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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0485738209

BIOLOGY **9700/21**

Paper 2 Structured Questions AS **October/November 2009**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
Ruler (cm/mm)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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.

For Examiner's Use	
1	
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Total	

This document consists of **13** printed pages and **3** blank pages.

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Answer **all** the questions.

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1 During an immune response, plasma cells secrete antibody molecules. Fig.1.1 is a diagram of an antibody molecule. The diagram is **not** complete.



Fig. 1.1

(a) (i) Draw a circle around a variable region. [1]

(ii) Draw in and label the position of the disulfide bonds in the molecule. [1]

(iii) Explain the importance of disulfide bonds in protein molecules, such as antibodies.

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(b) Describe how antibodies provide protection against pathogens.

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(c) Other proteins are found in cell surface membranes.

Describe three roles of the proteins in cell surface membranes.

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[Total: 12]

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2 Amylase is an enzyme that catalyses the hydrolysis of starch. A student investigated the effect of pH on the activity of the enzyme.

Eight test-tubes were set up each containing 5 cm^3 of the same concentration of amylase solution but in buffer solutions of different pH values. The test-tubes were left in a water-bath at 30 °C for 10 minutes.

After 10 minutes, 5 cm^3 of a starch suspension at 30 °C was added to each test-tube. Immediately, the student took a sample from each test-tube and tested the reaction mixture for the presence of starch. Samples were then taken every minute for 10 minutes and tested in the same way.

The student's results are shown in Table 2.1.

Table 2.1

pH	time / min										
	0	1	2	3	4	5	6	7	8	9	10
2.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗
4.0	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗
5.0	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
6.0	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
7.0	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
8.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗
9.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

key
✓ = starch present
✗ = starch absent

(a) Describe how the student would test for the presence of starch.

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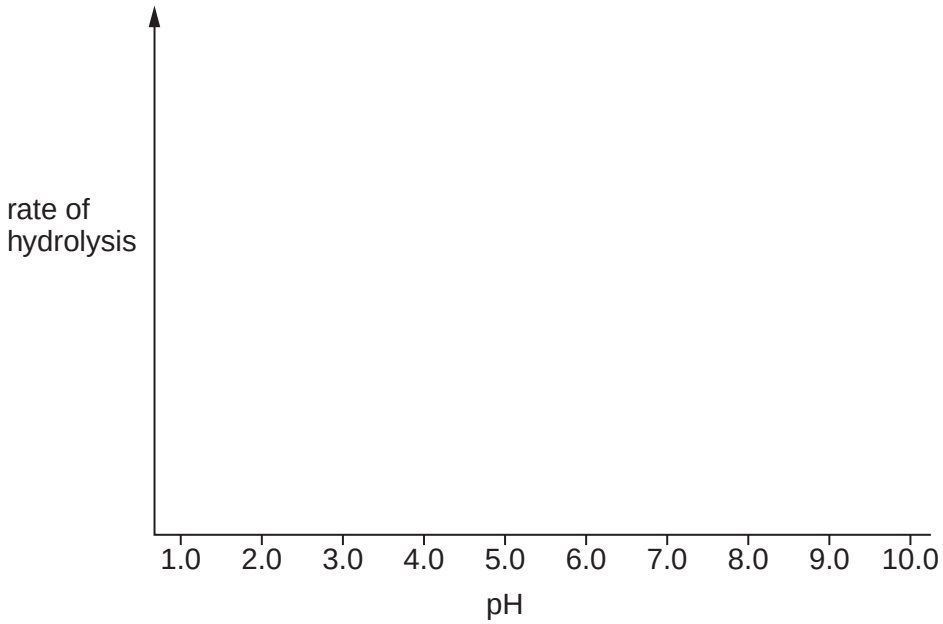
..... [2]

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(b) Use the axes below to sketch a graph to show the effect of pH on the **rate of hydrolysis** of starch by amylase.

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[2]

(c) With reference to the student's results, describe **and** explain the effect of pH on the rate of hydrolysis of starch by amylase.

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3 Fig. 3.1 is an electron micrograph of a lymphocyte in the process of cell division during an immune response.

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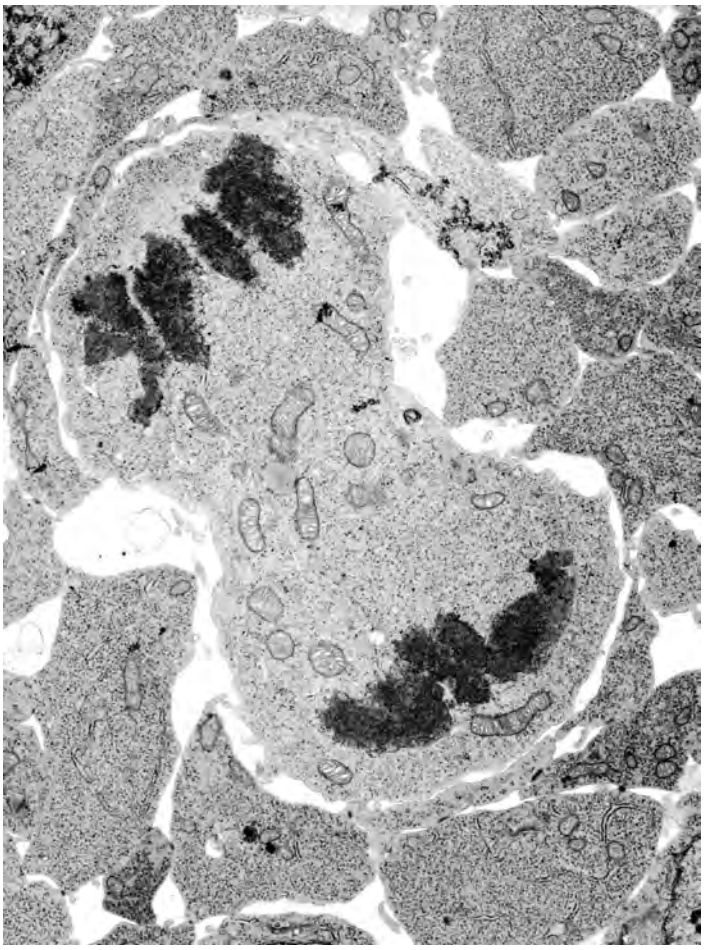


Fig. 3.1

(a) With reference to Fig. 3.1,

(i) name the stage of mitosis shown;

.....[1]

(ii) describe what is happening during this stage of mitosis;

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(iii) suggest the **disadvantages** of using an electron microscope to study mitosis.

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(b) Tumours may form inside the lungs of long-term smokers.

(i) Describe how a tumour develops in the lungs.

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(ii) Describe two signs or symptoms of lung cancer.

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[Total: 10]

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4 **(a)** Explain what is meant by the term transpiration.

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The rates of transpiration of plants of two species, **A** and **B**, were measured over a period of seven hours. The results are shown in Fig. 4.1.

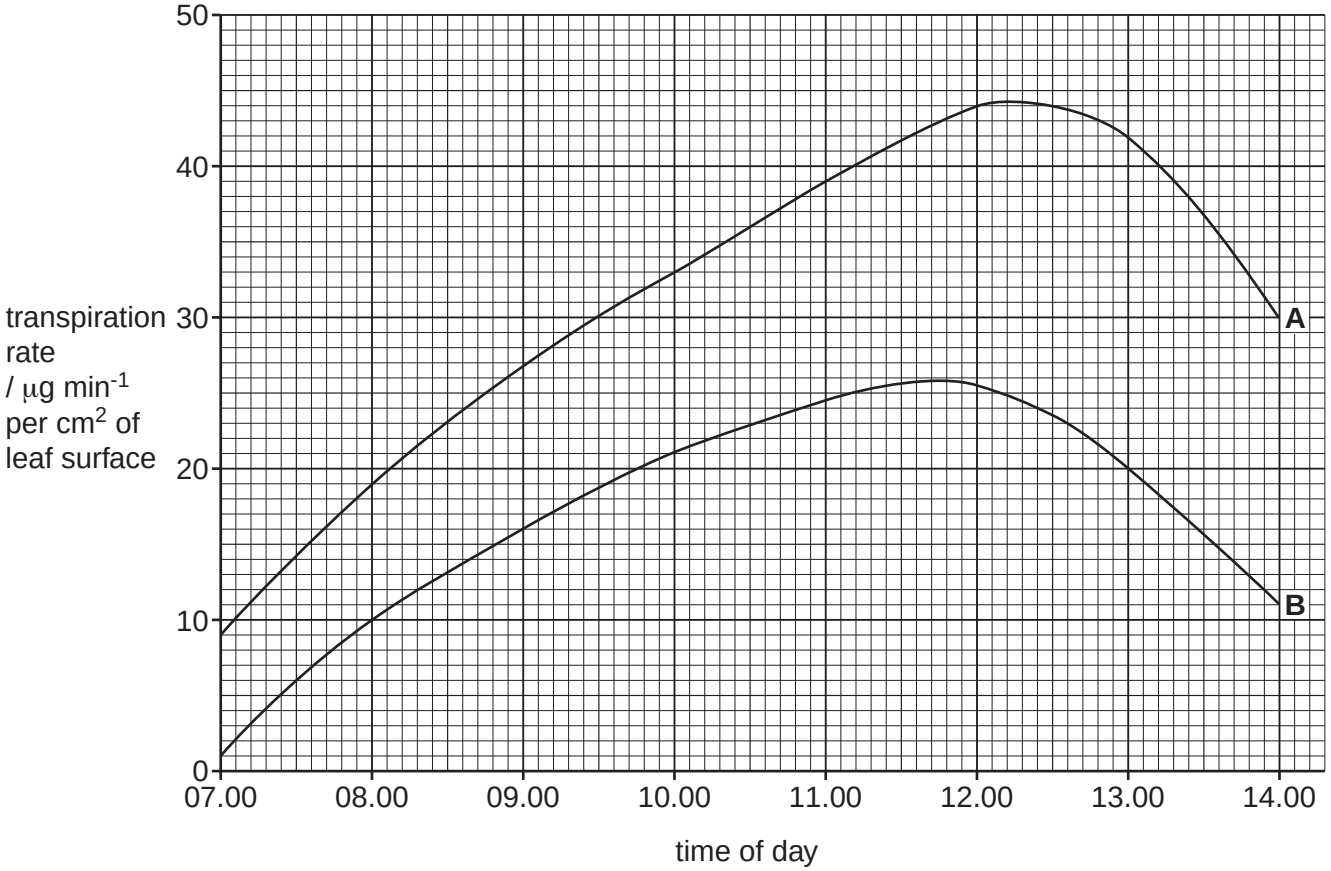


Fig. 4.1

(b) With reference to Fig. 4.1, compare the rates of transpiration of the two species over the seven hour period.

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(c) State two possible features of the **leaves** of species **B** that could explain the different rates of transpiration in comparison with species **A**.

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Explain how each feature acts to reduce transpiration.

feature .....

explanation .....

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feature .....

explanation .....

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[Total: 10]

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5 *Pneumocystis jirovecii* is a yeast-like fungus that lives in human lungs. It is the causative agent of one of the opportunistic pneumonia-like infections that may develop during AIDS.

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P. jirovecii is eukaryotic. Its life cycle is difficult to observe as it has never been cultured in the laboratory. Fig. 5.1 shows its possible life cycle. The numbers on the diagram represent the number of chromosomes in each stage.

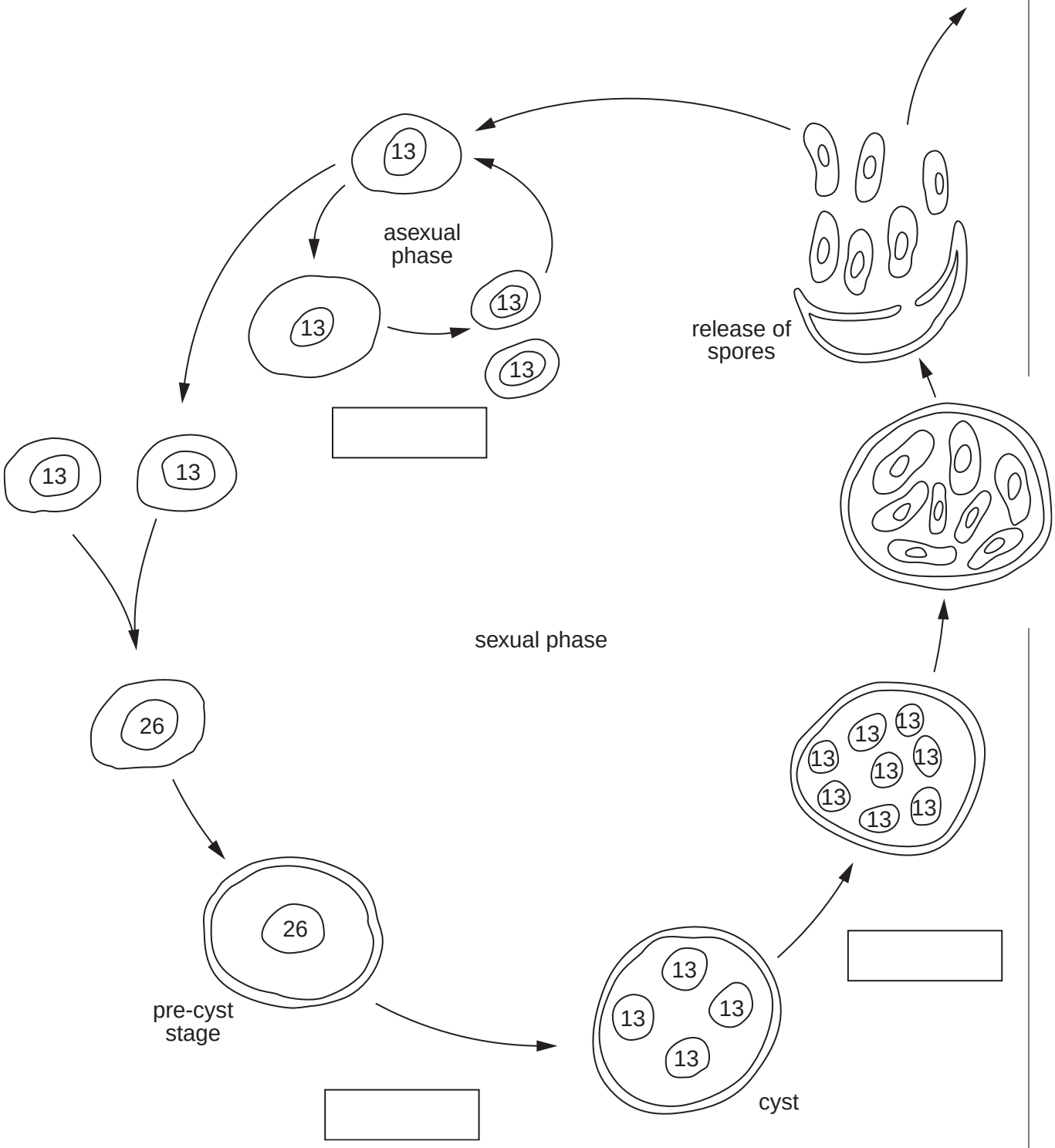


Fig. 5.1

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(a) *P. jirovecii* has a haploid number of 13 chromosomes.

Complete the life cycle by writing either mitosis or meiosis in the boxes in Fig. 5.1. [2]

(b) State two structural features that you would expect to find in the cytoplasm of *P. jirovecii* that indicate it is a eukaryote and not a prokaryote.

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(c) Suggest how *P. jirovecii* is transmitted from one person to another.

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(d) Discuss the problems in attempting to control the spread of HIV/AIDS.

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[Total: 10]

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6 **(a)** Explain what is meant by the term ecosystem.

For Examiner's Use

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Fig. 6.1 shows the energy flow through a river ecosystem.

All the figures are in kJ m^{-2} per year.

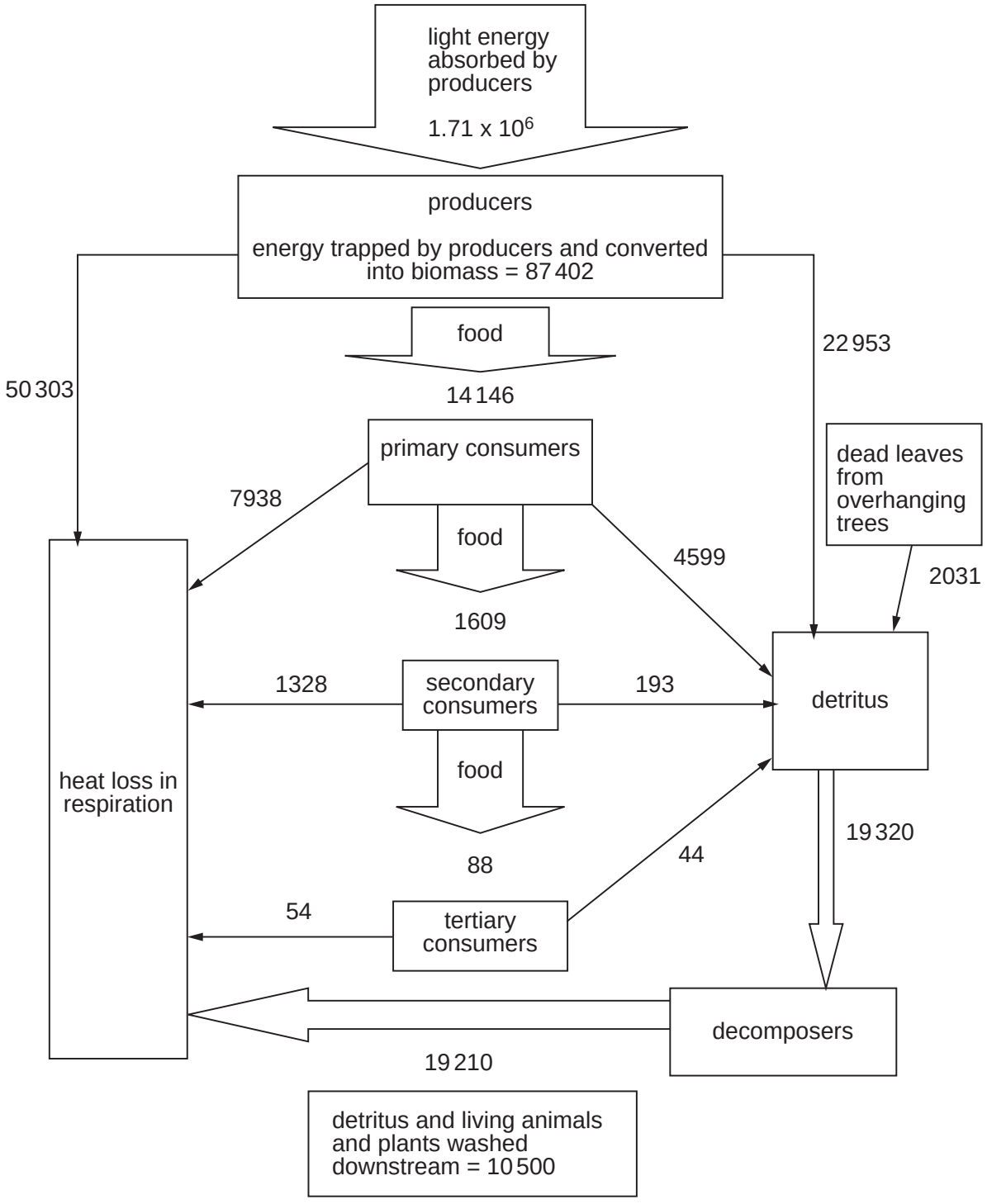


Fig. 6.1

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(b) The efficiency of energy transfer between trophic levels is calculated by comparing the energy available to a trophic level with the energy available to the next trophic level. Between secondary and tertiary consumers, this is calculated as follows:

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$$\frac{\text{energy available to tertiary consumers}}{\text{energy available to secondary consumers}} \times 100\%$$

Calculate the efficiency of energy transfer between secondary and tertiary consumers in the river ecosystem.

Express your answer to the nearest 0.1%.

Show your working.

Answer .....% [2]

(c) Explain why the energy efficiency between secondary and tertiary consumers is greater than that between producers and primary consumers.

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(d) Describe the roles of decomposers in recycling nitrogen.

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[Total: 9]

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Question 3 Fig. 3.1 © P673/063; Cell division, TEM; Science Photo Library.

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