

Exchange Surfaces

GCSE Biology · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Calculate the surface area to volume ratio of a cube with sides of 3 cm. (2 marks)

Step 1 · Surface area

$$6 \text{ faces} \times 3 \times 3 = 54 \text{ cm}^2$$

Step 2 · Volume

$$3 \times 3 \times 3 = 27 \text{ cm}^3$$

Step 3 · Ratio

$$54 : 27 = 2 : 1$$

Answer: 2 : 1

Check: Divide both sides by the volume to get '? : 1'.

2. Now try one with the steps

Explain why a single-celled amoeba does not need lungs or a blood system, but a mouse does. (3 marks)

Step 1 · Amoeba

Step 2 · Mouse

Step 3 · Solution

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Calculate the surface area of a cube with sides of 2 cm, in cm^2 . [1]

2. Calculate the volume of a cube with sides of 4 cm, in cm^3 . [1]

3. A cube has a surface area of 96 cm^2 and a volume of 64 cm^3 . Its SA:V ratio is ? : 1. Find the missing number. [1]

4. State three features shared by most efficient exchange surfaces. [3]
- _____
- _____
- _____
5. Name the tiny air sacs in the lungs where gas exchange happens. [1]
- _____
- _____
6. Describe how villi increase the rate of absorption in the small intestine. [3]
- _____
- _____
- _____
7. Explain why larger organisms need exchange surfaces and transport systems. [2]
- _____
- _____
8. Calculate the SA:V ratio of a cuboid 1 cm × 1 cm × 5 cm. Give your answer as ? : 1. [3]
- _____
- _____
- _____
9. Explain why a fish dies quickly if removed from water, even though air contains more oxygen than water. [2]
- _____
- _____
10. Explain how the movement of blood away from the alveoli helps oxygen to diffuse into it. [2]
- _____
- _____
11. In fish gills, blood flows in the opposite direction to water. Explain the advantage of this. [2]
- _____
- _____
12. Smoking damages alveolar walls, joining alveoli into fewer, larger spaces. Explain why a person with this damage becomes breathless. [3]
- _____
- _____
- _____

13. A cell is a sphere of radius $10\text{ }\mu\text{m}$. Calculate its SA:V ratio using $SA = 4\pi r^2$ and $V = (4/3)\pi r^3$. Give the answer in μm^{-1} (? : 1). [3]

14. Explain why a flat, thin leaf is an efficient exchange surface for carbon dioxide. [2]

4. Before you hand it in

"Big organisms have a bigger SA:V ratio because they are bigger."

As size increases, volume increases faster than surface area, so the RATIO gets smaller.

Using 4 faces instead of 6 for a cube

A cube has 6 faces: $SA = 6 \times \text{side}^2$.

"Villi absorb food by eating it."

Digested food molecules cross the villus cells by diffusion and active transport into the capillaries.

Listing features without linking them to rate

e.g. 'walls are one cell thick, so the diffusion distance is short, so diffusion is faster'.