
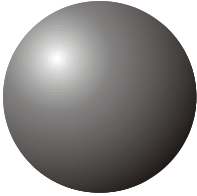


	sphere A	sphere B
		
diameter / cm	1	3
surface area / cm ²	3.14	28.27
volume / cm ³	0.52	14.14

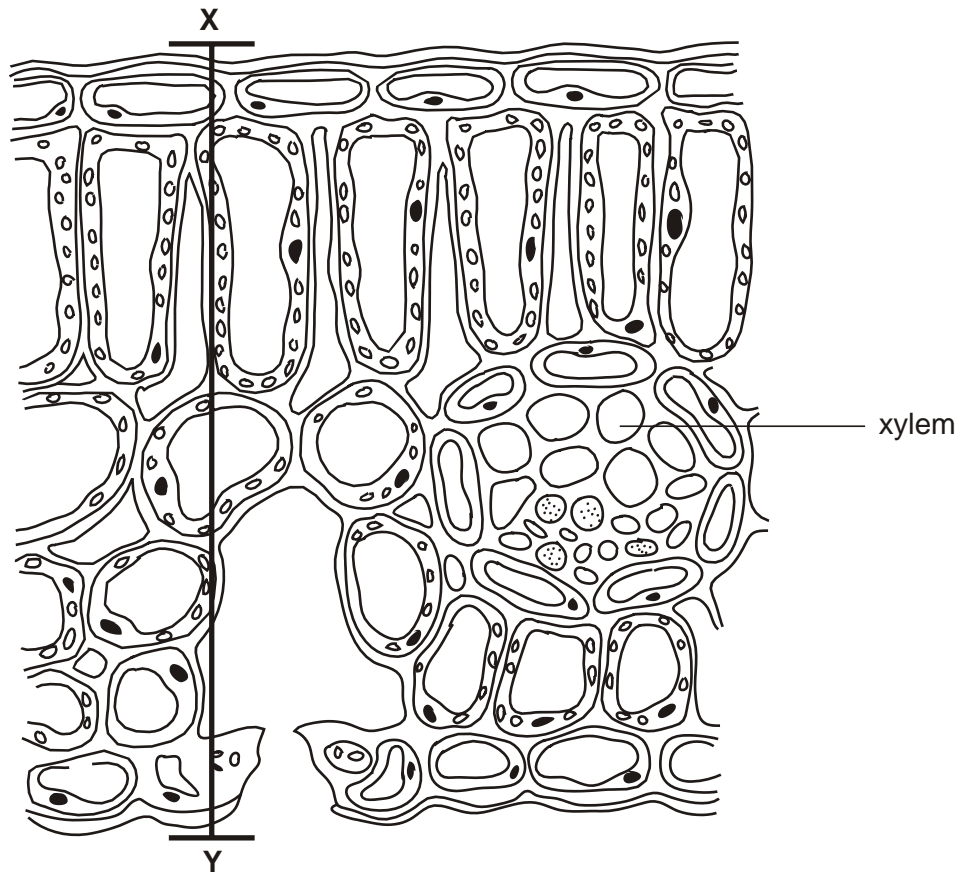
- (i) The student calculated the surface area: volume ratio of sphere **B** as 2:1. Calculate the surface area: volume ratio of sphere **A**. Show your working.

..... [2]

- (ii) How does the surface area: volume ratio of sphere **B** differ from that of sphere **A**?

..... [1]

3. (a) The diagram below is a drawing of a vertical section of part of a dicotyledonous leaf.



- (ii) The distance **XY** represents an actual distance of 0.7 mm. Calculate the magnification of the drawing. Show your working.

Answer =[2]

- (b) Explain why xylem is described as a *tissue*.

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.. [2]

4. The table below shows the approximate size and number of stomata in the leaves of three plant species. The data were collected by taking photographs of pieces of leaf placed under a microscope. The length and width of a large number of stomata visible on the photographs were measured.

species	mean number of stomata per mm ² on lower epidermis	mean length of fully open stomata / μm	mean width of fully open stomata / μm	mean area available for water loss through fully open stomata / μm ² per mm ²
<i>Phaseolus vulgaris</i> (bean)	281	7	3	5 901
<i>Hedera helix</i> (ivy)	158	11	4	6 952
<i>Triticum</i> sp. (wheat)	14	18	7	1 764

(a) (i) Explain why a large number of stomata are measured in order to calculate a mean.

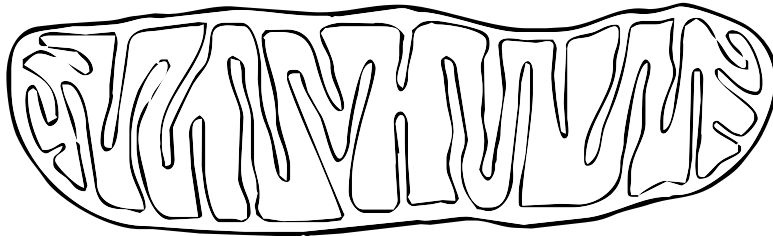
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.. [2]

(ii) Suggest **two** ways in which photographing the leaf surfaces makes measuring the stomata easier.

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[2]

5. The diagram below is a drawing of an organelle from a ciliated cell as seen with an electron microscope.



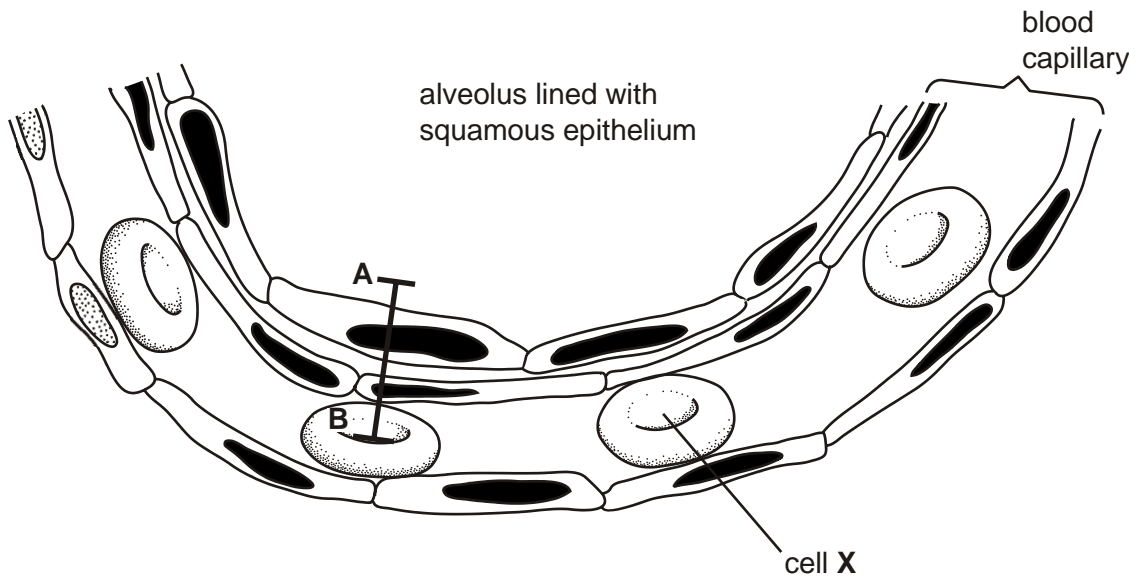
× 20 000

- (iv) Calculate the actual length of the organelle as shown by the line AB in the diagram. Express your answer to the nearest micrometer (μm).
Show your working.

Answer = μm

[2]

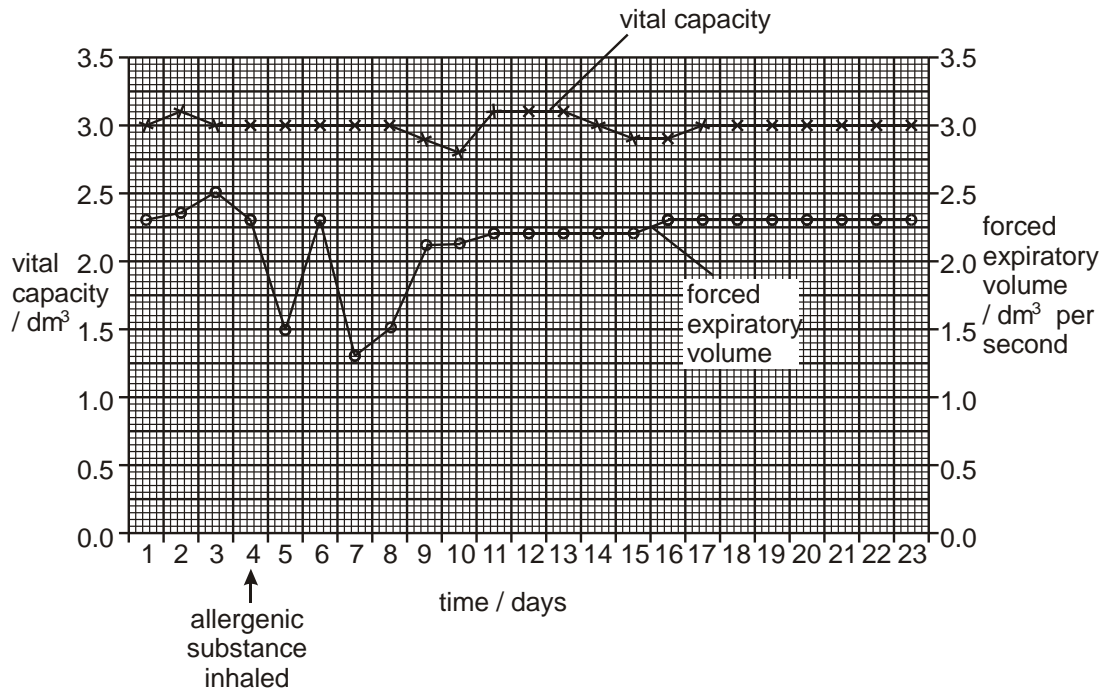
6. The diagram below is a drawing of an alveolus together with an associated blood capillary.



The line **AB** in the diagram represents an actual distance of $1.5 \mu\text{m}$. Calculate the magnification of the drawing. Show your working.

Answer = \times [Total 2 marks]

- The vital capacity and the forced expiratory volume of a person with asthma were measured over a period of 23 days. The forced expiratory volume is the volume of air that can be breathed out in one second. On day 4 of the investigation, the person breathed in an allergenic substance. The results are shown in the graph below.



- (i) Calculate for day 1 the percentage of the vital capacity that was breathed out in one second. Show your working and give your answer to the nearest whole number.

answer
%

[2]

- (ii) Using the data in the graph, describe the effect of the allergenic substance on the forced expiratory volume and the vital capacity.

forced expiratory volume

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vital capacity

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 .. [3]

[Total 5 marks]

8. The Body Mass Index (BMI) is one way of determining whether a person is underweight or overweight. BMI can be calculated using the formula:

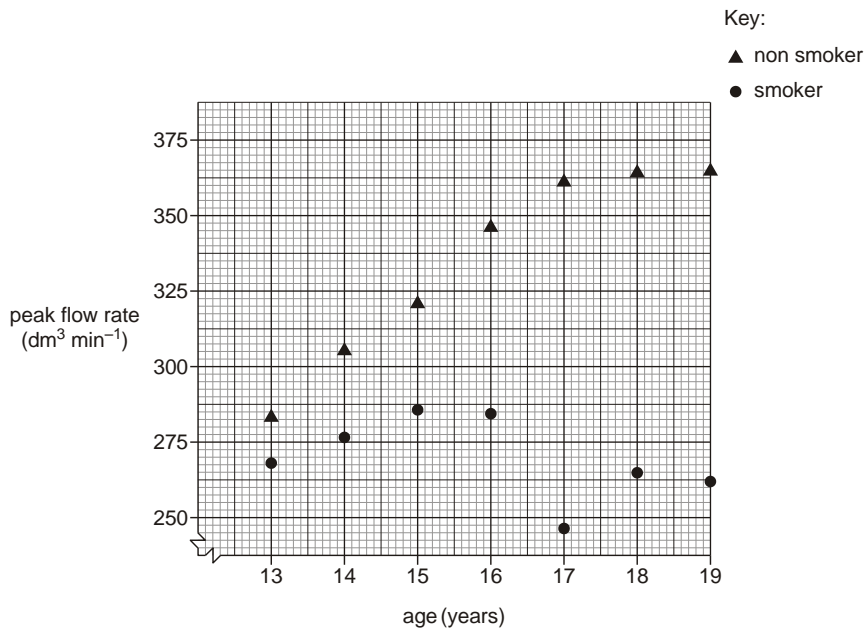
$$\text{BMI} = \frac{\text{mass in kg}}{(\text{height in m})^2}$$

Calculate the BMI of a female of mass 69 kg and a height of 1.67 m.
 Show your working. Give your answer to **one decimal place**.

Answer =

[Total 2 marks]

9. An investigation was conducted into the effect of smoking on lung function. One measure of lung function is peak flow rate. The peak flow rate is the maximum volume of air expelled from the lungs in one minute ($\text{dm}^3 \text{min}^{-1}$). Two male volunteers, one a smoker and one a non-smoker, had their peak flow measured once a year for seven years.



- (i) **Describe** the data shown in the figure above.

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[3]

[Total 9 marks]