Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6037156995

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **May/June 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **14** printed pages and **2** blank pages.

DC (JM/CB) 164995/3

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Answer **all** questions.

1 **(a)** Antibody molecules are proteins that show primary structure, secondary structure, tertiary structure and quaternary structure.

Fig. 1.1 shows a ribbon diagram of an antibody molecule.

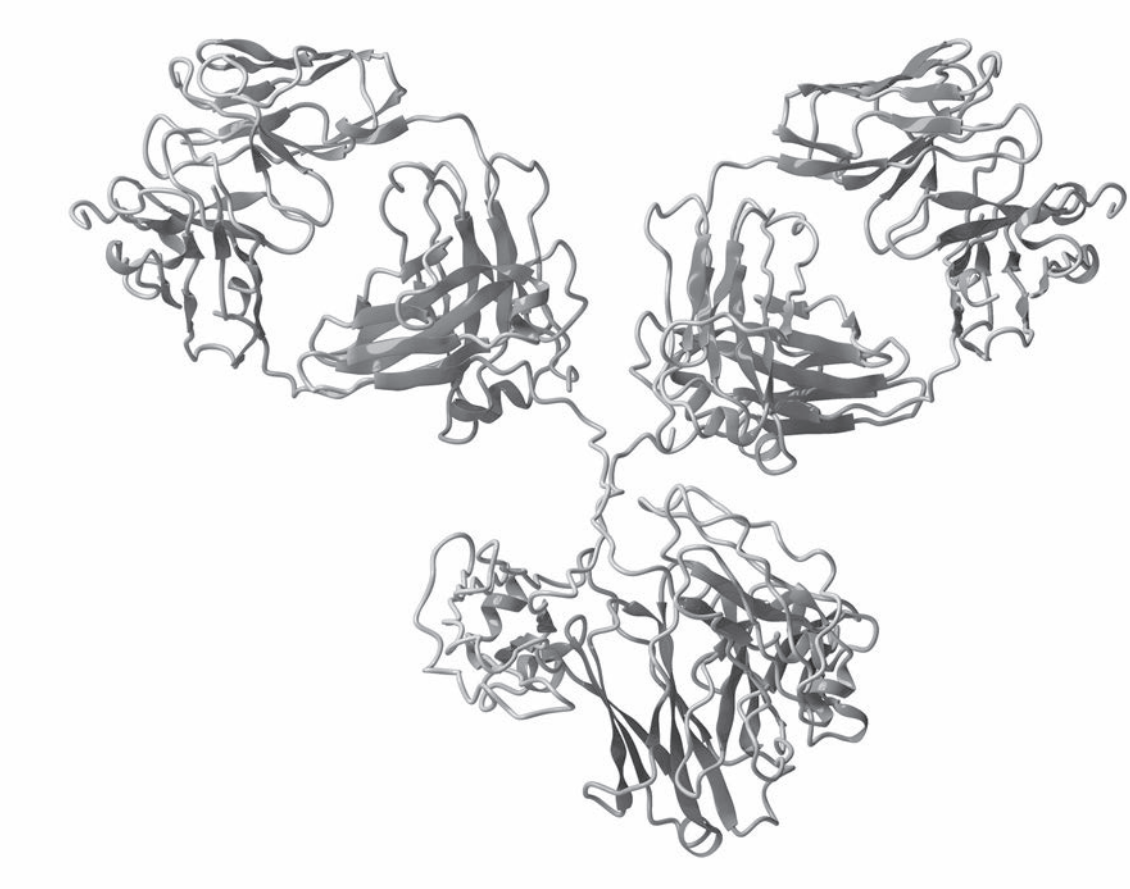

Fig. 1.1

Describe how Fig. 1.1 shows the secondary structure **and** tertiary structure of the antibody molecule.

secondary structure .....

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tertiary structure .....

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[3]

(b) Fig. 1.2 is a transmission electron micrograph of a hybridoma cell.

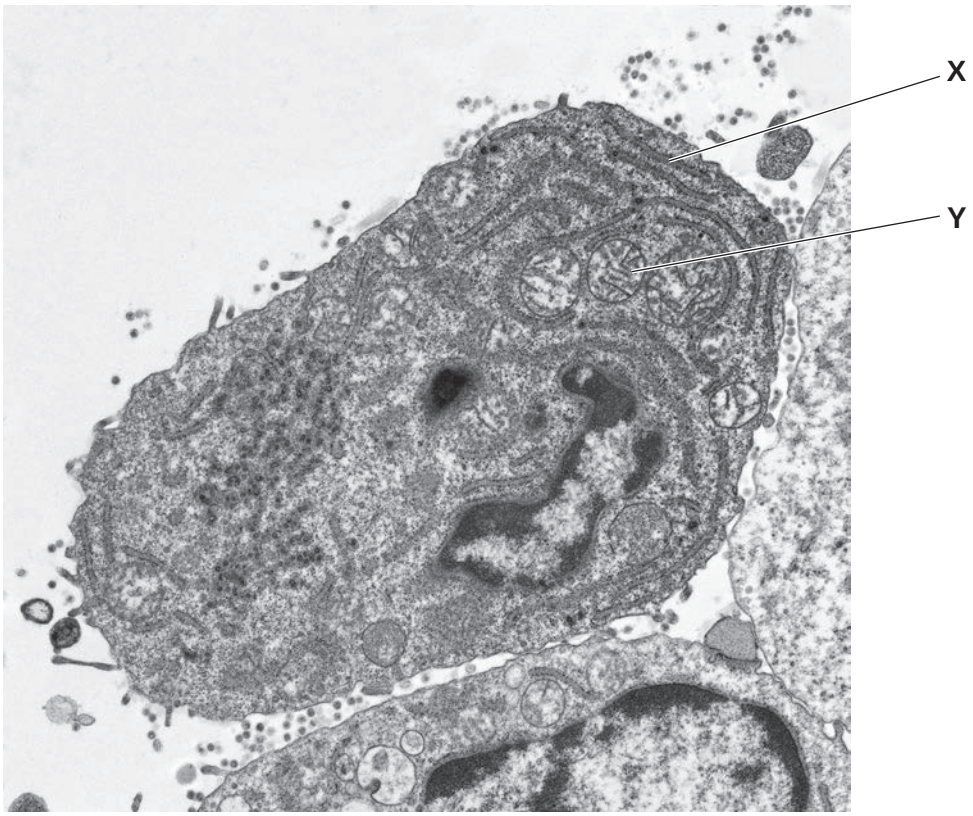

Fig. 1.2

(i) The hybridoma cell in Fig. 1.2 synthesises and secretes molecules of a monoclonal antibody.

State the roles of the structures labelled **X** and **Y** in the production of antibody molecules in the hybridoma cell.

X .....

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Y .....

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[2]

(ii) The hybridoma method for the production of monoclonal antibodies involves a number of stages. One of these stages is the formation of hybridoma cells.

Outline the stage in which hybridoma cells are formed.

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..... [3]

(iii) Outline the use of monoclonal antibodies in the treatment of disease.

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..... [3]

[Total: 11]

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2 Linoleic acid is an unsaturated fatty acid that is found in some triglycerides and some phospholipids.

Phospholipids are components of cell membranes.

Fig. 2.1 shows a molecule of linoleic acid.

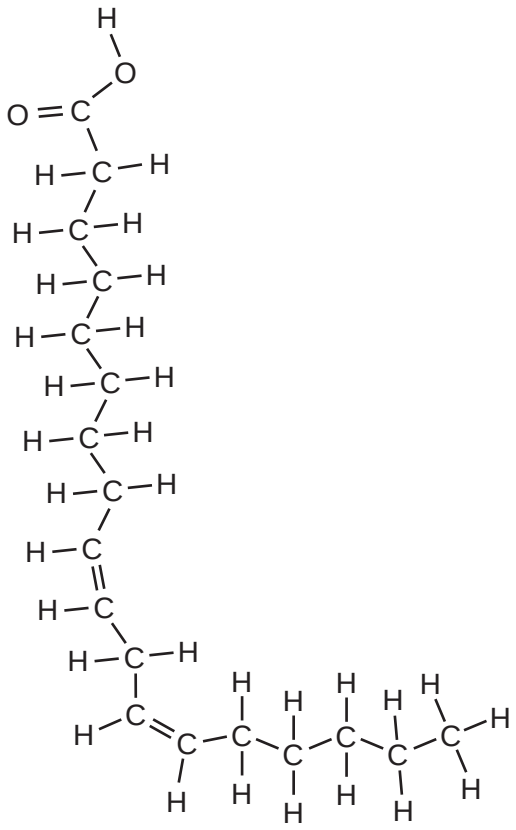

Fig. 2.1

(a) The composition of cell membranes of plants changes in response to changes in temperature.

At the start of the cold season there is an increase in the proportion of phospholipids with unsaturated fatty acids in the chickpea, *Cicer arietinum*. Chickpea plants that do not make this change do not survive.

Suggest how the increase in the proportion of phospholipids with unsaturated fatty acids helps plants, such as chickpea, survive decreases in temperature.

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..... [2]

(b) (i) State why triglycerides and phospholipids **cannot** be described as polymers.

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..... [1]

(ii) State two **differences** in the **structure** of triglycerides and phospholipids.

1 .....

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2 .....

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[2]

(c) Platelets metabolise linoleic acid to produce a molecule known as thromboxane.

Thromboxane is released by platelets when blood loss occurs. Thromboxane acts on smooth muscle cells in the walls of arteries. This causes arteries to constrict, which reduces blood flow.

Explain why the constriction of arteries following blood loss is an example of cell signalling.

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..... [4]

[Total: 9]

3 Neutrase® is an enzyme that is used to hydrolyse proteins in solution. When the enzyme is mixed with a 2% protein solution the reaction mixture changes from white to colourless.

A student carried out an experiment to find the effect of copper sulfate and potassium sulfate on the activity of Neutrase®.

The student made four reaction mixtures in test-tubes **A** to **D**. Test-tubes **A** to **C** contained equal volumes of protein solution and 0.1 cm^3 of solutions of copper sulfate or potassium sulfate. Test-tube **D** contained the same volume of protein solution and 0.1 cm^3 of water.

0.5 cm^3 of a 1% Neutrase® solution was added to test-tube **A** and immediately placed into a colorimeter. The colorimeter was used to measure the intensity of light that is absorbed by the solution (absorbance) over 100 seconds. The procedure was repeated with the other reaction mixtures, **B**, **C** and **D**.

The results are shown in Fig. 3.1.

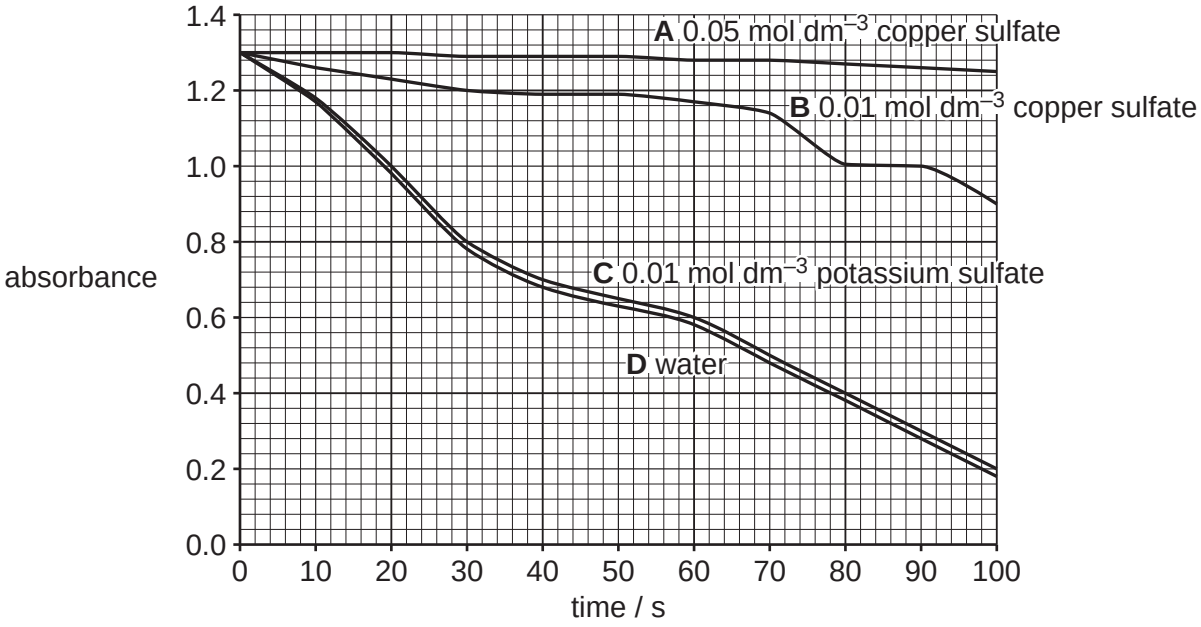

Fig. 3.1

(a) (i) Suggest **and** explain why measuring the absorbance of the reaction mixture over 100 s is a suitable method for determining the activity of Neutrase®.

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..... [2]

(ii) With reference to Fig. 3.1:

- describe the effects of copper sulfate solution and potassium sulfate solution on the activity of Neutrase®
- suggest explanations for the effects that you have described.

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(b) Neutrase® can be immobilised in alginate. Immobilised Neutrase® is used in the food industry to produce foods with high nutritional content.

Explain the advantages of using immobilised enzymes, such as Neutrase®, compared with using the same enzymes free in solution.

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..... [2]

[Total: 9]

4 Meristematic tissue is found in the growing regions of plants, such as shoot tips. Meristematic cells have a similar role to stem cells in animals.

Fig. 4.1 shows some of the stages in the formation of a mature phloem sieve tube element and companion cells from a meristematic cell.

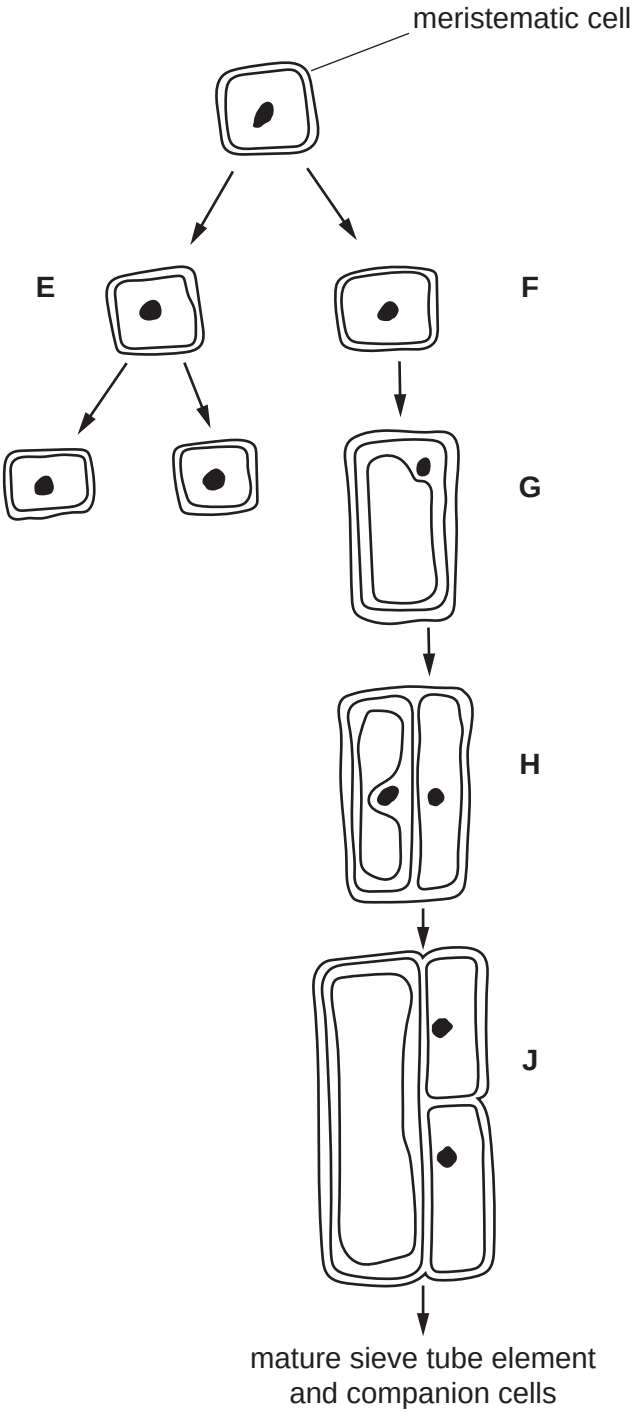

Fig. 4.1

(a) Cells **E** and **F** in Fig. 4.1 are daughter cells produced when the meristematic cell divides in the shoot tip.

Explain why it is important that one of the daughter cells (cell **E**) is a meristematic cell.

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..... [1]

(b) Complete Table 4.1 to describe the changes that are shown in Fig. 4.1 between stages:

- **F** and **G**
- **G** and **H**
- **H** and **J**.

Table 4.1

stages	description
F and **G**	
G and **H**	
H and **J**	

[3]

(c) Explain how the structure of a mature sieve tube element is related to its function.

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..... [4]

(d) Describe the functions of companion cells in transport in the phloem.

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..... [2]

[Total: 10]

5 **(a)** The mammalian circulatory system is described as a closed double circulation.

Explain why it is called a *closed* **and** *double* circulation.

closed .....

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double .....

..... [2]

(b) Fig. 5.1 shows a drawing of an external view of a mammalian heart.

Two cross-sections were made of the heart:

- section 1 was made across the line **A**–**B**.
- section 2 was made across the line **C**–**D**.

Drawings of the two sections were viewed from above as shown by the arrow on Fig. 5.1. Fig. 5.2 is a drawing of section **A**–**B**. Fig. 5.3 is a drawing of section **C**–**D**.

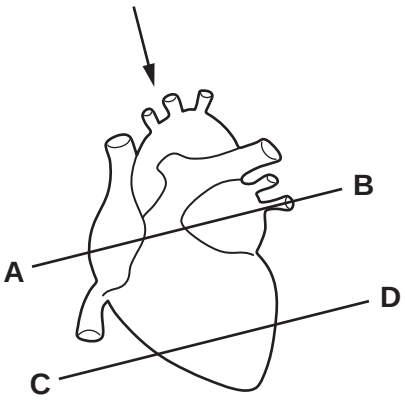

Fig. 5.1

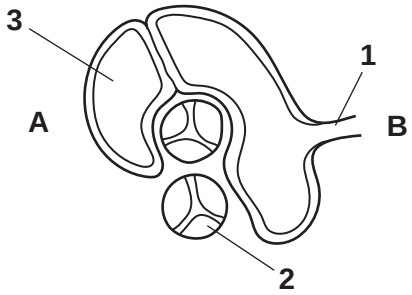

Fig. 5.2

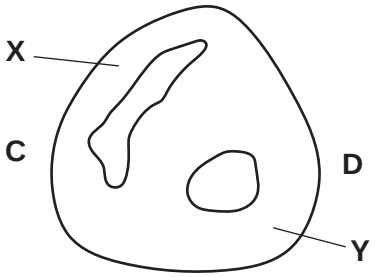

Fig. 5.3

(i) Name structures **1**, **2** and **3**, as shown in Fig. 5.2.

1 .....

2 .....

3 .....

[3]

(ii) Explain why the wall of chamber **Y** is thicker than the wall of chamber **X**, as shown in Fig. 5.3.

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..... [3]

(c) Explain how the contractions of the chambers of the heart are coordinated during one cardiac cycle.

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..... [4]

[Total: 12]

6 **(a)** The DNA in the nucleus is known as nuclear DNA.

(i) In the cells of the grasshopper, *Chorthippus brunneus*, 20% of the nucleotides in nuclear DNA contain thymine.

Calculate the percentage of nucleotides in the nuclear DNA of *C. brunneus* that contain guanine **and** explain your answer in terms of the structure of DNA.

percentage .....

explanation .....

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..... [3]

(ii) State another location, **other than** the nucleus, where DNA occurs in cells of *C. brunneus*.

..... [1]

(b) Fig. 6.1 is a diagram of a molecule of tRNA.

The region labelled **R** shows detail of part of the tRNA molecule.

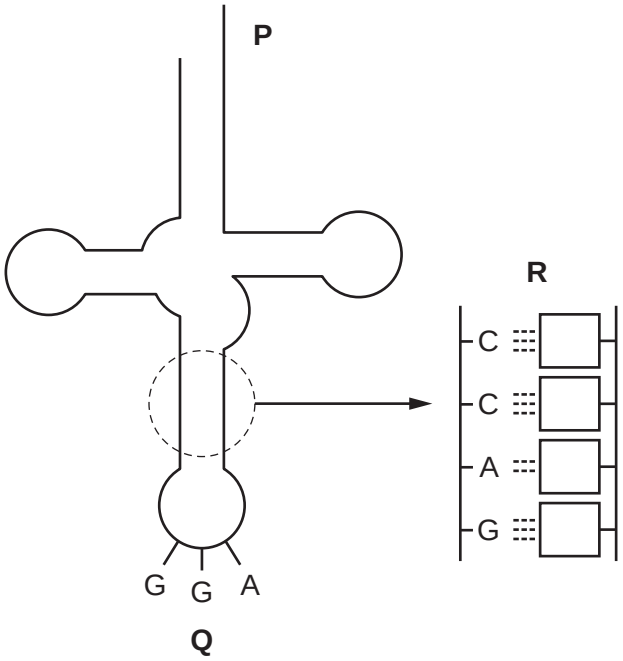

Fig. 6.1

(i) Complete Fig. 6.1 by writing the sequence of bases in the region labelled **R**. [1]

(ii) State the name of region **Q and** explain the role of region **Q** in translation.

name .....

explanation .....

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..... [3]

(iii) State the function of region **P**.

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..... [1]

[Total: 9]

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