**1.** A student investigated how the surface area of a single-celled organism is related to its volume. The student used two spheres, **A** and **B**, as models of two organisms. The surface area and volume of each sphere was calculated.

The results are shown in the table below.

|  |  |
| --- | --- |
| sphere **A** | sphere **B** |
|  |  |
| diameter / cm | 1 | 3 |
| surface area / cm2 | 3.14 | 28.27 |
| volume / cm3 | 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.

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[2]

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

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[1]

(iii) Single-celled organisms generally have a surface-area to volume ratio more like that of sphere **A** than sphere **B**.

Explain why.

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[Total 5 marks]

**2.** The lungs in the mammalian body are well developed to allow effective exchange of gases.

Describe the features of the lungs that make them effective organs for the exchange of gases.

 *In your answer, you should use appropriate technical terms, spelled correctly.*

*(Allow one lined page).*

[Total 5 marks]

**3.** The diagram below shows the trace from a spirometer. A spirometer is a device designed to measure the volume of air entering and leaving the lungs. A chamber in the spirometer contains soda lime to absorb the carbon dioxide released by respiration. The measurements shown were recorded from a healthy 17-year-old student at rest.



(i) Explain why the volume of air in the spirometer drops slowly over the first minute.

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[2]

(ii) After one minute, the student was asked to breathe in as deeply as possible and then breathe out as much as possible.

The resulting change in the trace is shown in the figure above as **X**.

State the term given to measurement **X**.

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[1]

[Total 3 marks]

**4.** The diagram below shows the detailed structure of a small part of the mammalian lung.



(i) State the name of the structure shown between lines **D** and **E**.

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[1]

(ii) List **three** features of the structure which you have identified in (i) which make it suitable for gas exchange.

1 ................................................................................................................

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2 ..................................................................................................................

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3 ....................................................................................................................

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[3]

[Total 4 marks]