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# BIOLOGY

## ORGANISMS EXCHANGE SUBSTANCES

| | |
|---|---|
| Level & Board | AQA (A-LEVEL) |
| TOPIC: | MASS TRANSPORT IN PLANTS |
| PAPER TYPE: | QUESTION PAPER - 1 |
| TOTAL QUESTIONS | 6 |
| TOTAL MARKS | 41 |

# Mass Transport in Plants - 1

**1.**

**(a)** The pressure within a willow plant stem's phloem tube was measured by a scientist.

He took nine readings after repeating his measurements.

In the table below, his outcomes are displayed.

| Phloem pressure / arbitrary units | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7.4 | 8.0 | 7.0 | 8.6 | 8.2 | 9.3 | 7.4 | 9.1 | 8.8 |

This formula is used to get the percentage inaccuracy of the mean phloem pressure in this phloem tube.

$$\text{Percentage error} = \frac{\text{uncertainty in measurement}}{\text{mean}} \times 100$$

Half of the measured values' range represents the measurement's uncertainty.

Determine the mean phloem pressure in this phloem tube's percentage error.

Display your work. **(2)**



I am Sorry !!!!!

**Percentage error _____ %**

**(b)** The flow of chemicals through phloem is explained by the mass flow hypothesis.

Explain how pressure is produced inside this phloem tube using what you know about the mass flow hypothesis. **(3)**

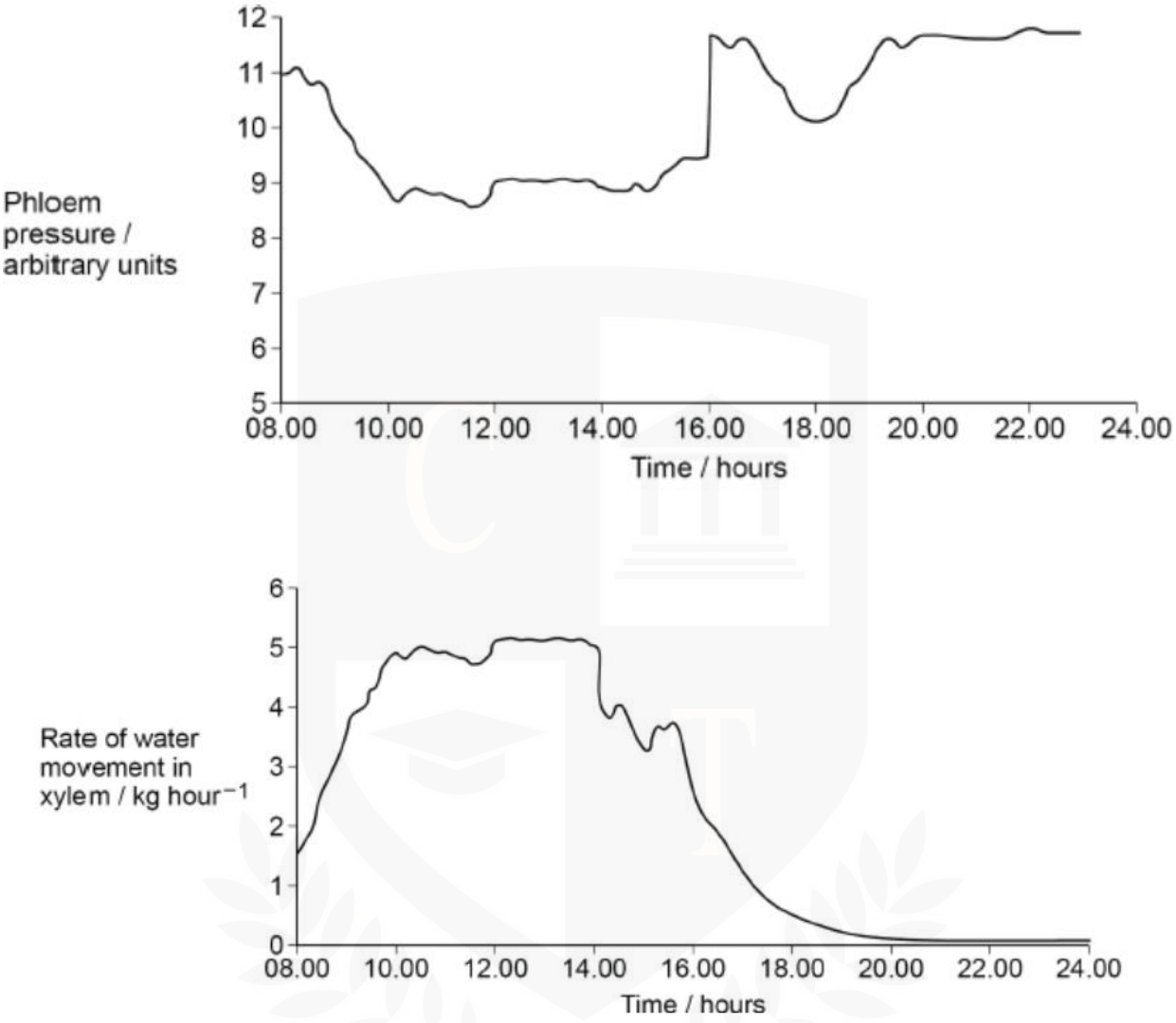


**(c)** At various points throughout the day, the scientist also recorded variations in the phloem pressure and the pace at which water moves through a willow plant xylem.



This is the graph that displays his results.




Explain the connection between this plant phloem pressure and the xylem water transport rate. **(1)**

**(d)** When the day is at its hottest, phloem pressure decreases. Explain why using the data in the above graph and your knowledge of mass flow and transpiration. **(3)**

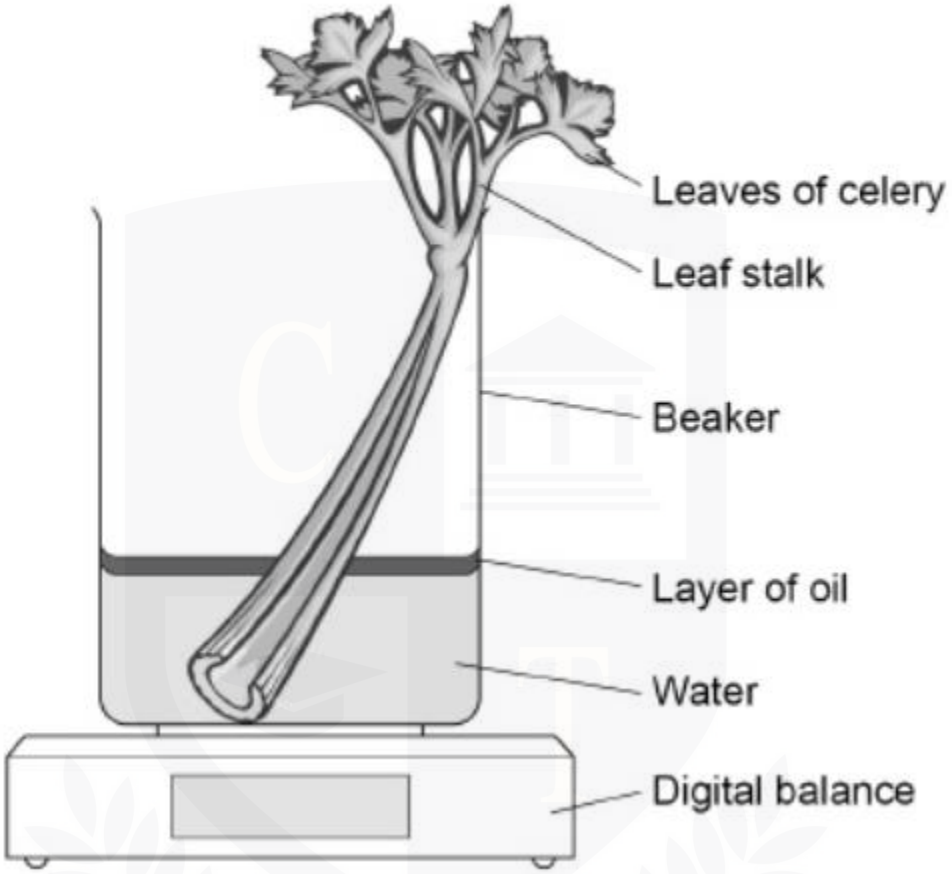
**2.**

A student measured the amount of water moving through a celery stalk in grams per hour for each group of xylem vessels using the equipment depicted in Figure 1 and a digital balance.



**Figure 1**




**(a)** The water movement time was measured by the student.

Describe the two more measurements he took to determine the water movement rate**. (2)**

**1.**

**2.**

**(b)** Explain the rationale behind the oil layer that was added to the beaker water. **(1)**

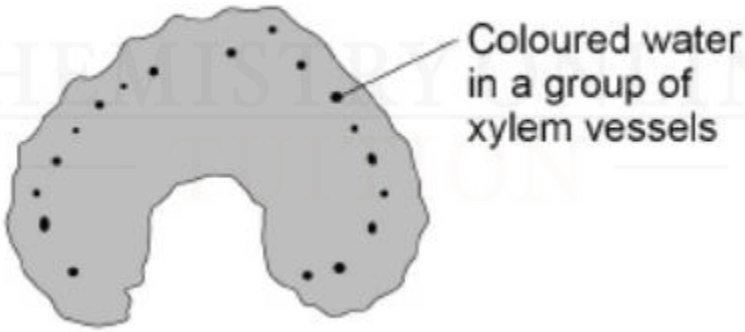
**(c)** Another student examined the flow of water in celery leaf stalks using colored water.

Throughout the process, she:

- cut equal lengths of stalk from each plant
- put the cut end of each stalk into colored water
- left these stalks to take up the colored water for 20 minutes
- used a sharp scalpel to cut slices from the stalks at 1 mm intervals
- until she reached a slice with no colored water.

A section of a leaf stem with colored water within clusters of xylem vessels is depicted in Figure 2.

**Figure 2**




Justify the movement of colored water up the stalks. **(3)**

**(d)** The student used a sharp scalpel to cut the celery. Describe how she should ensure she handled the scalpel safely during this procedure. **(2)**



I am Sorry !!!!!

Using eight celery stalks, the student calculated the distance that the colored water had traveled. Her outcomes are displayed in the table.

| Distance / mm | | | | | | | |
|---|---|---|---|---|---|---|---|
| 70 | 35 | 40 | 35 | 30 | 80 | 42 | 44 |

The student was required to select whether to compute the mean, median, or mode in order to summarize her measurements.

For this collection of measurements, circle the measurement that makes the most sense.

Explain your decision and calculate the value based on the measurements taken from each of the eight stalks. **(2)**

Mean* Median* Mode*

*circle one word.

**Reason:**

**Calculation:**



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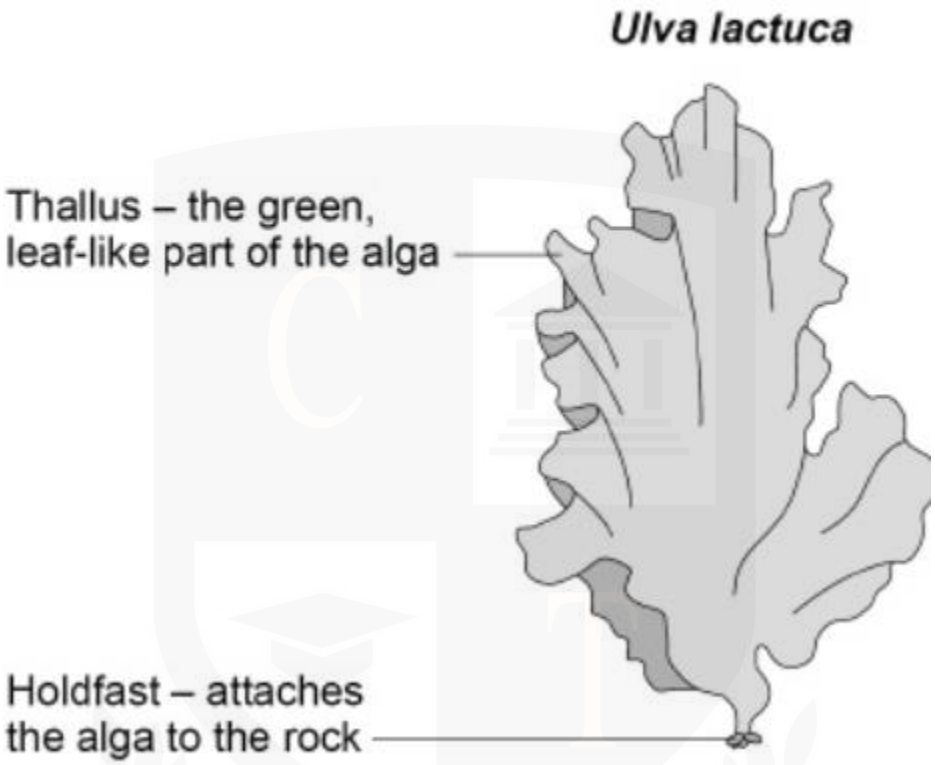
**3.**

An algae called Ulva lactuca inhabits the rocks along the coast. Seawater frequently covers it.

A schematic of a single Ulva lactuca alga is shown in Figure 1.

**Figure 1**




**(a)** Ulva lactuca is not a plant; it lacks xylem tissue.

Explain Ulva lactuca's ability to survive in the absence of xylem tissue. (1)



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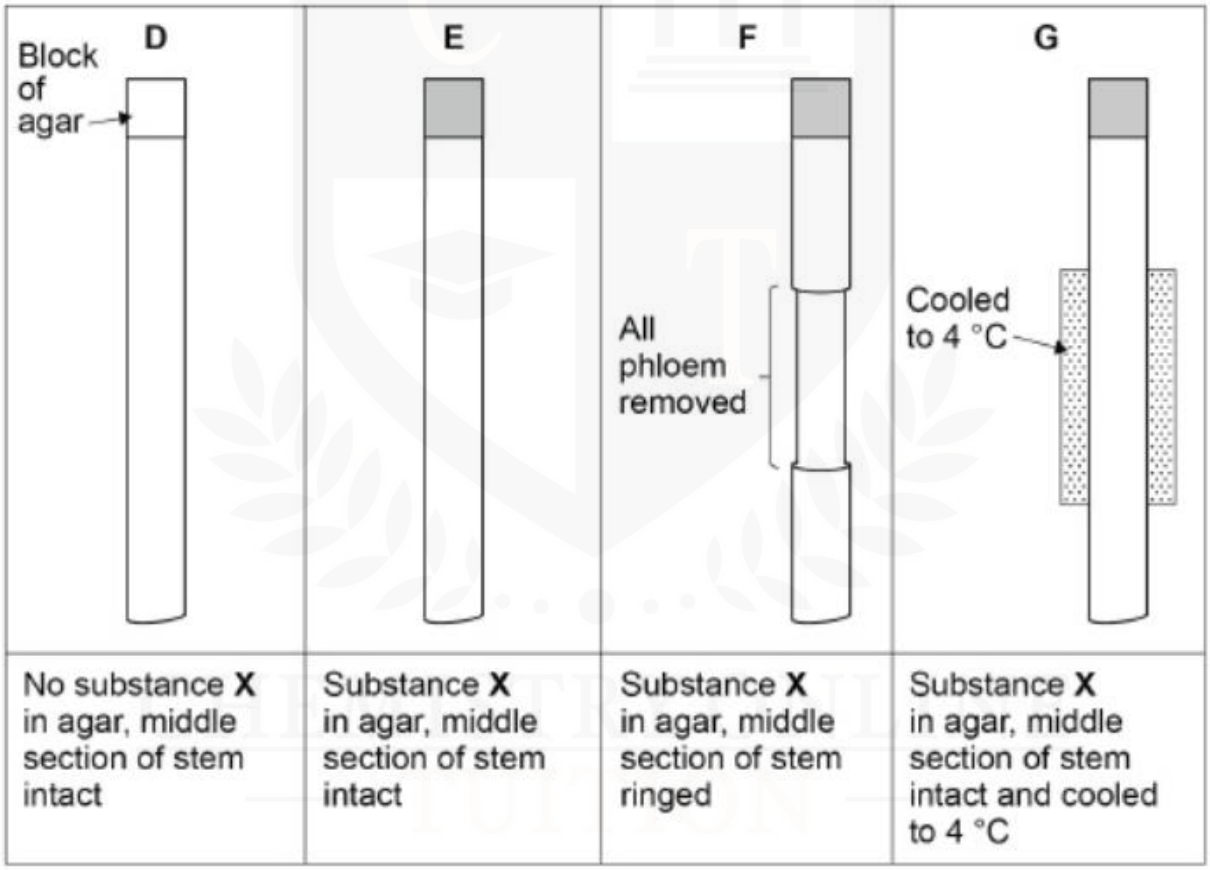
**4.**

When a plant stem is cut, new roots might emerge under the right circumstances. A scientist looked into how substance X affected the development of new roots.

She looked at the transport of substance X in lemon plant stems using a ringing experiment. She removed a segment of stem from every plant.

Next, she topped each length of stem with a little cube of agar. There were substance X-containing agar blocks.

The way she handled each length of stem is depicted in the diagram below.




She counted the number of roots per length of stem after growing the lengths of stem under the same environmental conditions for six weeks. At the opposite end of the stem from where the agar blocks were positioned, roots began to grow.

The scientist's findings are shown in the table below.

| Treatment | Mean number of roots per length of stem |
|---|---|
| D | 5 |
| E | 11 |
| F | 4 |
| G | 3 |

**(a)** Treatment D serves as a control. Describe how the scientist uses the measurement that comes from this control. **(2)**

**(b)** What conclusions about root growth can you draw from treatments D and E using the accompanying table and diagram? **(3)**

**(c)** The flow of chemicals through phloem is explained by the mass flow hypothesis.

Determine if the data from this study lend credence to this theory.

Don't include statistical analysis in your response. **(4)**





**5.**

Researchers looked into how a heat treatment affected the bulk movement of barley plants.

• On a small portion of a leaf from the heat-treated plants, they applied steam.

The arrows in Figure 1 depict this region.

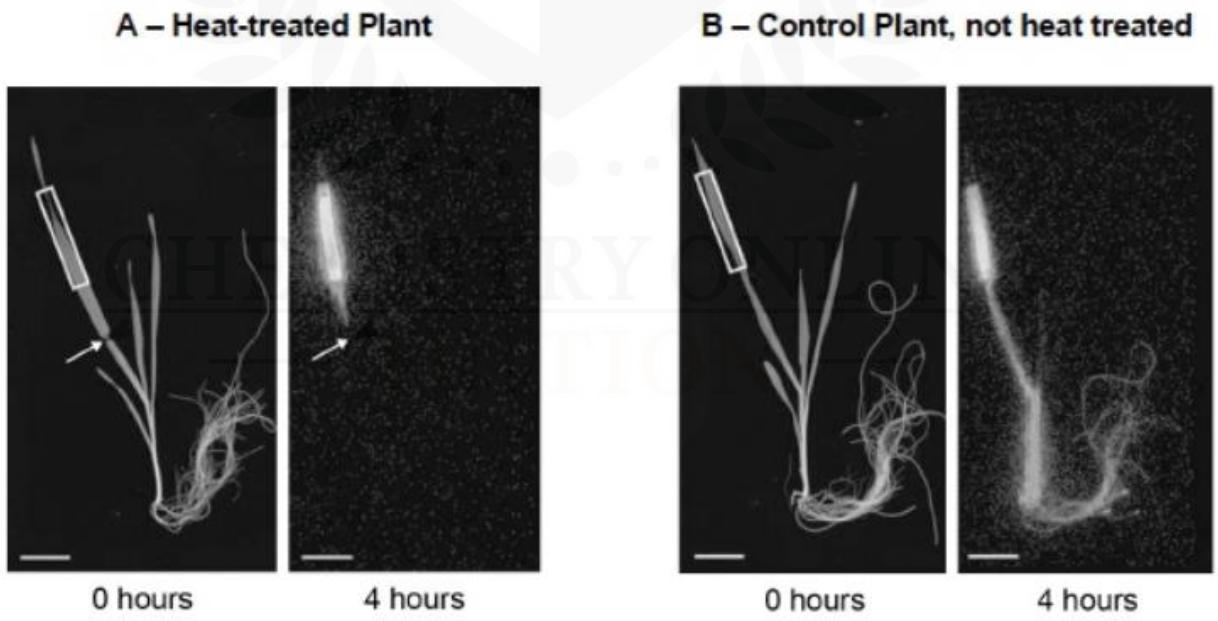
• The control plants' leaves were not subjected to steam.

• After that, they gave carbon dioxide that included carbon that had been radioactively labeled to every plant in the region depicted by the rectangular rectangles in Figure 1.

• Four hours later,

- they identified the location of each plant's radioactively marked carbon. Figure 1 presents these findings.
- noted the amount of water present in the leaf sections that received carbon dioxide that was radioactively labeled. The table presents these findings.

**Figure 1**



| Plant from which the leaf was taken | Water content of leaf / % of maximum (± 2 standard deviations) |
|---|---|
| Heat-treated Plant A | 84.6 (±11.3) |
| Control Plant, not heat treated B | 92.8 (±8.6) |

**(a)** The scientists deduced that the phloem was harmed by this heat treatment.

Describe how this conclusion is supported by the findings in Figure 1. **(2)**



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**(b)** The scientists also came to the conclusion that the xylem was unaffected by the heat treatment.

Describe how this conclusion is supported by the data in the table. **(2)**

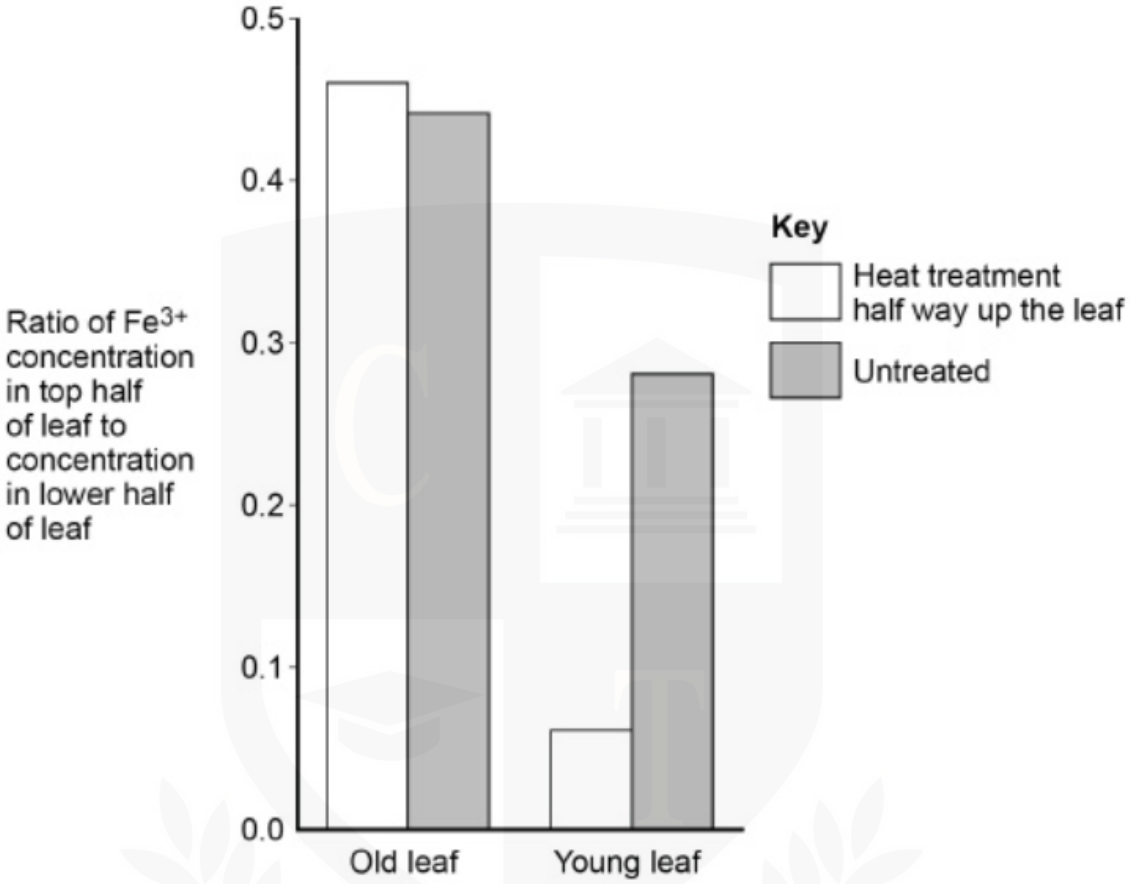
**(c)** The scientists next looked at how iron ions ($Fe^{3+)}$ moved from the soil to the young and old leaves of barley plants that had been heat-treated as well as to the leaves of plants that had not. The leaves were treated with heat halfway up. The amount of $Fe^{3+}$ in each plant's upper and lower leaf halves was measured by the scientists.

Figure 2 displays their findings.



**Figure 2**




What conclusions can you draw regarding Fe3+ transport in barley plants? Make use of all the available data. **(4)**





**6.**

**(a)** Explain the cohesion-tension hypothesis of xylem water transfer. **(5)**



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