

- 1 A student carried out an investigation to find the effect of carbon dioxide concentration on the rate of photosynthesis of an aquatic plant.

The apparatus that the student used is shown in Fig. 2.1. The student was advised to use a light meter positioned at the same distance from the lamp as the pond plant. The student counted the number of bubbles produced by the cut end of the stem.

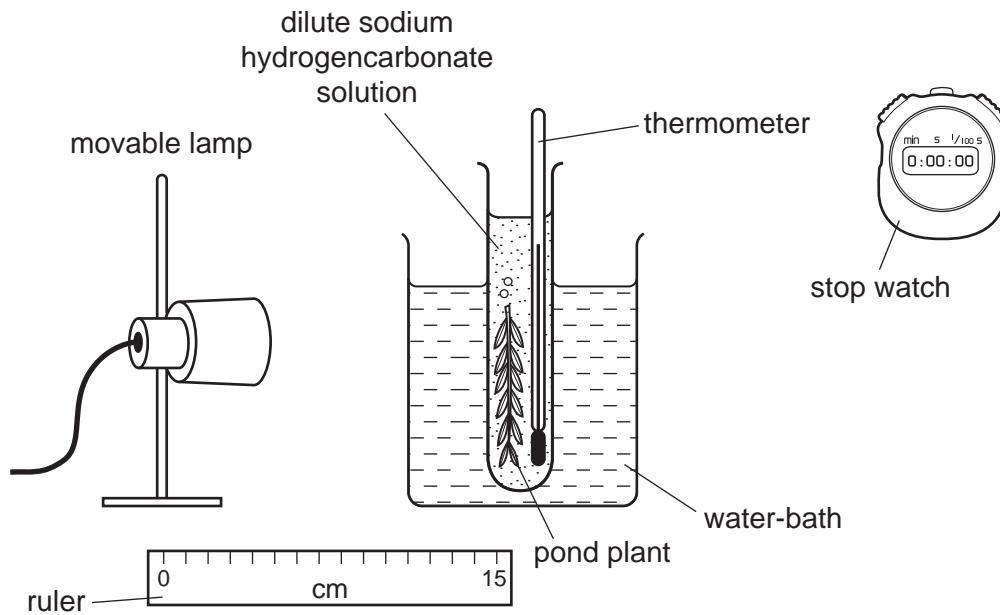


Fig. 2.1

(a) Explain why the student included the following in the apparatus.

- (i) The beaker of water and the thermometer.

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- (ii) The light meter and the ruler.

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(b) The results obtained by the student are shown in Fig. 2.2.

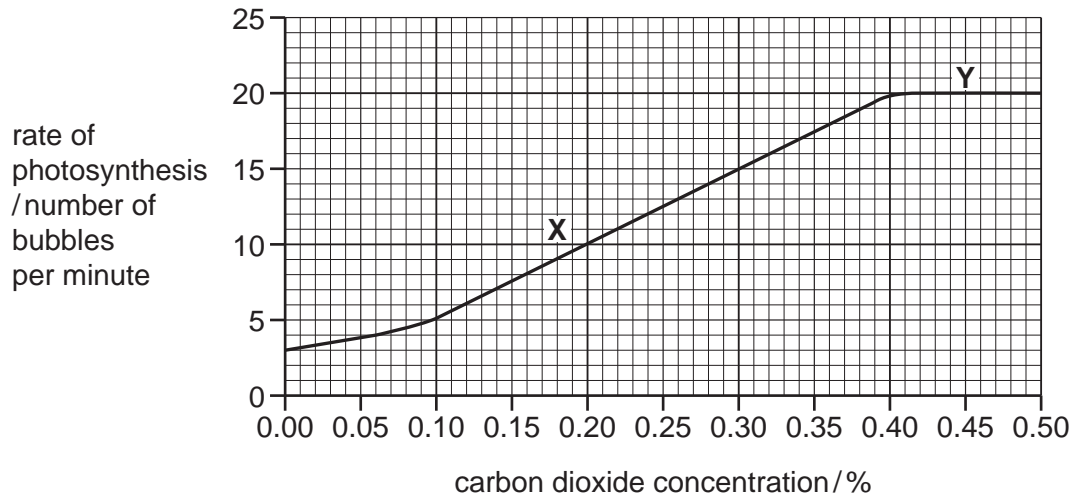


Fig. 2.2

(i) Describe the student's results.

You will gain credit if you use data from Fig. 2.2 in your answer.

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(ii) State the factor that is limiting the rate of photosynthesis in region X of the graph.

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(iii) Suggest **and** explain the reasons for the shape of the graph in region Y.

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(c) Counting bubbles may not be the best way to measure the rate of photosynthesis. The volume of the bubbles is not always exactly the same.

Suggest and explain **one** alternative way of measuring the gas given off to solve this problem.

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(d) Fig. 2.3 shows the carbon dioxide concentration in the atmosphere as determined at Mauna Loa in Hawaii between 1959 and 2013.

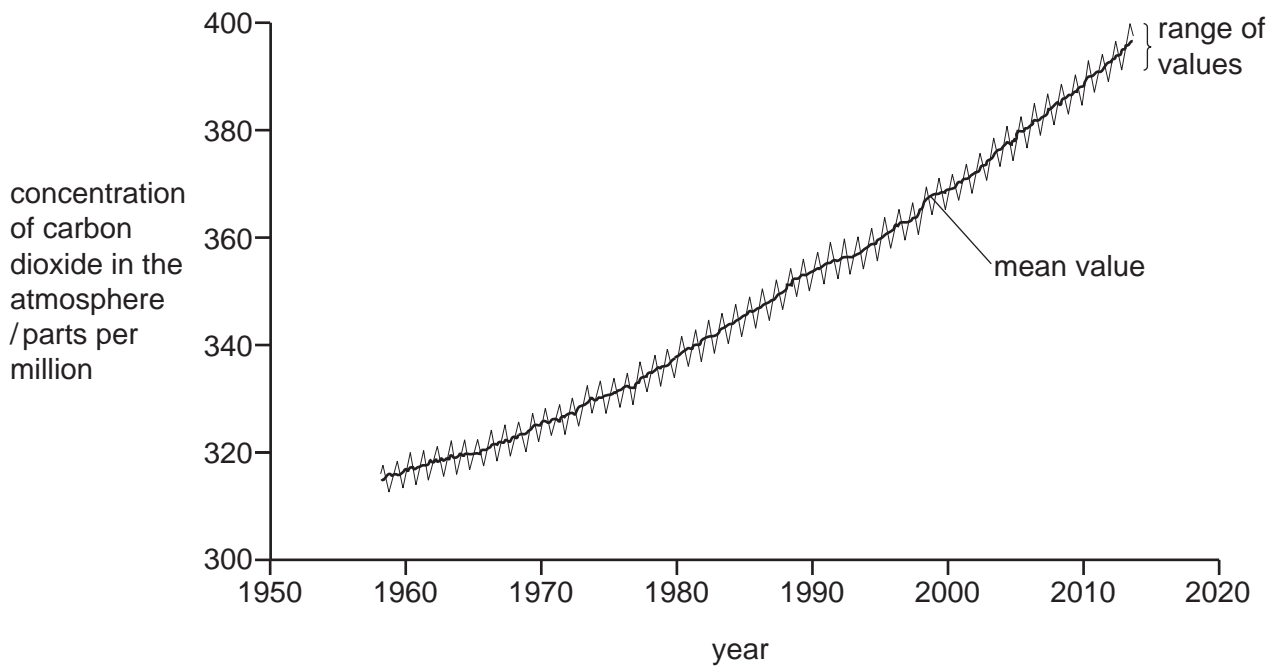


Fig. 2.3

(i) Explain why the concentration of carbon dioxide has increased between 1959 and 2013.

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(ii) Global warming is largely due to this increase in atmospheric carbon dioxide.

Explain how increases in atmospheric carbon dioxide concentrations contribute to global warming.

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[Total: 21]

2 Fig. 5.1 shows the nematode, *Caenorhabditis elegans*.



Fig. 5.1

(a) (i) State the genus of this nematode.

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(ii) State two **structural** features of nematodes.

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(b) Nematodes feed on dead and decaying material. Explain why this gives nematodes an important role in ecosystems.

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(c) Fig. 5.2 shows the life cycle of *C. elegans*. The diploid number of this species is 12.

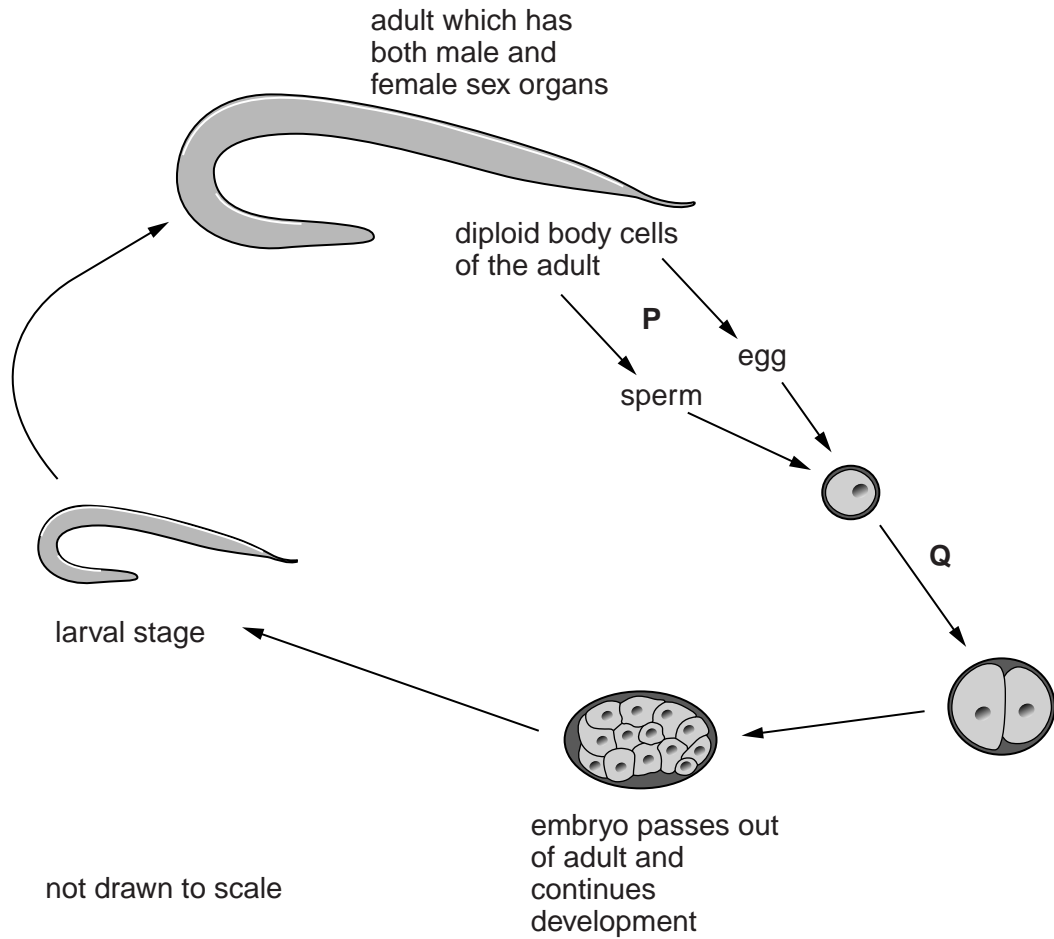


Fig. 5.2

(i) Suggest why there is very little genetic variation in the offspring of the adult nematode shown in Fig. 5.2.

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(ii) State the haploid number of *C. elegans*.

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(iii) Explain why **meiosis** occurs at **P** and **mitosis** occurs at **Q**.

meiosis at **P**

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mitosis at **Q**

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(d) *C. elegans* was one of the first organisms to have its genome sequenced.

An organism's genome is the sum of all its genetic material. Gene sequencing identifies all the component parts of the DNA that makes up the genome.

State where DNA is located in a cell.

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[Total: 14]

- 3 Ecologists study plants and animals in their natural environment. Some ecologists inserted probes into the water-conducting tissue in trees, as shown in Fig. 4.1. The ecologists measured the time taken for water to move up from probe 1 to probe 2.

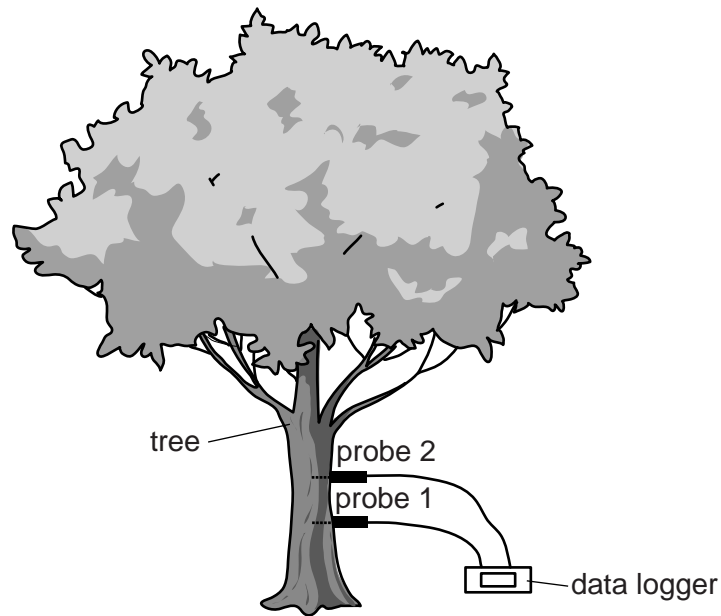


Fig. 4.1

- (a) (i) Name the water-conducting tissue into which the two probes were inserted.

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- (ii) Describe how the structure of this water-conducting tissue is adapted to its function.

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(b) Explain the mechanism of water movement from the roots up the tree to the leaves.

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(c) Fig. 4.2 shows the rate of water conduction up three different trees in a forest over 24 hours.

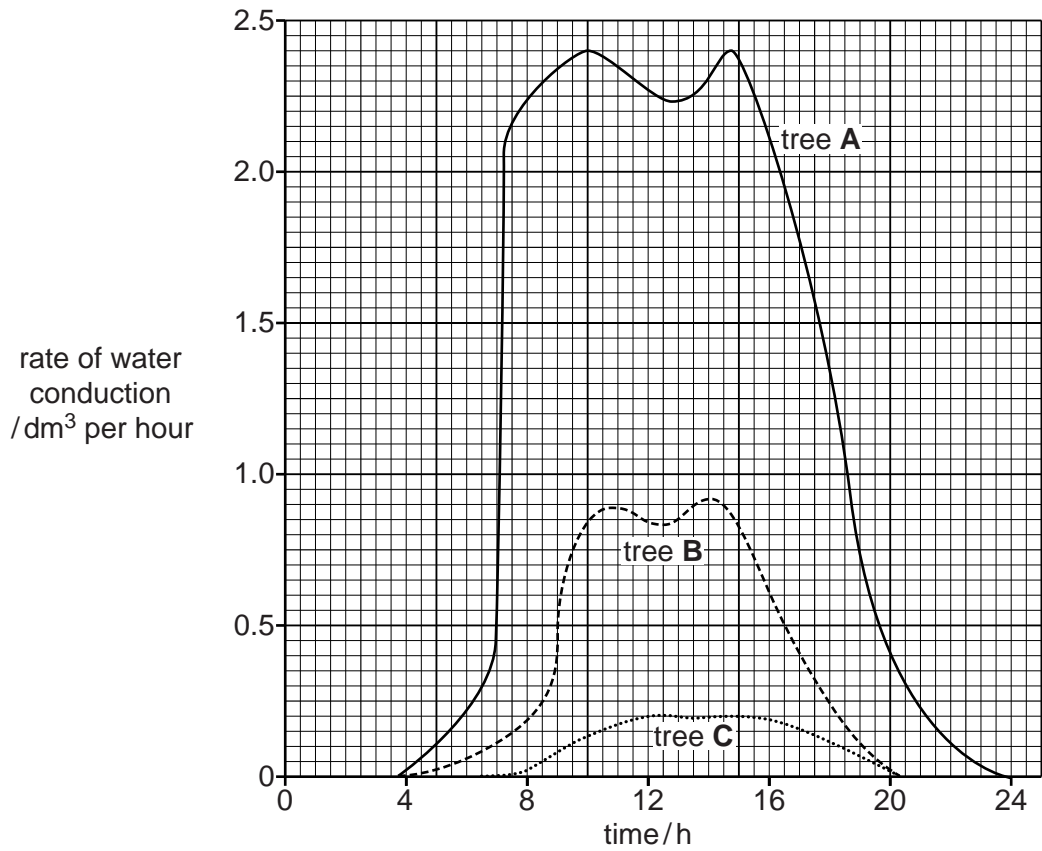


Fig. 4.2

(i) Describe the rate of water conduction in tree **A**, during this 24 hour period.

You will gain credit for using the data in Fig. 4.2 to support your answer.

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(ii) Suggest how the ecologists used the data in Fig. 4.2 to calculate the total volume of water used by a tree in 24 hours.

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(iii) In Fig. 4.2, tree **A** is a tall tree, tree **B** is a medium-height tree and tree **C** is a short tree. Suggest reasons for the different rates of water conduction in the three trees.

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(d) Loggers often cut down the tall trees in a forest.

Describe the effects on the forest ecosystem of cutting down trees.

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[Total: 18]