produced when one molecule of olestra is formed?

(1 mark)

8

Turn over ▶

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5 A student investigated the effect of putting cylinders cut from a potato into sodium chloride solutions of different concentration. He cut cylinders from a potato and weighed each cylinder. He then placed each cylinder in a test tube. Each test tube contained a different concentration of sodium chloride solution. The tubes were left overnight. He then removed the cylinders from the solutions and reweighed them.

5 (a) Before reweighing, the student blotted dry the outside of each cylinder. Explain why.

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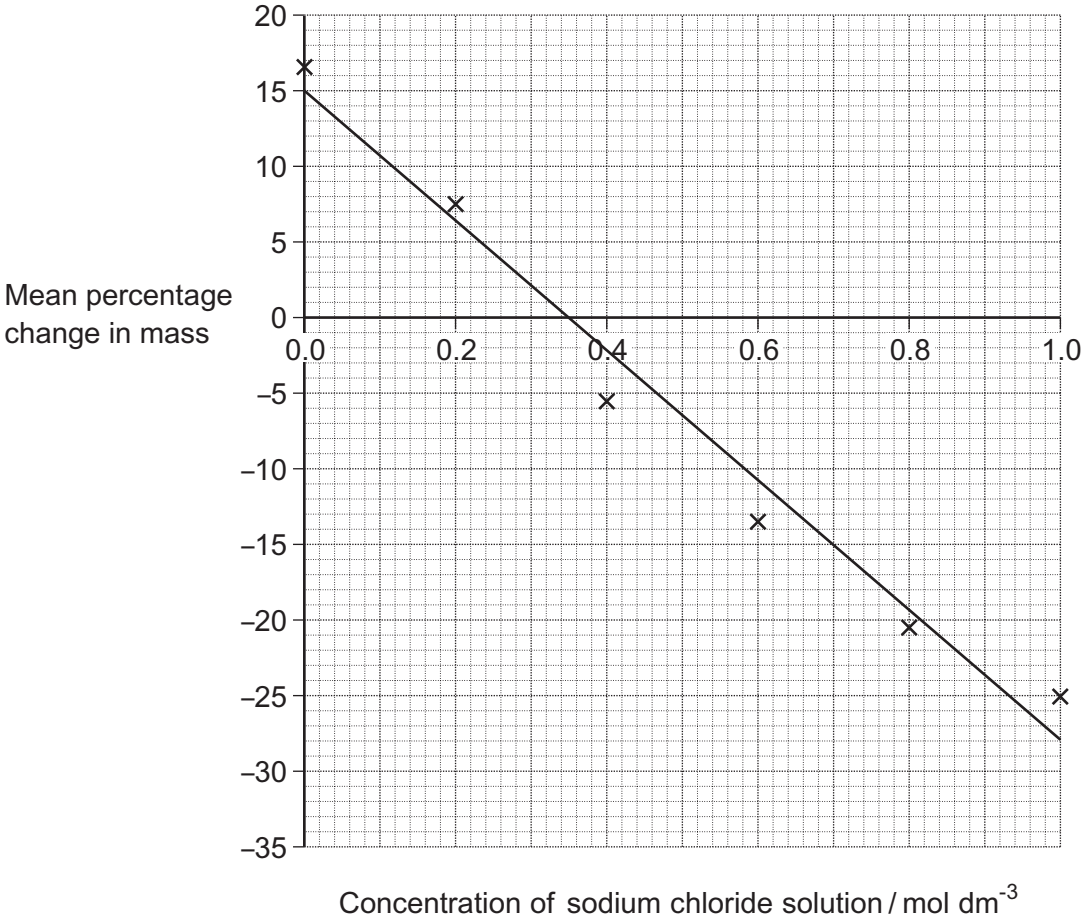
(2 marks)

The student repeated the experiment several times at each concentration of sodium chloride solution. His results are shown in the graph.



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5 (b) The student made up all the sodium chloride solutions using a 1.0 mol dm^{-3} sodium chloride solution and distilled water.

Complete the table to show how he made 20 cm^3 of a 0.2 mol dm^{-3} sodium chloride solution.

Volume of 1.0 mol dm^{-3} sodium chloride solution	**Volume of distilled water**

(1 mark)

5 (c) The student calculated the *percentage* change in mass rather than the change in mass. Explain the advantage of this.

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(2 marks)

5 (d) The student carried out several repeats at each concentration of sodium chloride solution. Explain why the repeats were important.

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(2 marks)

5 (e) Use the graph to find the concentration of sodium chloride solution that has the same water potential as the potato cylinders.

.....mol dm^{-3}

(1 mark)

8

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6 Read the passage below.

Most cases of cervical cancer are caused by infection with Human Papilloma Virus (HPV). This virus can be spread by sexual contact. There are many types of HPV, each identified by a number. Most of these types are harmless but types 16 and 18 are most likely to cause cervical cancer.

A vaccine made from HPV types 16 and 18 is offered to girls aged 12 to 13. Three injections of the vaccine are given over six months. In clinical trials, the vaccine has proved very effective in protecting against HPV types 16 and 18. However, it will be many years before it can be shown that this vaccination programme has reduced cases of cervical cancer. Until then, smear tests will continue to be offered to women, even if they have been vaccinated. A smear test allows abnormal cells in the cervix to be identified so that they can be removed before cervical cancer develops.

The Department of Health has estimated that 80% of girls aged 12 to 13 need to be vaccinated to achieve herd immunity to HPV types 16 and 18. Herd immunity is where enough people have been vaccinated to reduce significantly the spread of HPV through the population.

Use information from this passage and your own knowledge to answer the following questions.

6 (a) HPV vaccine is offered to girls aged 12 to 13 (line 5). Suggest why it is offered to this age group.

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(1 mark)

6 (b) The vaccine is made from HPV types 16 and 18 (line 5). Explain why this vaccine may **not** protect against other types of this virus.

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(2 marks)

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6 (c) Three injections of the vaccine are given (lines 5 to 6). Use your knowledge of immunity to suggest why.

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(2 marks)

6 (d) It will be many years before it can be shown that this vaccination programme has reduced cases of cervical cancer (lines 7 to 9). Suggest **two** reasons why.

1 .....

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2 .....

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(2 marks)

6 (e) Smear tests will continue to be offered to women, even if they have been vaccinated (lines 9 to 10). Suggest why women who have been vaccinated still need to be offered smear tests.

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(1 mark)

6 (f) Suggest **one** reason why vaccinating a large number of people would reduce significantly the spread of HPV through the population (lines 14 to 16).

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(2 marks)

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7 (a) Pulmonary tuberculosis is a disease of the lungs.
Describe the transmission and course of infection of pulmonary tuberculosis.

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(5 marks)

(Extra space) .....

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7 (b) Emphysema is another disease of the lungs. People with emphysema may feel weak and tired. Explain why.

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(5 marks)

(Extra space) .....

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10

END OF QUESTIONS

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