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— **TUITION** —

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BIOLOGY

ORGANISMS EXCHANGE SUBSTANCES

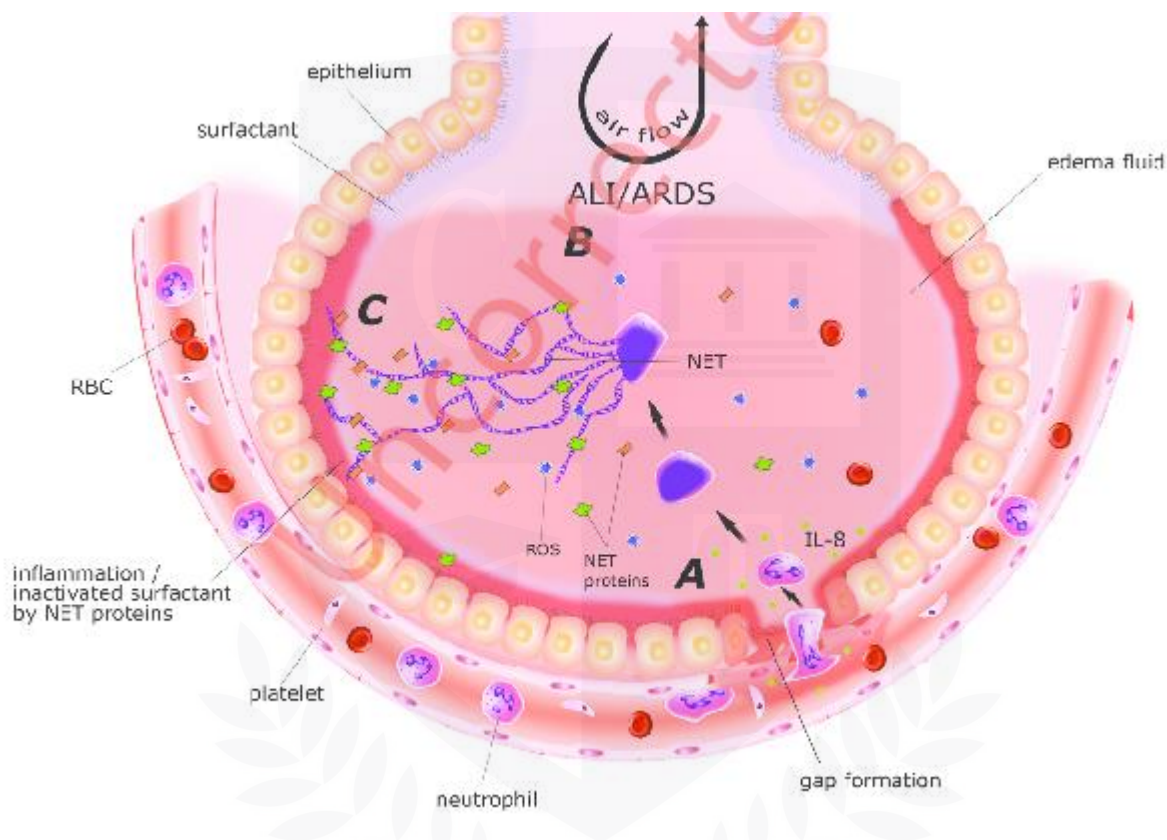
Level & Board	AQA (A-LEVEL)
TOPIC:	GAS EXCHANGE
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	6
TOTAL MARKS	33

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Gas Exchange - 1

1.

(a) Give an explanation of one characteristic of the alveolar epithelium that makes it a suitable surface for gas exchange.



In your response, do not mention surface area or moisture. (2)

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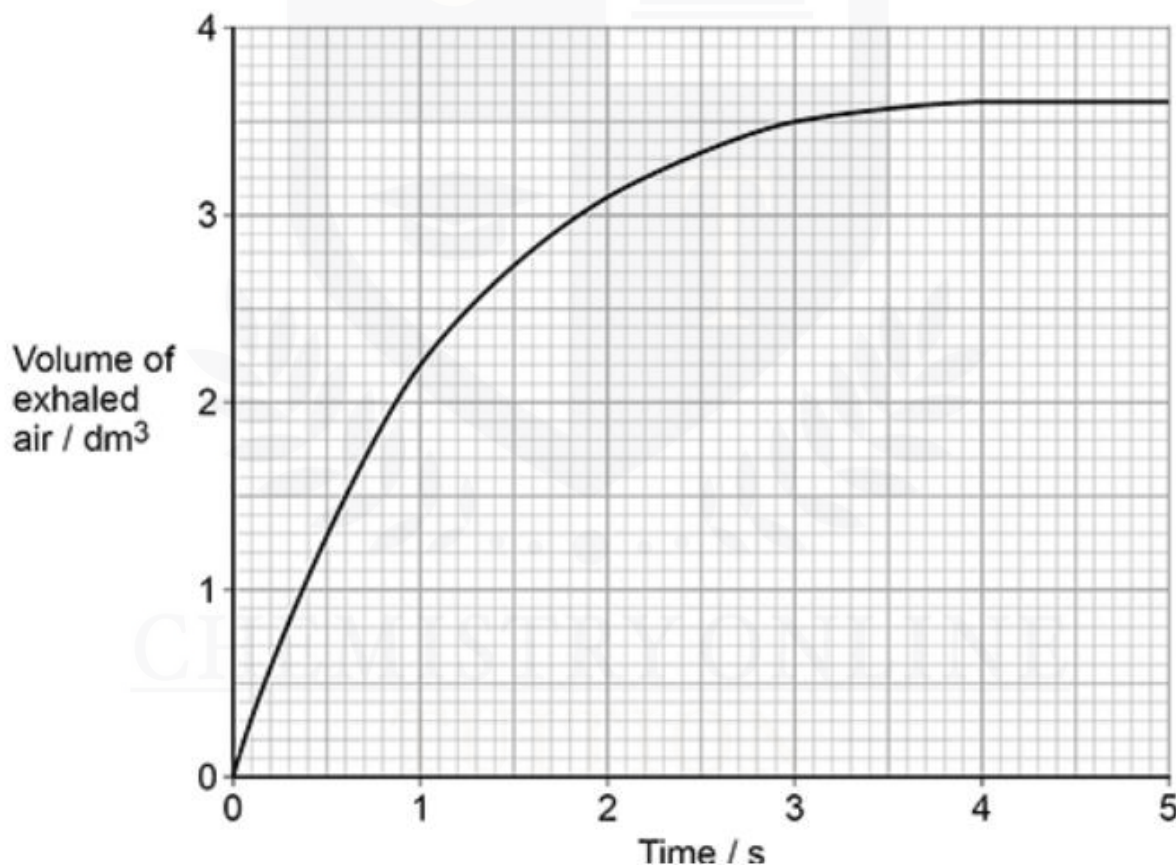
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To assess lung health, medical professionals compute the FEV1:FVC ratio.

- The maximum amount of air exhaled in a single second is known as FEV1.
- FVC is the most air that can be exhaled in a single breath.

Healthy lungs have a minimum FEV1:FVC ratio of 0.7:1.

A man suffering from emphysema blew air into his lungs. Then, in a single breath, he released as much of this air as he could. The air volume that was exhaled during this breath is depicted in the figure below.



(b) Determine the man's lungs' FEV1:FVC ratio using the information supplied.

Find out how many times higher his ratio is than the minimal ratio of healthy lungs. **(2)**

FEV1:FVC ratio of man's lungs = _____

How many times greater? _____

(c) The amount of air that a person breathes in and out in one breath while they are at rest is known as their tidal volume. When compared to a healthy individual, the tidal volume in an emphysema patient is lower.

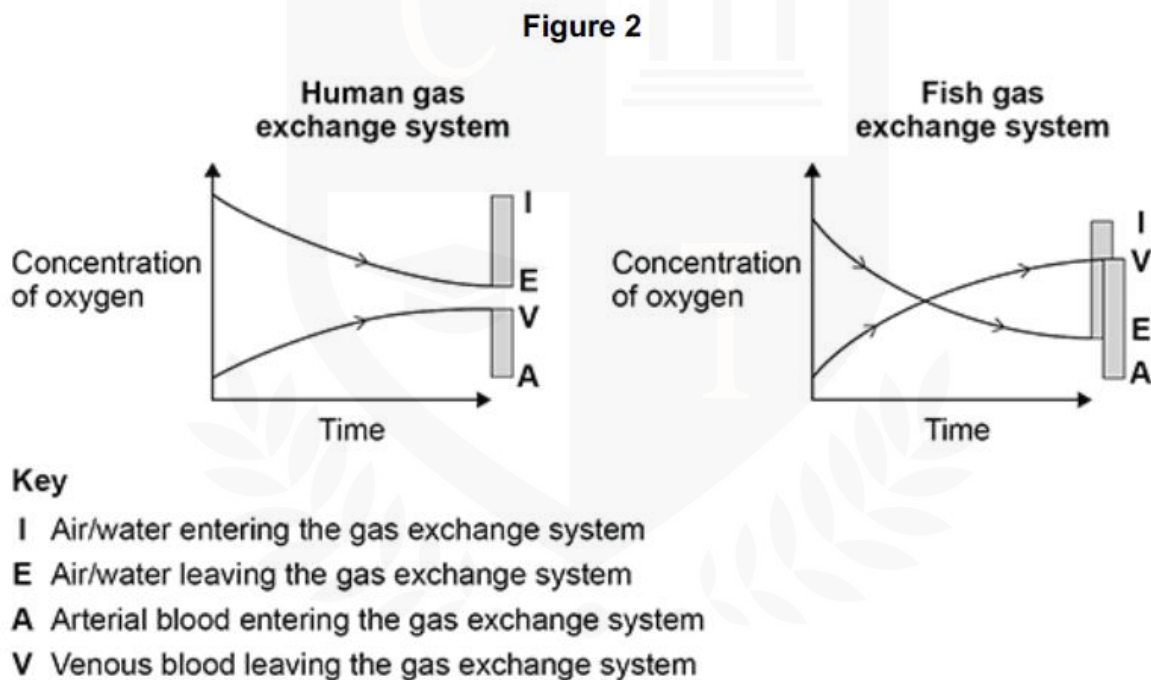
Provide a hypothesis and an explanation for how the blood-to-alveolar carbon dioxide exchange is impacted by a decreased tidal volume. **(3)**

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2.

(a) Changes in the oxygen concentration in two gas exchange systems are depicted in Figure 2.



After examining Figure 2, a student came to the conclusion that the gas exchange system in fish is more effective than that in humans.

Figure 2 can be used to support this conclusion. **(2)**

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(b) Describe how the fish gas exchange system effective oxygen uptake is made possible by the counter-current principle. **(2)**

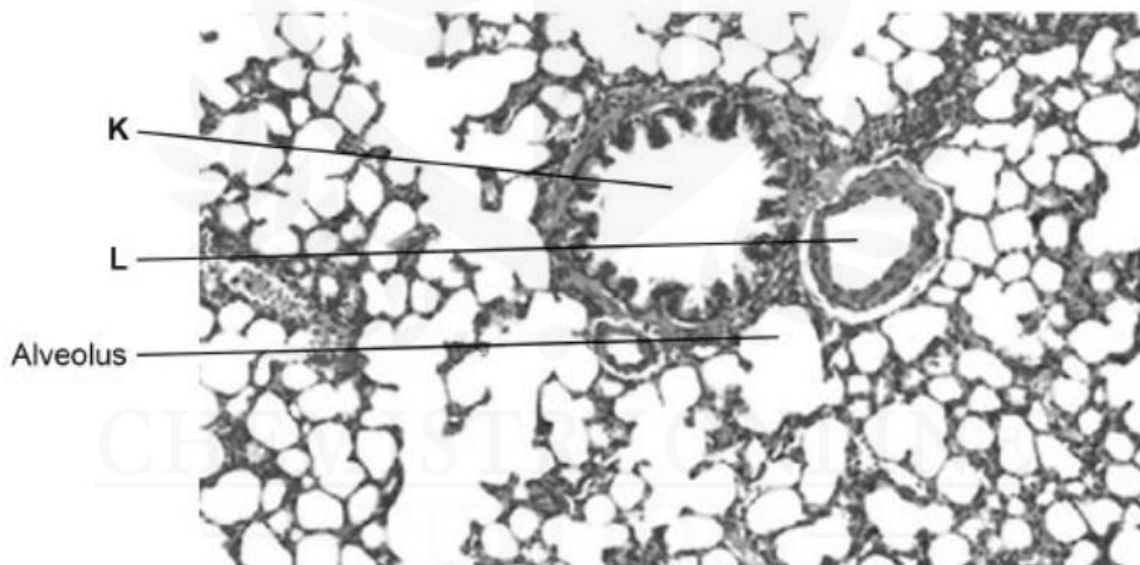
3.

(a) Describe and elucidate the process by which air fills the lungs. **(3)**

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A scientist used an optical microscope to examine lung tissue slices. One of these sections is depicted in the image below. L is a blood vessel, and K is an air-filled tube.



(b) Determine which structures are K and L. (1)

K

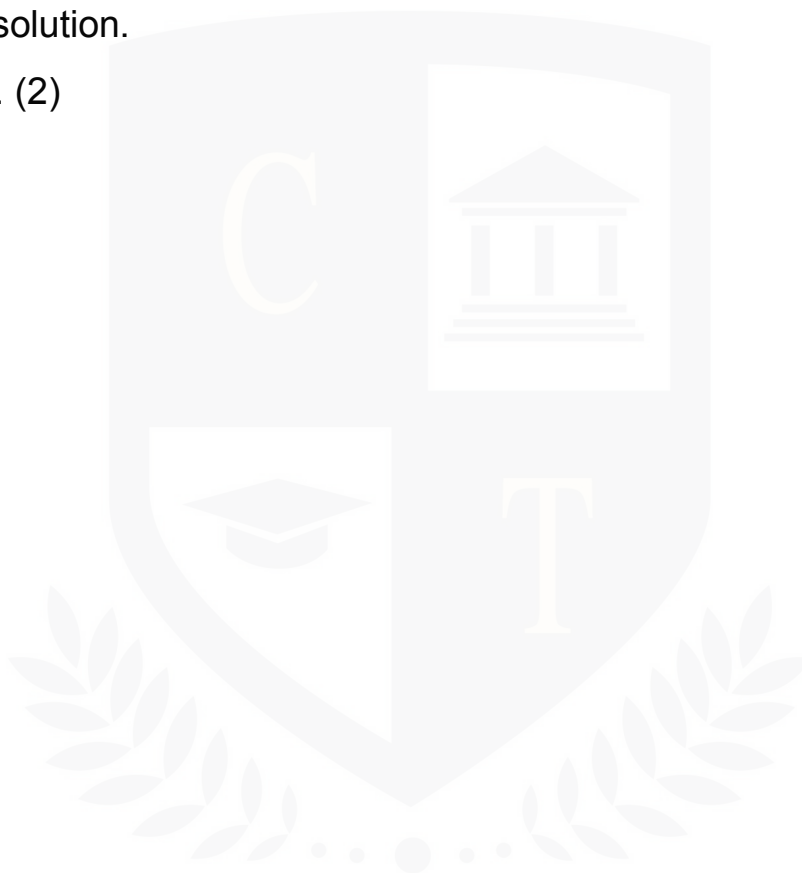
L

(c) Iodine solution and hematoxylin solution are two common staining solutions for tissues.

- DNA gets stained blue when soaked in hematoxylin solution.
- Starch gets stained a blue-black color by the iodine solution.

The lung tissue was stained by the scientist using hematoxylin solution rather than iodine solution.

Explain why. (2)



(d) Researchers looked into the relationship between three risk factors and the lung condition asthma. They looked at a lot of subjects. They noted whether the participants had asthma and whether they

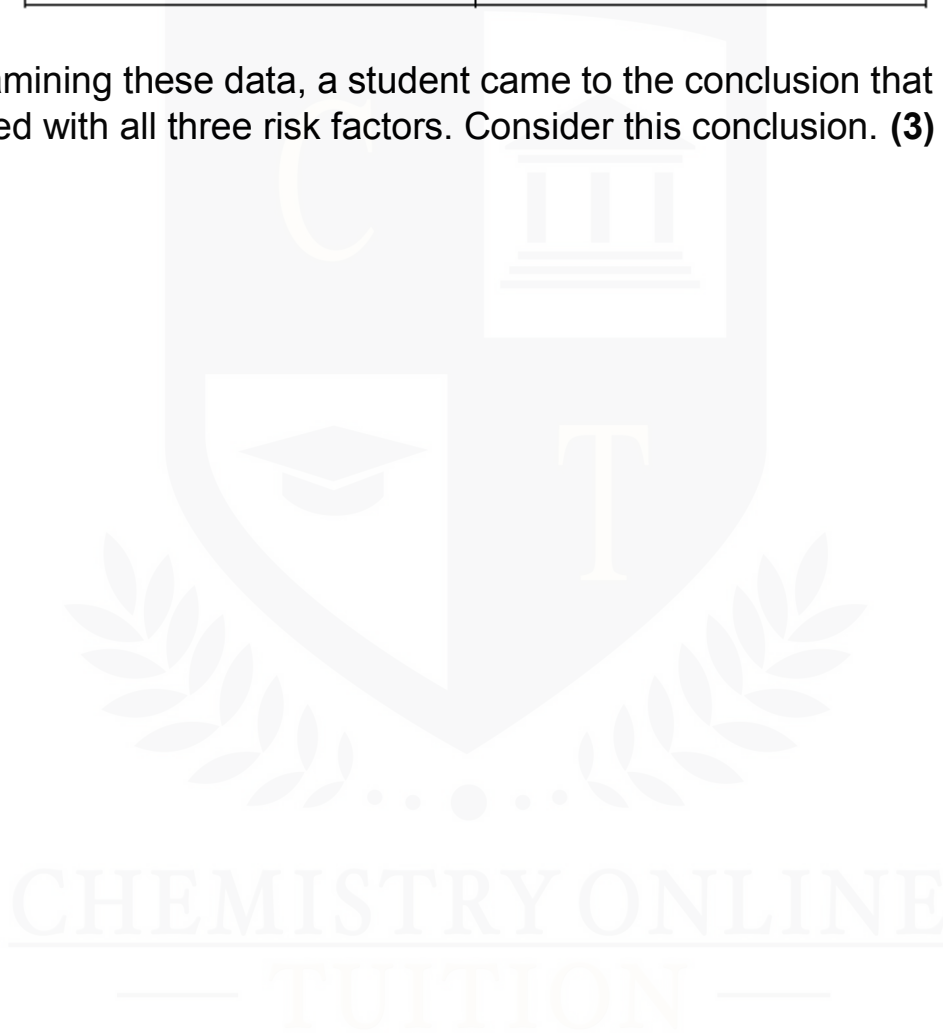
- were obese
- burned wood indoors as a fuel
- lived in a house with a cat or dog.

The researchers determined the likelihood that each risk factor association with asthma was the result of random variation using a statistical test.

Their results are shown in the table below.

Risk Factor	Probability (P value)
Obese	< 0.001
Burned wood indoors	= 0.06
Lived with a cat or dog	< 0.05

After examining these data, a student came to the conclusion that asthma is associated with all three risk factors. Consider this conclusion. **(3)**



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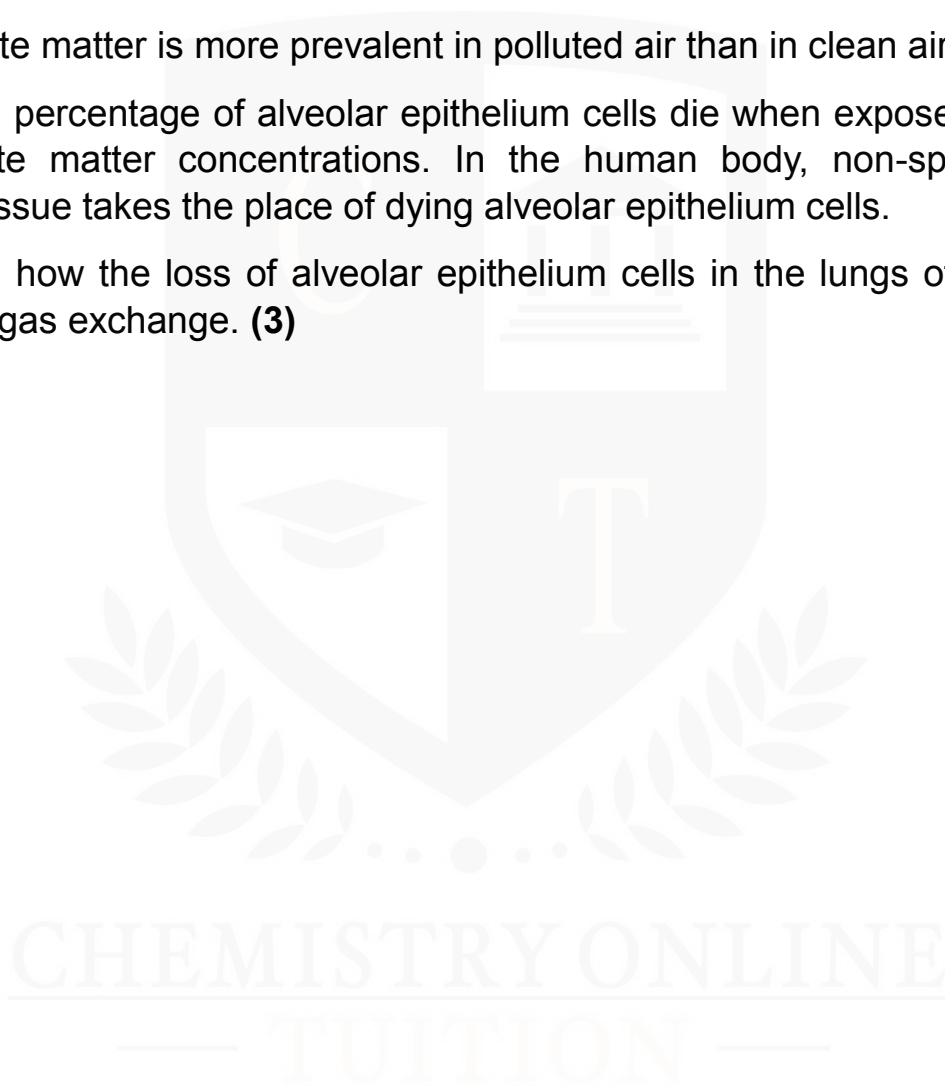
4.

(a) Particulate matter is made up of liquid and solid particles that are airborne.

Particulate matter is more prevalent in polluted air than in clean air.

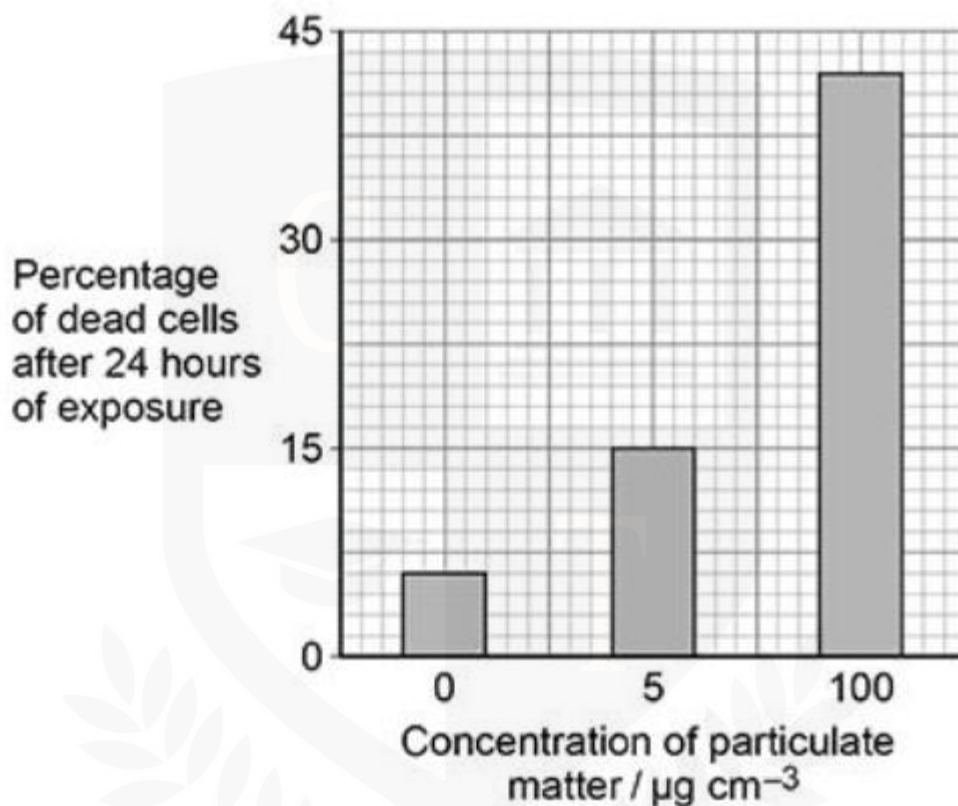
A certain percentage of alveolar epithelium cells die when exposed to high particulate matter concentrations. In the human body, non-specialized, thicker tissue takes the place of dying alveolar epithelium cells.

Describe how the loss of alveolar epithelium cells in the lungs of humans reduces gas exchange. **(3)**



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Alveolar epithelium cells were cultured and subjected to varying concentrations of particulate matter by the scientists. The percentage of these alveolar epithelium cells that perished after being exposed to particulate matter for 24 hours was determined. The graph below displays their findings.



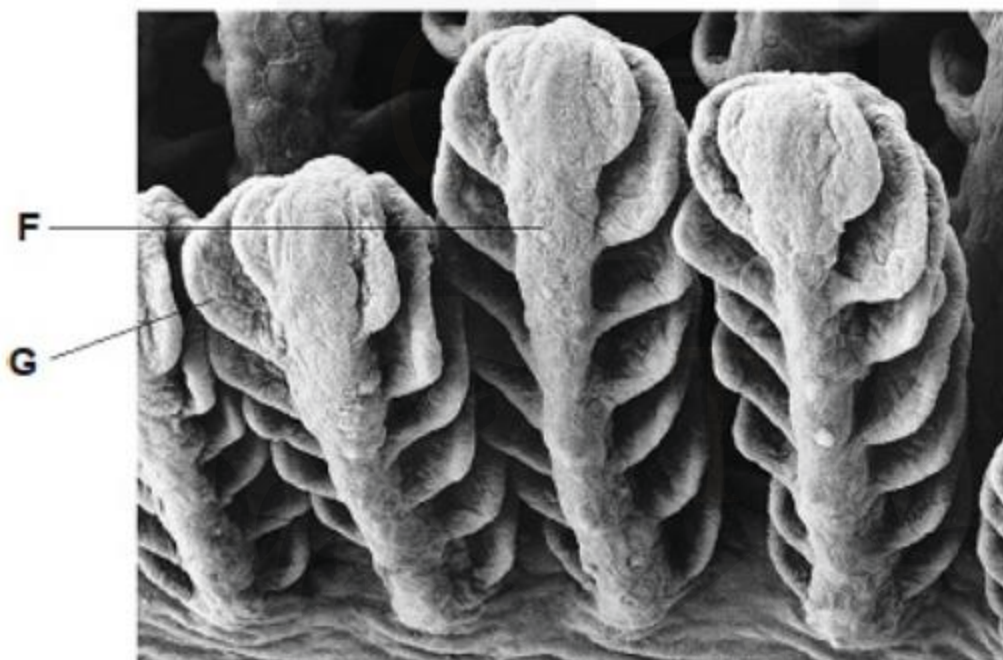
(b) Does the data in the above graph indicate a linear relationship between the percentage of dead cells and the particulate matter concentration?

Make the appropriate calculations to support your response. **(2)**

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5.

Below is a scanning electron microscope image of a fish gill.



(a) Determine which structures are F and G. (1)

F

G

(b) Give an example of the counter-current principle benefit for gas exchange through a fish gill. (3)

6.

The soil water content has an impact on the water potential of leaf cells.

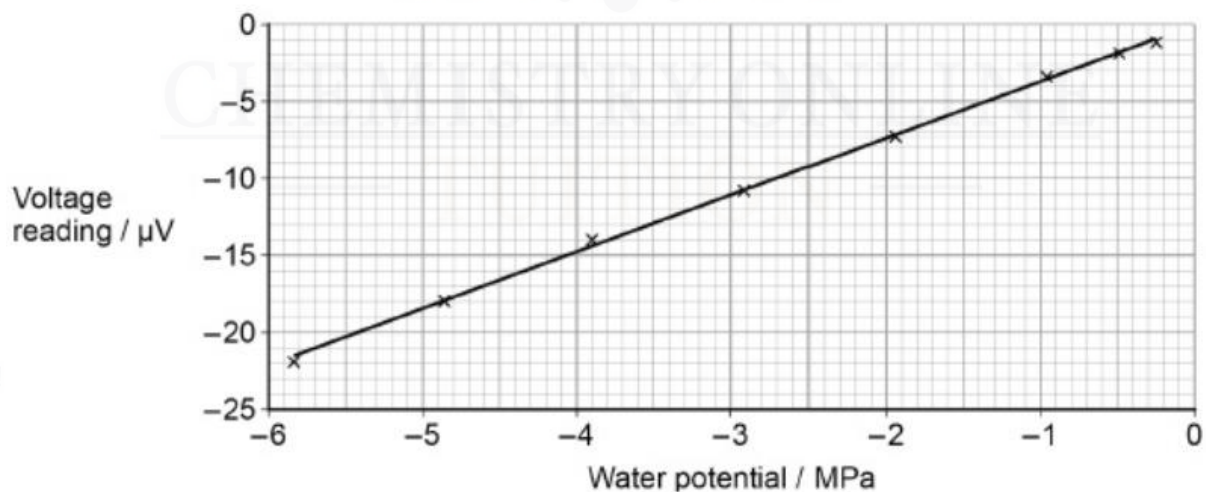
Researchers cultivated sunflower plants. They provided varying amounts of water to various plants.

After two days, they used a device that provided a voltage reading to ascertain the water potential in the leaf cells.

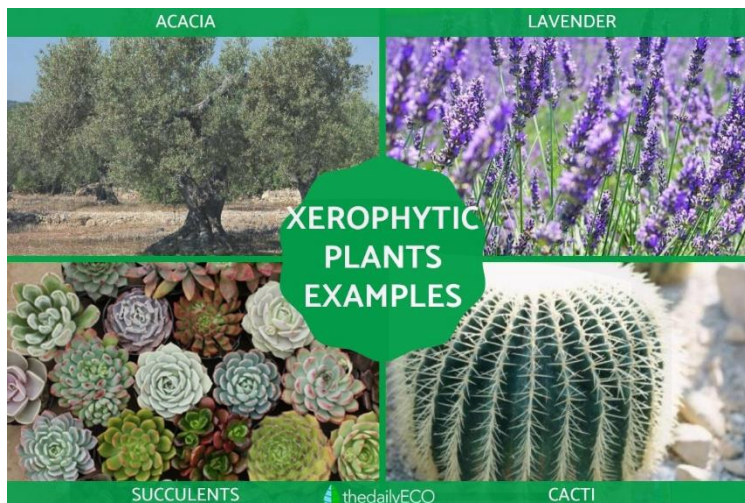
The voltage readings were converted to water potential by the scientists using a calibration curve they created.

They have a calibration curve in Figure 1.

Figure 1



(a) It is not a xerophytic plant, sunflowers. Using xerophytic plants, the scientists conducted the experiment once more.



Provide an example of how the leaf development of xerophytic plants differs from that of sunflowers in Figure 2. **(2)**

(b) Using your understanding of gas exchange in leaves, explain why plants grown in very dry soil only develop slowly. **(2)**

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