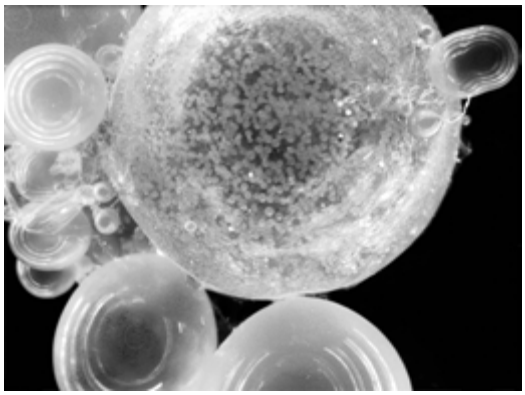
2 All organisms exchange gases with their environment.

(a) Sailor's eyeball (*Valonia ventricosa*) is a single-celled, spherical organism.

One of these organisms can have a diameter of 1 cm to 4 cm.



The table shows the diameter, surface area and volume of different *Valonia ventricosa* cells.

Diameter / cm	1	2	4
Surface area / cm²	3.14	12.57	50.27
Volume / cm³	0.52	4.19	

(i) The volume of a sphere can be calculated using the following equation.

$$V = \frac{4\pi r^3}{3}$$

What is the volume of a cell with a diameter of 4 cm?

(1)

☒ **A** 33.51 cm^2

☒ **B** 33.51 cm^3

☒ **C** 268.08 cm^2

☒ **D** 268.08 cm^3

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(ii) Describe why single-celled organisms, such as *Valonia ventricosa*, do not need a specialised gas exchange surface.

(2)

(b) Mammalian lungs are adapted for rapid gas exchange.

Explain how the structure of the human lungs enables rapid gas exchange.

(4)

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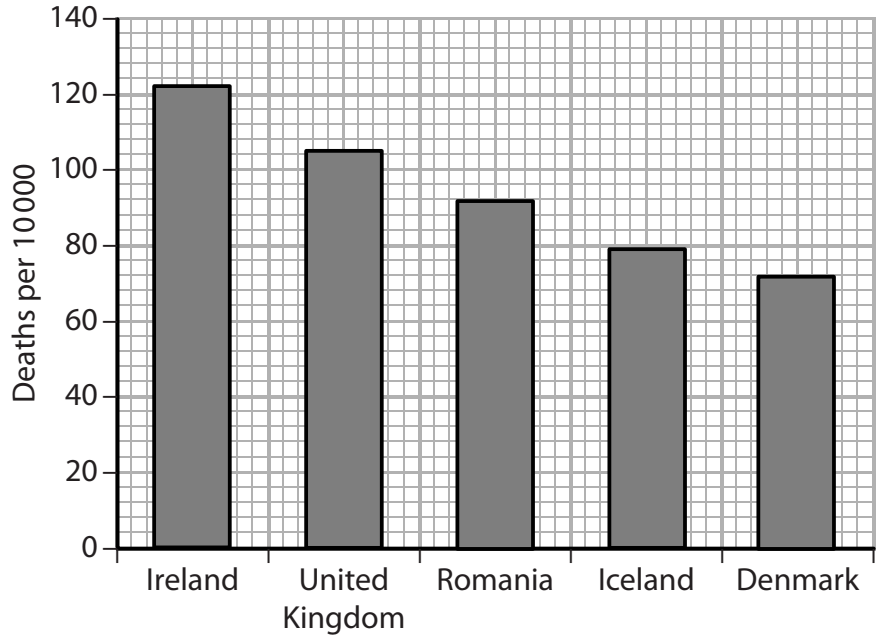
(c) The graph shows the death rates due to diseases of the respiratory system in some countries.

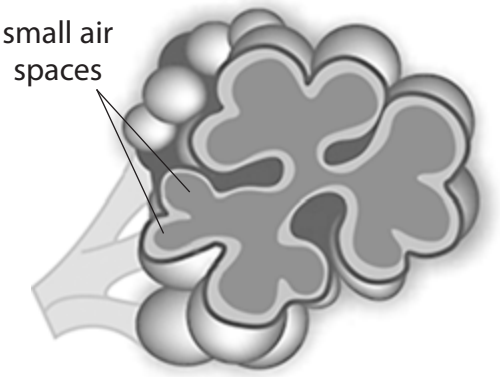


Calculate the probability of dying from a disease of the respiratory system in the United Kingdom.

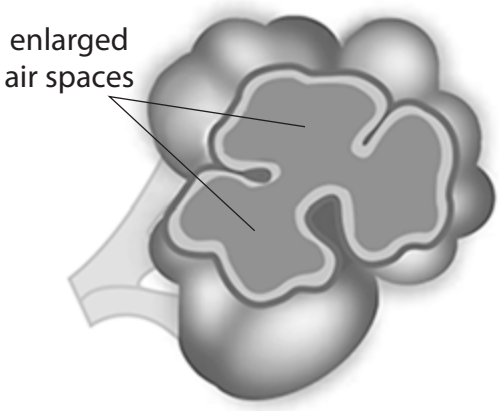
(2)

Answer .....

(d) Emphysema is a disease of the respiratory system that affects the structure of the lungs.



Lung without emphysema



Lung with emphysema

Explain why people with emphysema are given air with a higher concentration of oxygen than atmospheric air.

(2)

(Total for Question 2 = 11 marks)